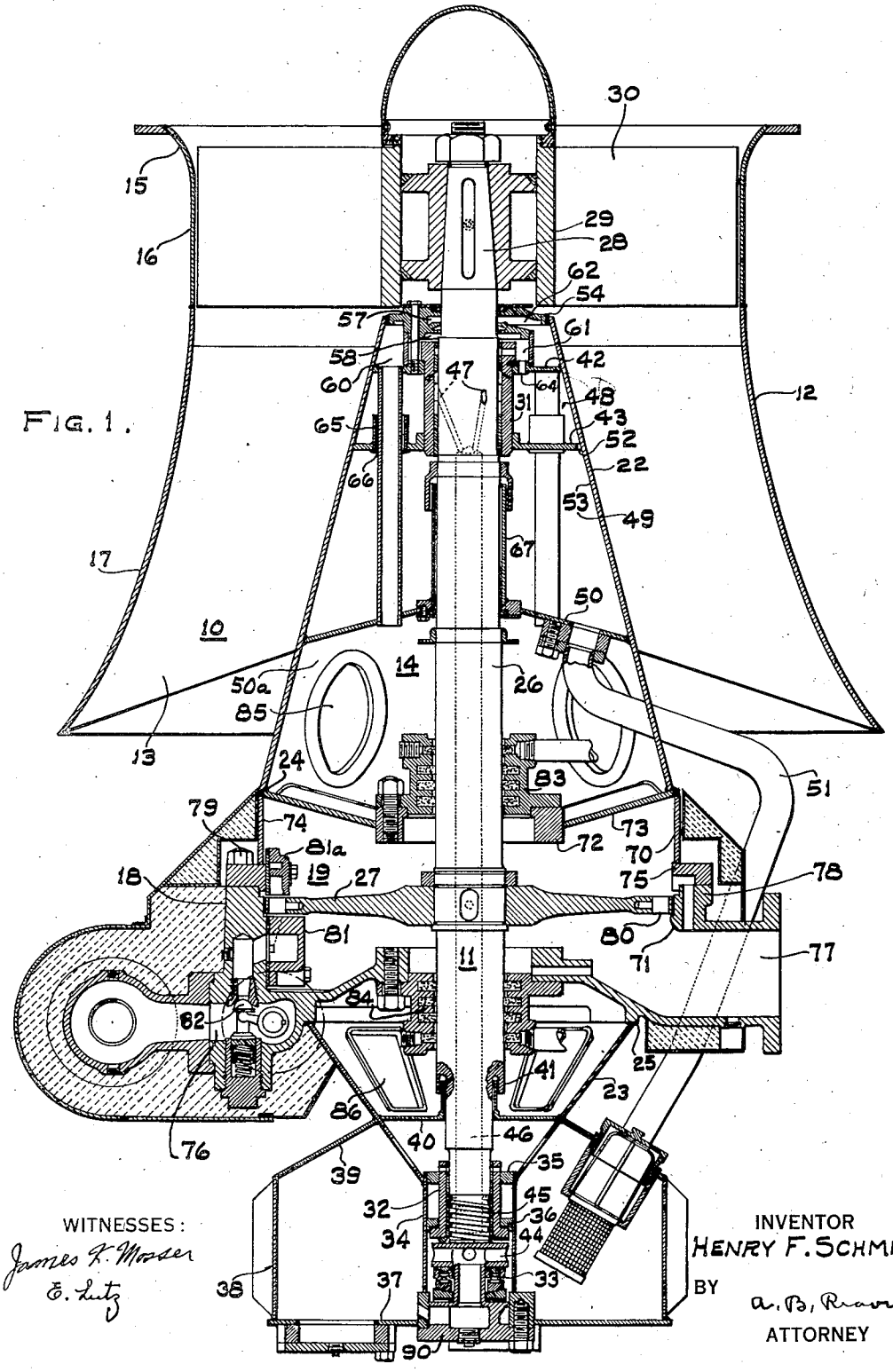
Feb. 11, 1936. H. F. SCHMIDT 2,030,474

BLOWER

Filed March 8, 1935 3 Sheets-Sheet 1

FIG. 1.



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BLOWER

Filed March 8, 1935 3 Sheets-Sheet 2

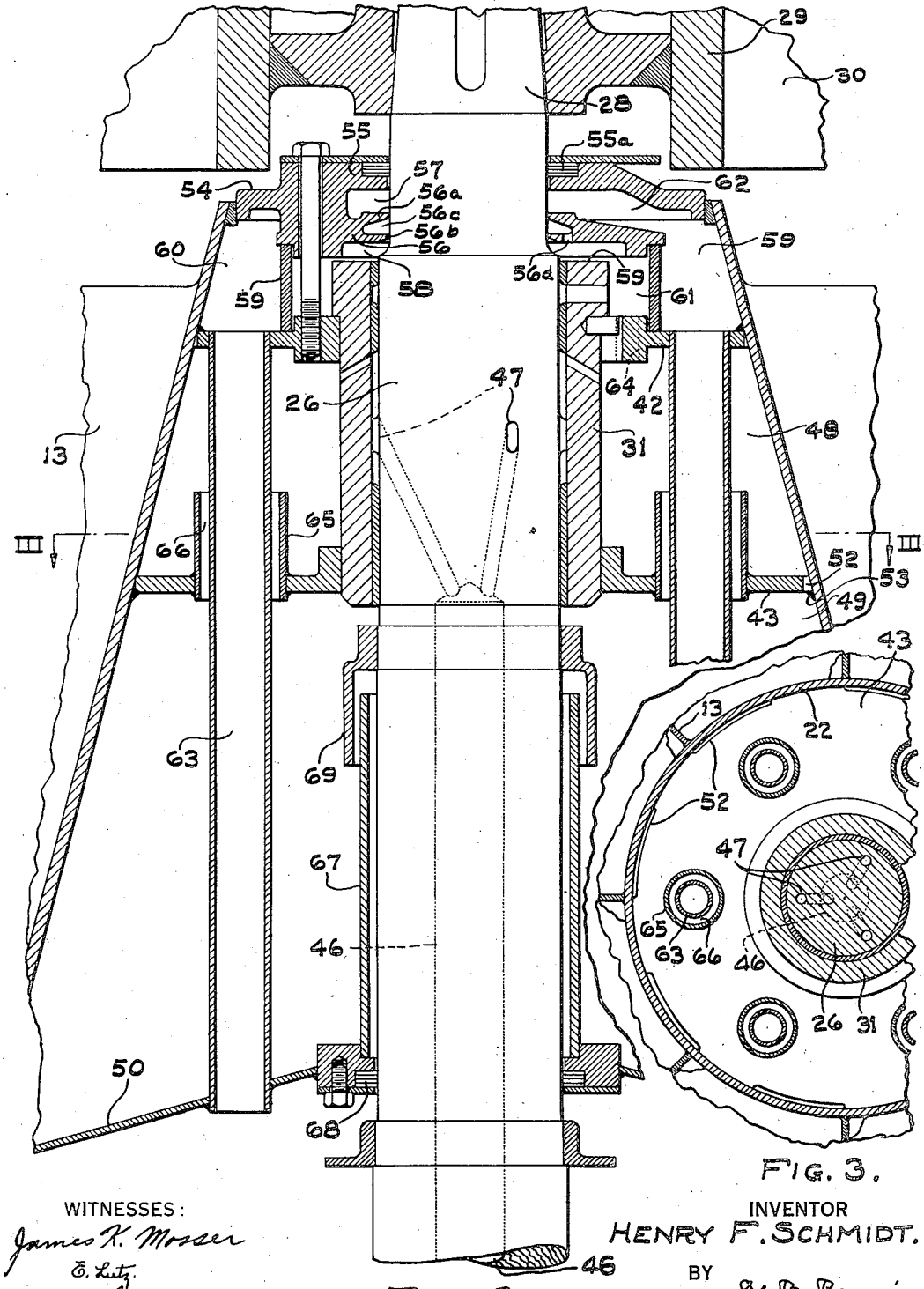


FIG. 2.

FIG. 3.

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BLOWER

Filed March 8, 1935 3 Sheets-Sheet 3

FIG. 4.

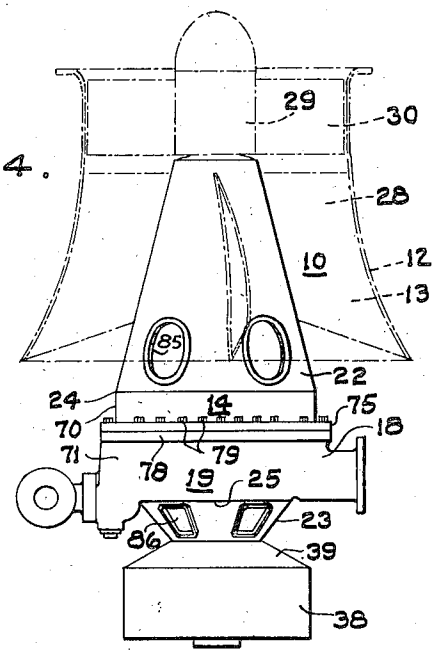
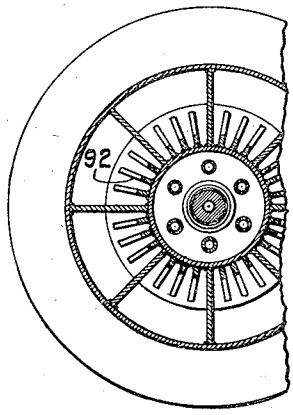


FIG. 8.



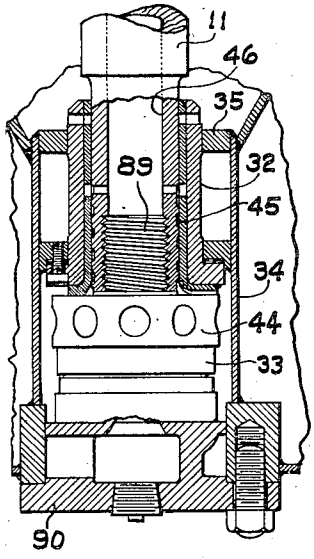


FIG. 6.

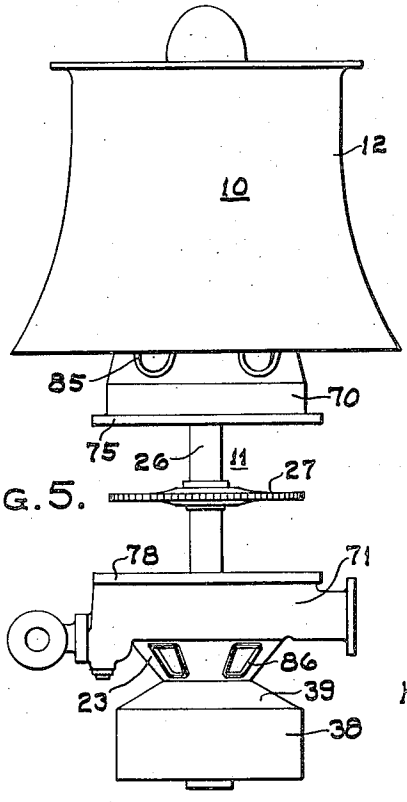


FIG. 5.

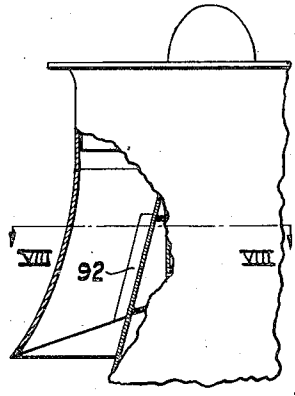


FIG. 7.

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Patented Feb. 11, 1936 2,030,474

UNITED STATES PATENT OFFICE

2,030,474

BLOWER

Henry F. Schmidt, Lansdowne, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application March 8, 1935, Serial No. 9,963

20 Claims. (Cl. 230—116)

My invention relates to fluid translating apparatus of the propeller type and it has for an object to provide improved guide vane structure for supporting the propeller.

A further object of my invention is to provide fluid translating apparatus of the propeller type wherein oil for lubricating the bearings is cooled by the medium translated by the propeller.

A further object of my invention is to provide fluid translating apparatus of the propeller type with improved means for counteracting the tendency for oil to flow from the bearing adjacent to the propeller into the latter and the stream of medium translated thereby.

A further object of my invention is to provide a blower wherein the parts are constructed and arranged to serve mechanical and aero-dynamic ends very effectively and which, in serving these ends, is inherently very stiff and strong and, at the same time, quite light.

A further object of my invention is to provide a propeller blower wherein the housing aggregate carries a central housing structure which supports the spindle aggregate and the propeller, the central housing structure being comprised by frusto-conical tubular elements having their larger ends welded to opposite sides of the stator of the motor device used for driving the propeller and having their smaller ends carrying bearings for the spindle, whereby there is provided a structure which uses material efficiently, wherein desired material of component parts may be selected, and which gives strong and firm support for the propeller and the spindle aggregate. The outer housing, the central housing structure and the connecting guide vanes have large moments of inertia with the result that the component parts, as well as the structure as a whole, is strong and stiff and relatively light. The arrangement of parts satisfying aero-dynamic ends is at the same time productive of a structure having these advantages.

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 drawings, forming a part of this application, in which:

Fig. 1 is a vertical sectional view of my improved propeller type fluid translating apparatus;

Fig. 2 is a fragmentary sectional view showing the bearing adjacent to the propeller and associated features;

Fig. 3 is a sectional view taken along the line III—III of Fig. 2;

Fig. 4 is a fragmentary view showing the housing structure for enclosing and supporting the spindle aggregate;

Fig. 5 is an exploded view of apparatus shown in Fig. 4;

Fig. 6 is a detail view showing the connection of the impeller and thrust collar with the spindle;

Fig. 7 is a vertical sectional view of an alternative structure; and

Fig. 8 is a sectional view taken along the line VIII—VIII of Fig. 7.

In accordance with my invention, I provide a propeller blower including a housing aggregate having an outer tubular housing provided with the usual throat. A propeller is disposed in the throat portion and it is connected to a spindle driven by a suitable motor or turbine, having its rotor directly connected to the spindle so that the rotor and the spindle constitute a spindle aggregate.

The spindle aggregate and the propeller are carried by a central housing structure supported from the outer housing by guide vanes and comprised by the motor or turbine stator and by frusto-conical tubular elements having their larger ends joined to opposite sides of the stator. Spindle bearings are carried by the smaller ends of the frusto-conical tubular elements and cooperate with the spindle to hold the latter in position with the propeller in the throat portion.

The frusto-conical tubular elements are inherently stiff and possess relatively great strength and rigidity for the weight of material employed. Accordingly, the housing structure including the tubular elements and the stator, with the larger ends of the tubular elements joined to opposite sides of the stator, constitutes a rigid and strong support for the spindle bearings located at opposite ends thereof and adequate support for the housing structure is secured by the guide vanes which extend for the major portion of the length of the frusto-conical tubular element arranged adjacent to the propeller.

The bearings are preferably lubricated by a system including a bore formed in the spindle and supplied with lubricant by a pump carried by the tubular element remote from the propeller, and lubricant is returned from the bearing adjacent to the propeller by means utilizing the interior of the upper tubular element as a passageway and as storage space. Preferably, the first or upper tubular element has a portion of the wall thereof functioning as a cooler for lubricant, lubricant being filmed over the interior and medium translated by the propeller passing over the

exterior so that heat may be transferred from the lubricant to the medium.

As one of the spindle bearings is located adjacent to the propeller, the latter exerts a suction effect tending to cause oil to travel from the bearing toward the propeller and into the stream of medium translated by the latter and this tendency is counteracted by a special arrangement of air chambers, air being supplied to one of the chambers in such quantity that the suction effect is satisfied by air instead of oil. Accordingly, a structure is carried by the small end of the upper tubular element and has radially-extending walls defining upper and lower annular air chambers encompassing the spindle. A plurality of conduits extend through the cooling and drainage chamber and serve to supply air from the space therebelow to the upper annular chamber. The bottom of the cooling and drainage chamber is provided with means permitting of the ingress of air so that air pressures may be equalized at different portions of the bearing from which oil escapes and in the lower chamber, whereby oil is free to drain into the drainage and cooling space; and, since the conduits afford such copious supply of air to the upper chamber that leakage of air therefrom toward and into the propeller produces negligible reduction in pressure in the upper chamber, the pressures of air in the upper and lower chambers, as well as at portions of the upper bearing from which lubricant escapes, are in substantial equilibrium, whereby it is assured that the pumping tendency is satisfied by air and leakage of oil toward and into the propeller is prevented.

The blower preferably utilizes a steam turbine as its motor device, and the blower bearings serve also as turbine bearings. The stator carries glands at opposite sides and which cooperate with the spindle to prevent leakage of steam from the turbine. The frusto-conical tubular elements are provided with openings to afford access to the glands and to permit air to enter freely the space below the bottom of the lubricant drainage space and the upper gland to exert an additional cooling effect and particularly to provide a region with which communicate the means for effecting the air seal to prevent lubricant leakage as already pointed out.

In manufacturing the blower, the housing aggregate is formed of upper and lower parts carrying upper and lower portions of the turbine or motor stator, whereby, with disconnection of the stator portions, the spindle aggregate may be inserted or removed; and, with the spindle aggregate inserted, the stator portions may be joined together so that the housing aggregate becomes a unitary arrangement and the central housing structure comprising the upper and lower frusto-conical tubular elements and the stator constitutes a relatively light, rigid and strong structure enclosing and supporting the spindle aggregate. The upper part of the housing aggregate comprising the outer tubular housing, the guide vanes, the upper frusto-conical tubular element, and the cover part of the stator is fabricated from suitable sheet steel. The lower part of the housing aggregate, except for the lower portion of the stator, is also comprised by a fabricated steel plate structure, the lower portion of the turbine stator being made of cast steel and the lower frusto-conical tubular element being welded thereto. Thus, it will be seen that the process of manufacture results in stationary structure comprised by upper and lower units which may be disconnected so as to expose the spindle aggregate in such a manner that the latter may be readily removed or inserted.

Referring now to the drawings more in detail, there is shown a housing aggregate, at 10, carrying the spindle aggregate, at 11.

The housing aggregate includes an outer tubular housing 12 connected by curved guide vanes 13 to an elongated, inner or central housing structure, at 14, which extends coaxially of the outer tubular housing and cooperates with the latter to provide an annular discharge passage.

The outer tubular housing 12 is preferably provided with converging, throat, and diverging portions 15, 16, and 17, respectively.

The central or inner housing structure includes the stator 18 of the motor, at 19, preferably constituted by a steam turbine, and elements 22 and 23 joined to opposite sides of the stator. The elements 22 and 23 are preferably frusto-conical and tubular and having their larger ends connected, for example, by means of annular connections or welds 24 and 25, to opposite sides of the stator.

The frusto-conical element 22 has its exterior joined to the inner radial edges of the guide vanes 13 and the outer radial edges of the latter are joined to the interior of the diverging portion 17, whereby the central or inner housing structure, at 14, is supported from the outer tubular housing 12.

The spindle aggregate, at 11, includes the spindle 26 and the rotor 27 carried thereby. The spindle 26 is enclosed by the central or inner housing structure, at 14, except for the end portion 28 thereof which extends beyond one end of the housing structure and is connected to the hub 29 of the propeller 30 arranged in the throat portion 16 of the outer tubular housing 12.

The spindle aggregate is supported in position with the propeller in the throat portion by means of bearings 31, 32, and 33. The radial bearing 31 is carried by the smaller end of the frusto-conical tubular portion 22. The radial bearing 32 and the step bearing 33 are supported from the smaller end of the frusto-conical tubular element 23. From the structure described, it will be apparent that the bearings support the spindle aggregate from the central housing structure, at 14, to properly position the propeller 30 in the throat portion 16 and the guide vanes 13 support the central or inner housing structure, at 14, from the outer tubular housing 12, the frusto-conical tubular element 22 being arranged at the discharge side of the propeller and cooperating with the discharge or diverging portion 17 to provide an annular discharge passage.

The lower frusto-conical tubular element 23 has its lower end encompassing and welded to the sleeve 34 having interior rings 35 and 36 supporting the lower bearing 33. The lower end of the sleeve 34 is also secured to the bottom 37 of the receptacle 38, which has its top wall 39 encompassing and welded to the exterior of the frusto-conical tubular element 23, whereby the receptacle serves as a stress construction cooperating with the lower tubular member 23 to provide, for the sleeve 34, a support having adequate strength and rigidity. Also, the frusto-conical tubular member 23 is reenforced by an interior transverse plate 40 having a guard or seal device 41 to seal the receptacle against the leakage of lubricating oil.

The upper bearing 31 is supported within the smaller end of the upper frusto-conical tubular

element 22. To this end, I show annular plates 42 and 43 having their peripheries welded to the interior of the tubular element 22 and encompassing and supporting the bearing 31.

The upper and lower bearings 31 and 32 are supplied with lubricant from the receptacle 38 by means of the impeller 44 carried directly by the spindle 26, the impeller supplying oil to the viscosity pump 45, disclosed and claimed in my application, Serial No. 734,093, filed July 7, 1934, and which, in turn, by means of the longitudinal bore 46 formed in the spindle 26, supplies oil, through the ports 47, to the upper bearing 31.

Oil escaping from the upper bearing enters the upper and lower drainage spaces 48 and 49, the upper drainage space 48 being included between the upper and lower annular plates 42 and 43 and encompassed by the tubular element 22 and the lower drainage space 49 being included between the lower plate 43 and the bottom plate 50 and also encompassed by the tubular element 22. Oil entering the upper space or chamber 48 flows to the lower space or chamber 49 in the manner hereinafter described, oil returning from the lower chamber 49 by means of the conduit 51 extending around the turbine or motor device, at 19, and discharging into the receptacle 38.

It is desirable to cool the circulating lubricating oil. Accordingly, the lower annular plate 43 has recesses 52 arranged adjacent to the interior of the frusto-conical tubular element 22 so that oil from the upper or collection chamber 48 flows downwardly as a film against the interior of the wall portion 53 of the frusto-conical member 22, whereby heat from the oil film so formed is readily transmitted to air translated by the propeller along the exterior of the frusto-conical element. Heat transfer is promoted, not only by the thinness of the metallic septum wall, but also by the relatively large extent of oil surface in contact with the wall compared to the quantity flowing and by the high air velocity.

In operation, a relatively lower pressure or suction effect is induced at the region of the propeller hub 29, and, unless counteracted, leakage of oil would occur from the upper bearing toward the propeller and into the stream of air translated thereby. The upper end of the frusto-conical tubular element 22 is provided with a closure 54 secured thereto, the closure having inwardly-extending radial webs 55 and 56 defining sealing clearances with respect to the spindle 26 and providing upper and lower annular air chambers 57 and 58 encompassing the spindle, the upper air chamber 57 being arranged between the webs 55 and 56 and the lower chamber 58 being arranged between the lower web 56 and the upper end 59 of the bearing 31.

Air is copiously supplied to the upper chamber 57, so that, even though leakage toward the propeller is necessarily induced, practically no reduction in pressure is caused in the upper chamber 57. Also, means is arranged to provide equilibrium of pressures in the lower chamber 58 and at each end and along the bearing 31. As the upper and the lower chambers 57 and 58 communicate with a common space below the bottom wall 50 by means hereinafter described, pressures in the annular chambers 57 and 58 and at each end and along the bearing 31 will be in equilibrium with the result that oil escaping from the bearing 31 is free to drain into the chamber 49 without any inducement of flow of oil toward the propeller and into the air stream translated thereby, the suction effect at the hub portion of the propeller being satisfied by air copiously supplied to the upper annular chamber 57.

Referring now to the structure for supplying air to the upper annular chamber 57, a vertical sleeve 59 has the ends thereof fitting against opposing faces of the closure 54 and of the upper annular plate 42, the sleeve dividing the space between these parts into outer and inner chambers 60 and 61, the outer chamber communicating with the annular chamber 57 by means of a passage 62 formed in the closure. The outer chamber 60 freely communicates with the space below the bottom plate 50 by means of a circumferential series of conduits 63 having their ends carried by the plates 42 and 50. With this arrangement, it will be apparent that, as the flow area for air supplied to the upper annular chamber 57 is relatively so great compared to the leakage area between the web 55 and the spindle 26, practically no reduction in pressure will occur in the upper annular chamber 57.

Equilibrium of pressures in the lower chamber 58 and at each end and along the bearing 31 is secured by means of passages establishing communication with the space below the bottom plate 50 and with which the conduits 63 also communicate. The inner chamber 61 communicates with the collection chamber 48 by means of openings 64 formed in the upper annular plate 42. The upper and lower chambers 48 and 49 are placed in communication by means of tubular elements 65 carried by the lower annular plate 43 and encompassing and spaced from the conduits 63 to form passages 66, the tubular elements 65 extending upwardly into the chamber or space 48 a sufficient distance to prevent leakage of oil around the conduits 63 from the upper chamber 48 to the lower chamber 49, whereby oil accumulating in the chamber 49 is discharged through the recesses 52 and flows as a film along the interior of the wall portion 53 in order that transfer of heat from the oil to the air flowing externally thereof may be effected. The cooling effect is aided by the guide vanes 13 which are joined to the wall portion 53 so that they serve as heat-dissipating fins.

The lower chamber 49 has its bottom 50 provided with a central tube 67 extending upwardly and encompassing the spindle, felt packing 68 being carried by the lower end of the tube construction 67 and cooperating with the spindle to prevent steam escaping from the turbine gland blowing up into the oil reservoir space and causing oil vapor to be blown out. The felt packing 68, however, permits sufficient flow of air to maintain a condition of equilibrium of static pressures in the lower annular chamber 58 and along and at each end of the bearing 31. To minimize the entrance of oil into the upper end of the tubular structure 67, a hood 69 is preferably carried by the spindle, the hood having a sleeve portion which overlaps the tubular portion 67 so as to effectively guard the latter against the entrance of oil.

As the lower ends of conduits 63 and of the tube structure 67 are in communication with the common region or air chamber 50a below the bottom plate 50, the conduits 63 providing for the supplying of air to the upper annular chamber 57 in such manner as to prevent reduction in pressure in that chamber incident to air leakage, equilibrium of pressures will be secured in the upper and lower chambers 57 and 58 and along

and at each end of the bearing 31. Hence, as the suction effect exerted on the bearing is satisfied by air and as the spaces referred to are in equilibrium, lubricant escaping from the bearing 31 flows directly therefrom into the upper and lower chambers 48 and 49 and from the upper end of the bearing into the inner chamber 61, from which oil drains through the passages 64 into the collection chamber 43.

The web 55 is provided with spaced radial portions 56a and 56b defining sealing clearance with respect to the spindle and providing an annular oil catching chamber 56c. The portion 56b is provided with one or more openings 56d providing for drainage into the lower chamber 58 of oil leakage entering the chamber 56c through the sealing clearance between the radial portion 56b and the spindle. Thus, it will be seen that entrance of oil into the upper chamber 57 is effectively resisted.

The upper web 55 is preferably provided with felt washer means or packing 55a serving to prevent the entrance of foreign matter into the upper chamber and capable of resisting leakage of oil from the latter.

As the spindle 26 is provided with the bore 46 for the passage of oil to the upper bearing and as the conduit 51 extends around the stator 18, it will be apparent that the lubricant is circulated without going through the interior space of the turbine or motor device and a relatively simple circulating system is provided. The upper frusto-conical tubular element 22 not only forms an essential part of the oil circulating system but it provides for sealing against oil leakage and for cooling of the circulating oil. The cooling feature is important not only because of heat generated by friction in the bearings but also because of heat absorbed by the oil as it traverses the portion of the bore 46 passing through the motor device or turbine.

As shown, the motor device, at 19, is comprised by a steam turbine including the stator 18 and the rotor 27, already referred to. The stator 18 is comprised by an upper fabricated cover part 70 and a lower cast part 71. The upper fabricated part comprises an inner ring 72 encompassed by a web 73 which is welded thereto. The outer periphery of the web 73 is welded to one end of the relatively short cylinder 74, the other end of the latter being welded to the flange 75. The lower or body portion 71 of the stator is preferably of cast steel construction and it is formed to provide steam inlet and exhaust passages 76 and 77, respectively. The cast or body part of the stator has an annular flange portion 78 fitting the flange 75 and secured thereto by means of bolts 79.

The rotor 27 is shown provided with an annular row of blades 80 with which cooperate the nozzle means 81 and the reversing chamber means 81a disposed at opposite sides thereof, the nozzle means 81 being carried by the lower body or cast stator part and the reversing chamber means 81a being carried by the fabricated cover. The cast or lower part of the stator also carries a suitable valve 82 operatively connected to a governor (not shown) and serving to control the admission of steam to the turbine.

The stator 18 is provided with glands 83 and 84 secured thereto and extending from the upper and the lower sides thereof, the glands cooperating with the spindle to minimize leakage of steam from the turbine. Since the frusto-conical tubular elements 22 and 23 and the stator 18 constitute a unitary inner housing structure and since it is necessary that access be had to the glands 83 for assembly, repair, and adjustment of the latter, I show the frusto-conical tubular elements provided with openings 85 and 86, respectively, serving this purpose.

The openings 85 also provide for additional cooling of the lubricant and for maintenance of air under suitable pressure in the chamber 50a with which communicate the passages for the air sealing device of the upper bearing. As a substantial portion of the length of spindle 26 is directly exposed to air in the chamber 50a, such exposed portion, when rapidly revolving, induces circulation of air in the chamber 50a with the result that the lower surface of the plate 50 and the exposed portion of the spindle are enabled to transfer heat to the circulating air, whereby reduction in temperature of the oil is effected.

In manufacturing, the blower arrangement described comprises four unit assemblies: (1) the propeller; (2) the spindle aggregate comprised by the spindle 11 and the rotor 27; (3) the upper part of the housing aggregate comprised by the housing 10, the guide vanes 13, the frusto-conical tubular element 22 and the stator cover 70; and (4) the lower part of the housing aggregate including the body or cast part 71 of the stator and the lower frusto-conical tubular element 23 and the reinforcing receptacle structure. To assemble the structure, the spindle aggregate is inserted in the upper part of housing aggregate and the propeller is secured to the upper end of the spindle. The lower part of the housing aggregate is then secured to the upper part, the flanges 75 and 78 abutting and being secured together by means of the screws or bolts 79. When the spindle aggregate is inserted in the upper part, the upper journal portion of the spindle is disposed in the upper bearing 31; and, incident to connection of the lower part of the structure to the upper part, the bearing 32 is brought into cooperative relation to the lowermost journal portion of the spindle. As the impeller 44 is arranged below the bearing 32 and as the step bearing 33 is arranged below the impeller, it is necessary to provide for assembly of the latter parts with respect to the spindle. Preferably, the impeller has a threaded boss 89 (Fig. 6) engaging within the lower end of the spindle. A cap 90 closes the lower end of the tube structure 34 and it is secured to the bottom end portion thereof, the cap 90 not only providing for assembly and dismantling of the impeller and the step bearing with respect to the spindle, but also affording a suitable support for the step bearing. Therefore, it will be seen that the stationary part or housing aggregate of the blower comprises upper and lower parts, such parts incorporating complementary portions of the central or inner housing structure carrying the bearings 31 and 32 for the spindle and the two parts of the housing aggregate of the blower facilitating assembly and dismantling of the spindle aggregate with respect thereto without detracting from the strength and rigidity of the housing structure which encloses the spindle aggregate and supports the latter firmly in running position by means of the upper and lower bearings 31 and 32.

In Figs. 7 and 8, transfer of heat is aided by the provision of cooling fins 92 joined to the outer surface of a heat transfer wall 53 and extending for the length of the latter. In this form, not only is the transfer of heat effected by the upper frusto-conical member and the guide vanes serving as fins, as hereinbefore described, but such transfer

is additionally promoted by the cooling fins arranged between guide vanes and extending for the length of the heat transfer wall of the upper tubular member.

From the foregoing, it will be apparent that I have provided a very compact propeller blower wherein the housing, by means of guide vanes, supports a central or inner housing structure carrying the propeller and the means for driving it. The component parts, as well as the structure as a whole, are arranged to function aero-dynamically to the best advantage; and, incident to the attainment of this objective, the component parts and the structure as a whole are strong, stiff, and relatively light. Since the outer housing is comprised by a convergent-divergent tubular member, it has a relatively high moment of inertia for the weight of material employed, in consequence of which it is very strong and stiff. The same is true with respect to the central housing structure, which is not only tubular but has the portions thereof converging or tapered toward its extremities, constructed and arranged to carry the spindle bearings. The guide vanes are arranged in the annular discharge passage between the outer housing and the central housing structure, such guide vanes not only serving to guide properly medium discharged from the propeller but also to support the central housing structure from the outer housing; and the guide vanes are curved in a direction lengthwise of their annular discharge passage both for aero-dynamic and supporting purposes, the curvature giving a structural element which is strong, stiff and light, whereby it is assured that the structure as a whole not only effectively serves the intended aero-dynamic purposes but it is strong, stiff, and relatively light.

The central or inner housing structure encloses the spindle aggregate, and it is comprised by a pair of frusto-conical tubular elements welded to either side of the motor or turbine stator, whereby the housing structure, so constituted, provides a relatively rigid and light construction for maintaining the spindle aggregate accurately in running position. Incident to the formation of the rigid and strong housing structure for this purpose, the frusto-conical tubular elements thereof also provide for cooling of lubricant, this effect being accomplished by causing the lubricant to flow in film formation against a portion of the wall of the upper frusto-conical tubular element and by circulation of air in the air chamber below the bottom of the drain chamber. Openings are provided in the frusto-conical members to give access to the glands and the openings in the upper tubular member serve the additional purpose of allowing air to freely enter the air chamber 50*a* both to secure additional cooling of lubricant and to provide a common region or space having air under suitable pressure for the air sealing device for the upper bearing. The upper frusto-conical tubular element serving as an essential part of the oil circulating system is formed to provide an air sealing arrangement which functions to prevent the leakage of oil from the upper end of the upper bearing into the propeller and the stream of air translated thereby, the pumping effect of the propeller exerted on the bearing being satisfied by air copiously supplied to the air sealing arrangement. As the stationary portion of the blower is comprised by upper and lower parts which are attached together, it will be apparent that the spindle aggregate may be readily inserted or removed with the parts detached; and to this end, the joint between the parts of the stationary structure divides the stator. Furthermore, it will be noted that the blower is entirely fabricated except for the lower stator part, whereby economy of construction, lightness and desired quality of constituent elements are secured. The lower stator part is cast because of structural complexity due to steam passages and which would make fabrication thereof difficult. In order that fabrication may be carried to this extent, it is desirable to provide a reentry type of turbine to secure maximum simplicity of the cover so that the latter may be readily fabricated and incorporated as a constituent part of the upper blower structure. In addition to the aforementioned advantages, the lubricating system, with the very compact arrangement of parts described, is provided by means which does not in any way enter the interior space of the turbine, such means comprising the bore formed in the spindle and the return conduit which passes around the turbine stator. Furthermore, by modification of the spindle in this manner, it is unnecessary to provide a supply conduit in addition to the spindle and it is unnecessary to complicate the interior structural arrangement of the upper frusto-conical tubular member to provide for such a supply conduit.

While I have shown my invention in several forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other 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 set forth in the appended claims.

What I claim is:

1. In a propeller blower, an outer tubular housing having throat and diverging portions, a spindle arranged coaxially of the housing, a propeller in the throat portion and connected to one end of the spindle, an elongated central tubular structure arranged coaxially of the outer housing and encompassing the spindle, the central housing structure including first and second portions which converge toward the respective extremities thereof and the first convergent portion being disposed in the divergent portion of the outer housing so that its small end is adjacent to the propeller and the first convergent portion cooperating with the divergent portion of the outer housing to provide an annular discharge passage for the propeller, guide vanes in the annular discharge passage and joined to the interior of the divergent portion of the outer housing and to the exterior of the first convergent portion of the central housing structure for supporting the latter from the former, said guide vanes extending substantially for the full length of the annular passage and being curved lengthwise of the latter, and bearings carried by the outer extremities of the convergent portions of the central housing structure for supporting the spindle.

2. In a propeller blower, a tubular outer housing having throat and discharge portions; a propeller in the throat portion; a spindle having one end connected to the propeller; a motor device including a stator and a rotor and the rotor being connected to the spindle to constitute a spindle aggregate; a central, elongated housing structure arranged coaxially of the outer housing, enclosing the spindle aggregate except for the portion thereof connected to the propeller and spaced from the discharge portion of the outer housing to provide an annular discharge passage;

said housing structure including said stator and elements joined to opposite sides of the latter; at least one of said elements being tubular and extending within said discharge portion to provide said annular discharge passage; spindle bearings carried by the outer ends of said elements and cooperating with the spindle to hold the spindle aggregate in position with the propeller in the throat portion; and guide vanes in the annular passage and having their radial edges joined to the exterior of said tubular element of the housing structure and to the interior of said discharge portion to provide for the support of the central housing structure from the outer housing; said stator including complementary parts and means for connecting the parts together, whereby the central housing structure is comprised by portions which may be separated to provide for insertion or removal of the spindle aggregate.

3. In a propeller blower, a vertical outer housing having throat and diverging portions; a propeller in the throat portion; a vertical spindle having its upper end connected to the propeller; a steam turbine including a stator, a rotor, and glands carried by the sides of the stator and cooperating with the spindle; an elongated central housing structure enclosing the spindle aggregate except for the portion of the latter connected to the propeller and comprising said stator and upper and lower frusto-conical tubular elements having their larger ends joined to opposite sides of the stator and having openings therein to provide access to the glands; an upper spindle bearing carried by the upper and smaller end of the upper tubular element; a lower spindle bearing carried by the lower and smaller end of the lower tubular element; guide vanes joined to the exterior of the upper tubular element and to the interior of the diverging portion of the outer housing and serving to support the central housing structure from the outer housing; means for supplying lubricant to the upper bearing; a closure for the upper end of the upper tubular member and having radial upper and lower walls arranged between the upper bearing and the propeller and defining sealing clearance with respect to the spindle; said upper and lower walls defining an upper chamber therebetween and the lower wall defining a lower chamber with respect to the upper end of the upper bearing; a bottom member secured to the interior of the upper tubular member above said openings formed therein and providing a drainage chamber; means affording communication of the lower annular chamber and of portions of the upper bearing from which lubricant escapes with the drainage chamber; means including a plurality of conduits effecting communication of the space below the bottom and the upper chamber and extending through the drainage chamber; and means providing for the ingress of air from the space below the bottom and into the drainage chamber.

4. In a propeller blower, a vertical housing having throat and diverging portions; a propeller in the throat portion; a vertical spindle having its upper end connected to the propeller; motor means including a stator and a rotor and the rotor being carried by the spindle to provide a spindle aggregate; a vertically disposed elongated housing structure enclosing the spindle aggregate and arranged below the propeller and coaxially with the housing; said housing structure comprising said stator and upper and lower frusto-conical tubular elements having their larger ends joined to opposite sides of the stator; an upper spindle bearing supported by the smaller and upper end of the upper tubular element; a lower spindle bearing supported from the lower and smaller end of the lower tubular element; guide vanes having their inner radial edges joined to the exterior of the upper tubular element and having their outer radial edges joined to the interior of said diverging portion, whereby said housing structure, the spindle aggregate and the propeller are supported from the housing; and means for lubricating the bearings including a bore extending longitudinally of the spindle for supplying lubricant to the upper bearing; and means for causing drainage from the upper bearing to flow against the interior of the upper tubular element so that heat is transferred through the latter to air flowing along the exterior thereof.

5. In a propeller blower, a vertical outer housing, a spindle arranged coaxially of the housing, a propeller in the housing and connected to one end of the spindle, an elongated tubular housing structure arranged coaxially of the outer housing and telescoping with respect to the latter to provide an annular discharge passage for the propeller, guide vanes arranged in the annular discharge passage and connected to the telescoping portions of the outer housing and of the inner housing structure for supporting the latter from the former, bearings carried by the upper and lower extremities of the inner housing structure and cooperating with the spindle to hold the latter and the propeller in running position, means for supplying lubricant to the bearings, means including a bottom plate extending transversely of the inner housing structure to provide a drain chamber thereabove and an air chamber therebelow, means providing for the drainage of lubricant from the upper bearing into the drain chamber, the wall portion the inner housing structure encompassing the air chamber having openings therein and a portion of the spindle being exposed in said air chamber in order that circulation of air in contact with said bottom plate may be induced to effect cooling of lubricant, and means for returning cooled lubricant from the drain chamber to the supply means.

6. In a propeller blower, a vertical tubular outer housing having throat and diverging portions; a spindle arranged coaxially of the housing; a propeller in the throat portion and connected to the upper end of the spindle; a turbine including a rotor connected to the spindle and a stator provided with glands fitting the spindle; an inner elongated tubular housing structure arranged coaxially of the outer housing; said inner housing structure including said stator and upper and lower members having their adjacent ends joined to the stator and the upper member being comprised by a frusto-conical tubular element having its smaller end disposed adjacent to the propeller and cooperating with the diverging portion of the outer housing to provide an annular discharge passage for the propeller; guide vanes in the annular discharge passage and joined to the interior of the divergent portion and to the exterior of the frusto-conical element for supporting the inner housing structure from the outer housing; upper and lower bearings carried by the uppermost and lowermost ends of the upper and lower members, respectively, for supporting the spindle and the propeller in running position; means for supplying lubricant to the bearings; means including a transverse bottom plate for dividing the interior of the frusto-conical element into an upper lubricant drain chamber and a

lower air chamber; means for causing lubricant draining from the upper bearing to the drain chamber to flow as a film on the interior of the frusto-conical element to effect cooling of lubricant by the air translated along the exterior of the frusto-conical element; said frusto-conical element having the portion thereof bounding the air chamber provided with openings and the portion of the spindle between the upper gland and the bottom plate being exposed to air in the air chamber, whereby access to the upper gland may be had through the openings and air admitted through the openings and circulated by the spindle in contact with the bottom plate serves to effect further cooling of the lubricant; and means for returning cooled lubricant from the drain chamber to said supply means.

7. In a propeller blower, a vertical tubular outer housing having throat and diverging portions; a spindle arranged coaxially of the housing; a propeller in the throat portion and connected to the upper end of the spindle; a turbine including a rotor connected to the spindle and a stator provided with glands fitting the spindle; an inner elongated tubular housing structure arranged coaxially of the outer housing; said inner housing structure including said stator and upper and lower members having their adjacent ends joined to the stator and the upper member being comprised by a frusto-conical tubular element having its smaller end disposed adjacent to the propeller and cooperating with the diverging portion of the outer housing to provide an annular discharge passage for the propeller; guide vanes in the annular discharge passage and joined to the interior of the divergent portion and to the exterior of the frusto-conical element for supporting the inner housing structure from the outer housing; upper and lower bearings carried by the uppermost and lowermost ends of the upper and lower members, respectively, for supporting the spindle and the propeller in running position; means for supplying lubricant to the bearings; means including a transverse bottom plate for dividing the interior of the frusto-conical element into an upper lubricant drain chamber and a lower air chamber; means for causing lubricant draining from the upper bearing to the drain chamber to flow as a film on the interior of the frusto-conical element to effect cooling of lubricant by the air translated along the exterior of the frusto-conical element; said frusto-conical element having the portion thereof bounding the air chamber provided with openings and the portion of the spindle between the upper gland and the bottom plate being exposed to air in the air chamber, whereby access to the upper gland may be had through the openings and air admitted through the openings and circulated by the spindle in contact with the bottom plate serves to effect further cooling of the lubricant; means for returning cooled lubricant from the drain chamber to the supply means; a cover for the upper end of the frusto-conical element and having a pair of webs fitting the spindle with close clearance and defining upper and lower annular chambers encompassing the spindle; said lower annular chamber being defined in part by the upper end of the upper bearing and said drainage means providing for drainage of lubricant from the lower annular chamber and the bearing to the drain chamber; a plurality of conduits extending within the frusto-conical element and through the drain chamber and providing for flow of air from said air chamber to the upper annular chamber with such little resistance that leakage of air from the upper annular chamber toward the propeller produces negligible pressure reduction in the upper annular chamber; and means providing for ingress of air from the air chamber into the drain chamber, whereby air pressures in the upper and lower annular chambers and at each end and along the upper bearing are equalized so that lubricant is free to drain to the drain chamber without leakage toward the propeller.

8. In a propeller blower, a housing having throat and diverging portions, a propeller in the throat portion, a drive shaft extending axially of the housing and having one end connected to the propeller, a bearing for the drive shaft located adjacent to the propeller, a tubular member arranged coaxially of the housing and encompassing the drive shaft, means for supporting the bearing interiorly of the tubular member, guide vanes for supporting the tubular member from the housing, a plate extending transversely of the tubular member and having its periphery secured to the interior thereof, said last-named plate and the tubular member providing a lubricant drainage space, means for supplying lubricant to the bearing, means including openings formed in the bearing supporting means for draining lubricant from the bearing to the drainage space, and means for returning lubricant from the drainage space to the supply means.

9. In a blower, a vertically-disposed housing having throat and divergent portions, a propeller in the throat portion, a vertically-disposed shaft extending axially of the housing and having its upper end connected to the propeller, upper and lower bearings for the drive shaft, the upper bearing being located below and adjacent to the propeller, guide vanes having their outer radial edges joined to the interior of the divergent portion, a tubular member arranged coaxially of the housing, said tubular member encompassing the drive shaft and diverging in the same direction as the divergent portion, upper transverse plates joined peripherally within the upper portion of the tubular member and cooperating with the upper bearing for supporting the latter from the tubular member, a lower transverse plate having its periphery joined interiorly of the tubular member and provided with a central upwardly extending sleeve encompassing the drive shaft so that the portion of the tubular member immediately above the lower plate provides a lubricant drainage space, said tubular member having a portion extending below the lower edges of the guide vanes, a motor device including a stator and a rotor, the rotor being carried by the drive shaft, means including a circumferential connection between the lower end of the tubular member and the upper side of the stator, a structure for supporting the lower bearing and providing a lubricant reservoir, said structure including an upwardly-extending tubular member, means for supporting said structure from the lower side of the stator including a circumferential connection between the latter and the upper end of the upwardly-extending tubular member, means operated from the drive shaft for supplying lubricant from the reservoir to the upper and lower bearings, and means for returning lubricant from said drainage space to said reservoir.

10. In fluid translating apparatus of the propeller type, a housing; a propeller in the housing; a drive shaft connected to the propeller; a bearing for the drive shaft; a motor device including a rotor connected to the drive shaft;

heat exchange means arranged in said housing so as to mave medium translated by the propeller passed thereover; a lubricant pump operated by the drive shaft and located at the side of the motor device remote from the propeller; means for supporting the propeller, the drive shaft, the bearing, the heat exchange means, the motor device, and the lubricating pump from the interior of the housing; means for supplying lubricant from the pump to the bearing and including a longitudinal bore formed in the drive shaft; and means for returning lubricant draining from the bearing to the pump and including said heat exchange means and a conduit extending around the motor device.

11. In fluid translating apparatus of the vertical propeller type, a housing, a propeller in the housing, a drive shaft connected to the propeller, a bearing for the drive shaft, a central tubular member carrying said bearing and whose exterior surface cooperates with the interior surface of the housing to provide an annular passage for medium translated by the propeller, means for supplying lubricant to the bearing, means for causing lubricant draining from the bearing to flow as a film in contact with the inner surface of the tubular member so that heat is transferred from such film of lubricant to medium in contact with the exterior surface of the tubular member and translated by the propeller, and means for returning cooled lubricant to the lubricant supply means.

12. In fluid translating apparatus of the vertical type, a housing, a propeller in the housing, a drive shaft connected to the propeller, a bearing for the drive shaft and arranged adjacent to the propeller, a central tubular member whose exterior surface cooperates with the interior surface of the housing to provide an annular passage for medium translated by the propeller, guide vanes in the passage and connected to the housing and to the tubular member for supporting the latter from the former, means for supporting said bearing interiorly of the tubular member, means for supplying lubricant to the bearing, a transverse bearing-supporting plate arranged interiorly of the tubular member and providing a chamber for the collection of lubricant from the bearing, said plate having openings formed therein adjacent to the tubular member in order that lubricant leaving the collection chamber is caused to flow in film formation on the interior surface of the tubular member below the plate, whereby transfer of heat from the lubricant to the medium translated by the propeller is effected, and means for returning cooled lubricant to the lubricant supply means.

13. In fluid translating apparatus of the propeller type, a housing, a propeller in the housing, a drive shaft connected to the propeller, a bearing for the drive shaft arranged adjacent to the propeller, means for supplying lubricant to the bearing including an axial passage formed in the drive shaft, a central tubular member whose exterior surface cooperates with the inner surface of the housing to provide an annular discharge passage for medium discharged from the propeller, guide vanes in the discharge passage and connected to the housing and to the tubular member, means for causing lubricant discharged from the bearing to flow substantially as a film interiorly of the tubular member in order that heat may be transferred from the lubricant to medium translated by the propeller, and means for returning cooled lubricant to the supply means.

14. In a vertical propeller blower, a propeller; a drive shaft connected to the propeller; a bearing for the drive shaft and arranged adjacent to and below the propeller; means for supplying lubricant to the bearing; means for preventing the flow of lubricant from the bearing toward the propeller and into the medium translated by the propeller including a housing for the bearing, a structure at the upper end of the housing and having upper and lower radial walls between the upper end of the bearing and the propeller and defining sealing clearance with respect to the shaft, the upper and lower radial walls defining an upper annular chamber therebetween and the lower radial wall defining, with the upper end of the bearing, a lower annular chamber, said lower radial wall having an annular groove providing an annular recess with annular sealing portions at either side thereof, the sealing portion adjacent to the second chamber having openings therein providing for drainage of lubricant from the annular recess to the second chamber; means for maintaining equilibrium of air pressure at each end of the bearing and in the upper and lower chambers and providing for relatively unrestricted supply of air to the upper chamber; and means providing for the drainage of lubricant from the bearing and from said second chamber.

15. In a vertical propeller blower, a converging-diverging housing; a propeller in the throat portion of the housing; a drive shaft connected to the propeller; a bearing for the drive shaft disposed adjacent to and below the propeller; a central tubular member having its exterior cooperating with the housing interior to provide an annular discharge passage for medium translated by the propeller and which diverges in the direction of flow; guide vanes in the annular divergent passage and joined to the housing and to the tubular member for supporting the latter from the former; means for supporting the bearing in the housing; and means for preventing the flow of lubricant from the bearing to the propeller and into the stream of air translated thereby including a structure disposed between the propeller and the bearing and having upper and lower walls defining sealing clearance with respect to the shaft, the upper and lower walls defining an upper annular chamber therebetween and the lower wall defining, with the upper end of the bearing, a lower annular chamber, means including a plurality of conduits incorporated within the tubular member for supplying air from the lower end of the guide vane structure to the upper chamber with such little flow resistance that practically no drop in pressure occurs in the upper chamber incident to leakage of air therefrom toward the propeller, and means providing for drainage of lubricant from the bearing and for maintenance of air pressure in the second chamber which is in equilibrium with that at the lower end of the bearing and with that in the first chamber.

16. In a vertical propeller blower, a housing, a propeller in the housing, a drive shaft for the propeller, a bearing for the drive shaft and arranged adjacent to and below the propeller, means for supplying lubricant to the bearing, guide vane structure connected to and supported from the interior of the housing and including a central tubular member forming the inner boundary of the stream of medium translated by the pro-

peller, means for supporting the bearing in the upper end portion of the tubular member and including a transverse plate joined to the interior of the tubular member, means providing a closure for the top end of the tubular member and providing upper and lower radial walls extending between the bearing and the propeller and defining sealing clearances with respect to the shaft, said upper and lower radial walls defining an upper annular chamber therebetween and the second wall and the adjacent end of the bearing defining a lower annular chamber, a vertical sleeve having its upper end abutting the closure means and its lower end abutting said transverse plate and defining an outer chamber in communication with said upper chamber and an inner chamber in communication with said second chamber, a bottom transverse plate joined to the interior of the tubular member and having a central upright sleeve encompassing the shaft and cooperating with the tubular member and with the upper transverse plate to provide a lubricant drainage space, said inner chamber being arranged to receive lubricant discharged from the upper end of the bearing and from said second chamber and said upper transverse plate having openings therein providing for drainage of lubricant into said drainage space, conduit means extending longitudinally through said drainage space and through the upper and lower transverse plates to place said outer chamber in open communication with the space below the guide vane structure, said conduit means having such relatively large flow area that negligible reduction in air pressure occurs in the upper chamber incident to leakage of air through the upper wall clearance toward the propeller, and means providing for the ingress of air from below the guide vane structure into said drainage space to provide for pressure in the second chamber being in equilibrium with that at the lower end of the bearing and that existing in the first chamber.

17. In fluid translating apparatus of the propeller type, an outer housing; a propeller in the outer housing; a drive shaft connected to the propeller; motor means for driving the drive shaft and including stator and rotor elements with the rotor element connected to the drive shaft; an elongated housing structure extending axially of the outer housing and including said stator; drive shaft bearings carried by the extremities of the housing structure; means for supplying lubricant to the bearings including a lubricating pump operated by the drive shaft and located at the side of the motor device remote from the propeller and a longitudinal bore formed in the drive shaft for supplying lubricant from the pump to the bearing adjacent to the propeller; and means for returning lubricant draining from the last-named bearing to the pump and including a conduit extending around the motor device.

18. In fluid translating apparatus, a housing; a propeller in the housing; a bearing arranged adjacent to the propeller; a shaft fitting the bearing and connected to the propeller; means for supporting the propeller, the bearing and the shaft from the housing and including relatively thin metallic wall means disposed so as to have one surface thereof contacted with medium translated by the propeller; and circulatory lubricating means for said bearing including drainage means for the latter and comprised in part by said relatively thin metallic wall means so that lubricant draining from the bearing may flow in contact with the surface of said relatively thin metallic wall means opposite to the surface thereof along which medium is translated by the propeller, whereby said relatively thin metallic wall means is effective to transfer heat from the draining lubricant to medium translated by the propeller.

19. In a vertical propeller blower, an outer housing, a propeller in the housing, a drive shaft connected to the propeller, a motor device including a stator and a rotor and the rotor being connected to the drive shaft, first and second bearings for the drive shaft, the first bearing being arranged adjacent to the propeller and the second bearing being arranged at the side of the motor device remote from the propeller, a central housing structure enclosing the major portion of said drive shaft and supporting said bearings at its extremities, said central housing structure including said stator and a tubular member extending from one side of the latter toward the propeller and cooperating with the outer housing to provide an annular passage for medium translated by the propeller, means for supplying lubricant to the first and second bearings, drainage means for returning lubricant to the supply means and including means for causing lubricant to flow as a film along the interior surface of the tubular member to facilitate transfer of heat from the lubricant to medium translated by the propeller along the exterior of the tubular member.

20. In a vertical propeller blower, an outer housing, a propeller in the housing, a drive shaft connected to the propeller, a motor device including a stator and a rotor and the rotor being connected to the drive shaft, first and second bearings for the drive shaft, the first bearing being arranged adjacent to the propeller and the second bearing being arranged at the side of the motor device remote from the propeller, a central housing structure enclosing the major portion of said drive shaft and supporting said first and second bearings at its extremities, said central housing structure including said stator and a tubular member extending from one side of the latter toward the propeller and cooperating with the outer housing to provide an annular passage for medium translated by the propeller, means including a reservoir carried by the central housing structure for supplying lubricant to the first and second bearings, and drainage means for returning lubricant to the reservoir, said drainage means including means for causing lubricant to flow as a film interiorly of the tubular member so that heat of the lubricant may be transferred to medium translated along the exterior of the tubular member by the propeller and including a conduit extending around the stator.

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