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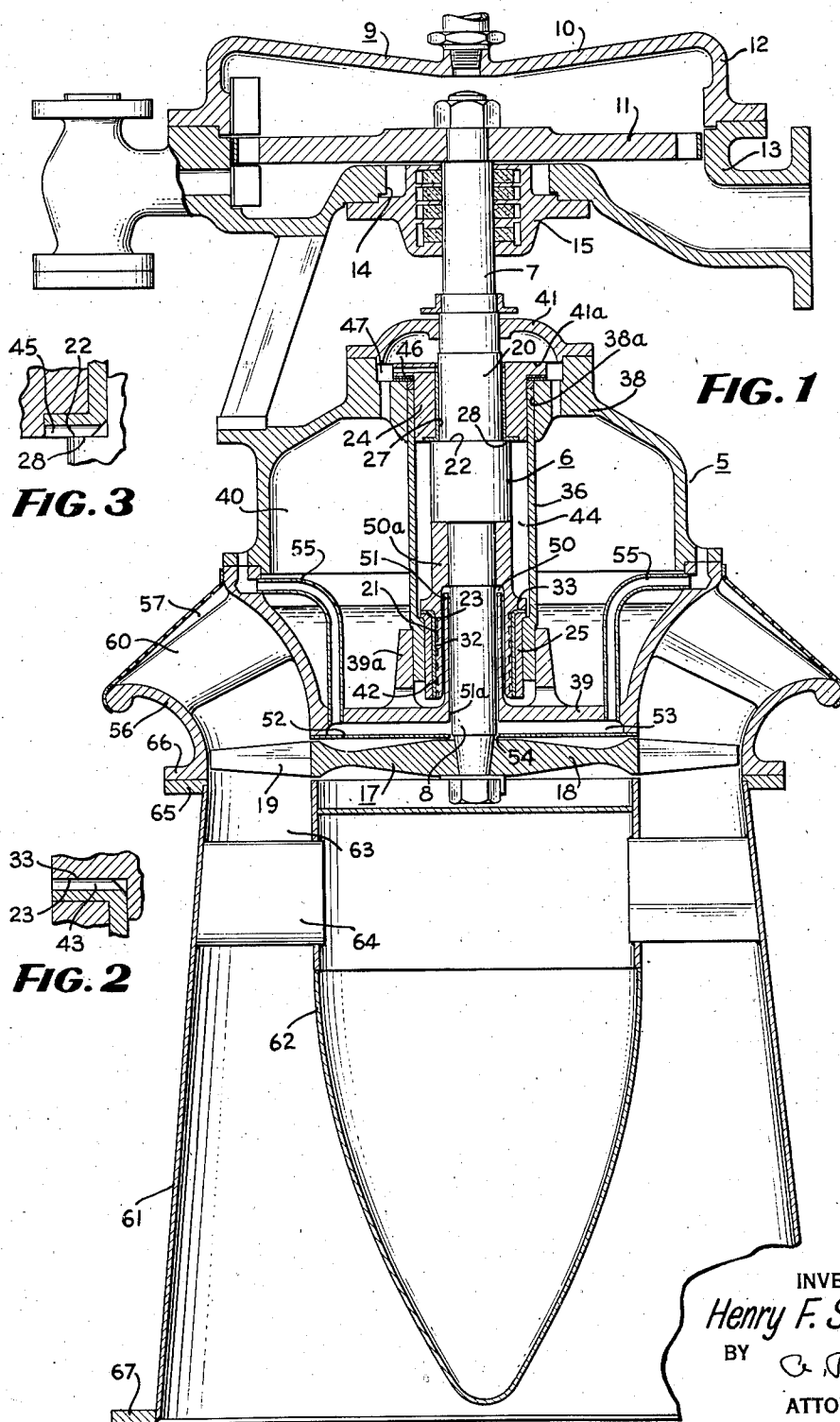
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2,390,332

BLOWER APPARATUS

Filed Oct. 14, 1943

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

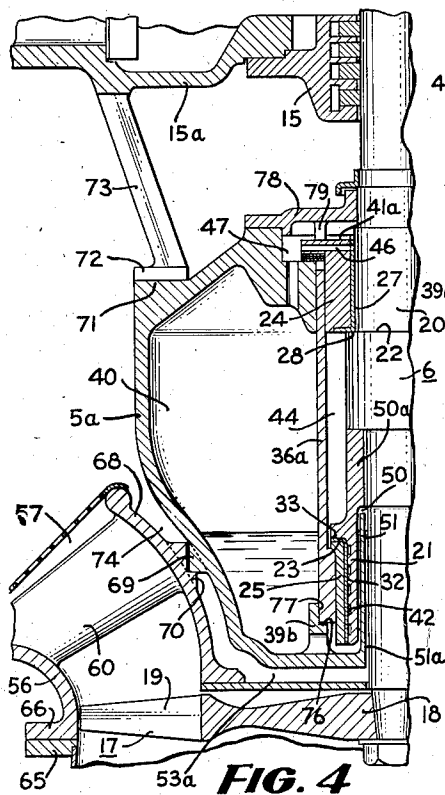


FIG. 4

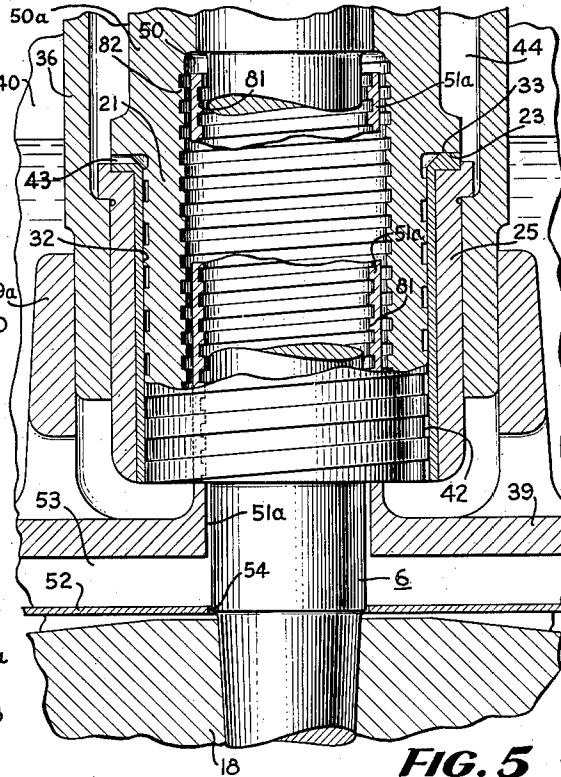


FIG. 5

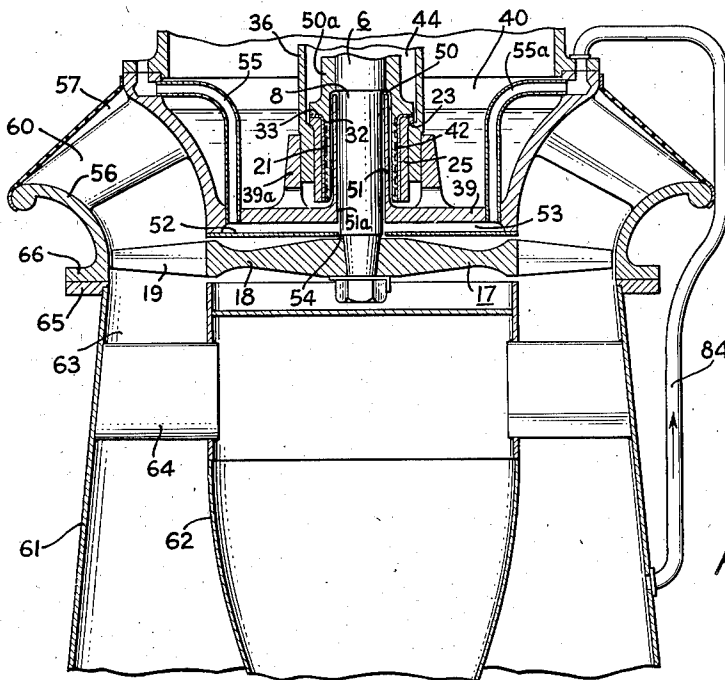


FIG. 6

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BLOWER APPARATUS

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Application October 14, 1943, Serial No. 503,155

9 Claims. (Cl. 230-132)

The invention relates to fluid translating apparatus of the propeller type, more particularly to blowers for handling gaseous media, such as air, and it has for an object to provide apparatus of this character which is of simplified construction, compact, and capable of economical manufacture.

A further object of the invention is to provide a blower incorporating a body member through which the drive shaft extends with the overhanging ends of the latter supporting the propeller and the rotor of the driving motor.

Yet another object of the invention is to provide a blower having overhung rotors with an improved lubricated bearing assembly for the drive shaft.

Another object of the invention is to provide a blower having a housing constructed and arranged to provide for the reception and removal of the drive shaft and bearings assembled as a unit.

A further object of the invention is to provide a vertical blower having a body member formed with an interior lubricating oil chamber and supporting bearings for a vertical drive shaft having end portions extending above and below the body member, together with means cooperating with the drive shaft and with the lower bearing to provide for the maintenance of a desired quantity of lubricating oil in the chamber while at the same time affording access of such oil to the lower end of the lower bearing.

A further object of the invention is to provide apparatus having upper and lower bearings and a lubricating chamber for furnishing oil to the bearings, the lower bearing being arranged above the bottom of the chamber, together with means cooperating with such bearing to provide for the maintenance of a desired quantity of oil in the chamber.

A further object of the invention is to provide, in connection with a lubricant reservoir whose bottom has an opening through which a shaft extends, means effective to prevent withdrawal of lubricating oil from a reservoir through the shaft opening.

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 elevational view of the improved blower;

Figs. 2 and 3 are enlarged detail views of bearing features;

Fig. 4 is a vertical sectional view of a modified form of apparatus; and

Figs. 5 and 6 are detail views showing a modified form of air balancing seals.

In the drawings, there is shown a body member 5 through which extends the drive shaft 6, the latter having end portions 7 and 8 which overhang opposite ends of the body member.

A steam turbine, at 9, or other suitable motor device, includes a stator 10 attached to and carried by the body 5 and a rotor 11 attached to the overhanging drive shaft portion 7. The stator or housing includes upper and lower housing parts 12 and 13 and the lower part has an opening 14 for the multiple-part gland 15 fitting the shaft portion 7 extending through the opening.

A propeller, at 17, includes a disc or hub portion 18 and blades or vanes 19 carried peripherally thereby, the hub being connected to the overhanging end portion 8.

In addition to the end portions 7 and 8, the drive shaft has journal portions 20 and 21 adjacent thereto and thrust abutments 22 and 23 at the ends of the journal portions remote from the overhanging end portions.

Bearings 24 and 25 are disposed at opposite ends of the body member and they are arranged to support the drive shaft both radially and axially. To this end, the bearing 24 has radial and thrust surfaces 27 and 28 with which cooperate the journal 20 and thrust abutment surface 22; and, in like manner, the bearing at 25 has radial and thrust surfaces 32 and 33 cooperating with journal 21 and the thrust abutment surface 23. The bearings 24 and 25 are separated by a spacing element 36.

Preferably, as shown, the blower is of the vertical type, the drive shaft 6 being vertically disposed and the body member 5 having upper and lower walls 38 and 39 providing an interior chamber 40 for lubricating oil.

From the structure so far described, it will be apparent that the drive shaft 6, the bearings 24 and 25, and the spacing element 36 constitute a drive shaft assembly comprising rotating and stationary components or aggregates, the rotating component including the drive shaft and the parts thereof, and the stationary component or aggregate including the upper and lower bearings and the spacing element.

The upper and lower walls 38 and 39 of the housing are formed to provide for positioning of the drive shaft assembly. To this end, the upper wall has an opening 38a and the lower wall 39 has

extending upwardly therefrom supporting and centering structure 39a formed to provide for access of lubricant in the reservoir 40 to the lower end of the lower bearing. A multiple-part cover 41 encompasses the drive shaft and is attached to the upper wall 38.

The openings 14 and 38a are of sufficient diameter to permit of the insertion and removal of the drive shaft assembly, whereby the drive shaft 6, the bearings 24 and 25, and the connecting spacing structure 36 may be bench assembled as a unit or aggregate, after which the latter may be positioned with respect to the housing or removed therefrom.

The stationary component or aggregate is, therefore, carried by the walls 38 and 39 so that the latter function to hold the bearings radially. Any suitable means may be used to confine the stationary component or aggregate axially with respect to the body member 5.

The drive shaft assembly stationary component or aggregate illustrated in Fig. 1 is more particularly described and claimed in the application of W. B. Flanders, Serial No. 506,143, filed October 14, 1943, and assigned to the assignee of the present invention, in accordance with which the lower bearing is confined radially by the lower wall 39 and is suspended from the upper bearing by the spacing or tubular element 36, the upper bearing having a flange 41a for attachment to the upper wall 38 to provide axial restraint for the stationary component or aggregate.

The bearing 25 is supplied with lubricating oil under pressure by means of a viscosity pump defined by a shallow helical groove 42, formed in either of the radial bearing surfaces of the lower bearing and of the lower journal. As shown, the groove is formed in the lower journal surface and it extends for the full axial length of the latter, it having its lower end open to the lubricating chamber 40, and its upper end arranged to discharge lubricating oil between the thrust surfaces 23 and 33, one of the latter, preferably the surface 33, having one or more radial grooves 43 (see Fig. 2) formed therein to facilitate discharge of lubricating oil through the thrust bearing.

While the upper bearing 24 may be lubricated in any suitable manner, preferably by means of oil escaping from the lower bearing, as shown in Fig. 1, the connecting or spacing element 36 is formed as a tube encompassing the drive shaft to provide an annular space 44 into which oil is discharged from the lower thrust bearing and which discharges oil at its upper end to the upper thrust bearing, this particular arrangement being disclosed and claimed in the application of A. I. Ponomareff, Serial No. 507,085, filed October 21, 1943, and assigned to the assignee of the present invention. Lubricating oil under pressure flows upwardly in the annular space and then radially inward between the thrust surfaces 22 and 28 of the upper bearing to the radial bearing surfaces of the upper bearing, the thrust surface 28 preferably also having one or more traversing radial passages 45 (see Fig. 3). Oil escaping from the upper end of the upper bearing drains into the chamber 40; and, to accommodate such drainage, the flange 41a preferably has one or more radial passages 46 whose inner ends are open to the bearing surface of the upper bearing 24 and whose outer ends are open to the drainage space 47 defined between the upper wall 38 and the cover 41 through which the drive shaft extends.

As the drive shaft 6 extends through the lower wall 39, means must be provided to retain oil in

the chamber 40. Accordingly, therefore, the drive shaft, including the lower journal portion 21 thereof, is formed with an annular channel 50 extending upwardly and axially from the lower end of the journal, and the lower wall has a tular dam element 51 bounding the shaft opening 51a formed in the lower wall, extending upwardly in the channel and serving as a dam to retain lubricating oil in the chamber. Preferably, both the channel 50 and the sleeve element 51 extend a suitable distance above the lower bearing. As shown, the channel may be formed by a sleeve element 50a attached to the shaft above the upper end of the dam.

As the disc or hub portion 18 of the propeller rotates close to the bottom of the lower wall 39, it is capable of developing a suction effect which would cause lubricating oil to be withdrawn from the reservoir 40 unless opposed by suitable sealing means. To provide a seal for this purpose, a plate 52 is attached to the lower end of the body member to define a space 53 through which the drive shaft extends and to which the latter is peripherally exposed. The plate has a central opening 54 having suitable clearance with respect to the drive shaft. Suitable means provides for free ingress of air from the atmosphere to the space 53; and, for this purpose, there are shown one or more pipes 55 carried by the body member, each pipe having one end opening into the space 53 and the other end opening to the atmosphere. The specific relation of pipes 55 and housing structure shown in Fig. 1 is more particularly disclosed and claimed in the application of Ponomareff aforesaid. With this arrangement, therefore, a low pressure condition at the bottom end of the shaft opening and due to any cause, for example, the suction effect of the propeller, particularly windage or the centrifugal pumping effect of the propeller hub 18, otherwise effective to entrain oil through the seal from the chamber, is satisfied by atmospheric air supplied to the space 53.

An annular member 56 encompasses the lower portion of the body member 5 and cooperates therewith to define an annular inlet passage 57 for the propeller blades 19. The annular member 56 is connected to the body member by means of inlet guide vanes 60, which function to provide the air with a suitable angle of approach for the propeller blades and which constitute the means by which the annular member 56 supports the body member 5 and all parts carried thereby. Preferably also, the annular member 56 extends downwardly axially so as to overlap the tips of the propeller blades 19.

The diverging conical shell 61 and the fairing cone 62 at the discharge side of the propeller provide an annular discharge passage 63 which diverges in the direction of flow to the extent desired. Guide vanes 64 are arranged in the discharge passage and they preferably constitute means for supporting the fairing cone 62 from the shell 61. Preferably, the shell constitutes the means by which the annular member 56 may be supported from any suitable structure, such as the deck of a ship; and, as shown in Fig. 1, the upper end of the shell has a flange 65 forming a support for the flange 66 of the annular member 56 and the lower end thereof has a flange 67 for attachment to suitable supporting structure (not shown).

While my invention is preferably embodied in the form of construction illustrated in Fig. 1, more particularly disclosed and claimed in the

aforesaid application of Ponomareff, in Fig. 4, I show an arrangement wherein the body member 5a is centered with respect to the inner member 68, bounding the suction passage, by means of lugs 69 and 70 formed on the body member and on the annular member and which are welded together. Also, the body member is formed with a flange 71 at its upper portion, to which is bolted the flange 72 formed on supporting structure 73 which is integral with the lower half of the turbine casing 15a. The nested arrangement of the body member 5a and the annular member 68 together with the connecting lugs provides space 74 therebetween forming a passage placing the chamber 53a in communication with the atmosphere.

In Fig. 4, instead of having the drive shaft assembly supported entirely from the upper end of the body member 5, as shown in Fig. 1, the stationary component of such assembly is supported by structure 39b extending upwardly from the bottom wall and formed with bottom and circumferential positioning surfaces 75 and 77. To hold the stationary component in position axially, the multiple part cover 78 attached to the upper end of the body member 5a has a rib or lug construction 79 bearing on the upper end of the component and cooperating with the abutment surface 76 to clamp the stationary component in position.

Fig. 5 shows additional features contributing to retaining oil in the reservoir, such features being comprised by threads 81 and 82 formed internally of the tubular dam element 51a and on the outer surface of the annular channel 50a, the threads 81 being of such hand that, for the direction of rotation, they tend to pump air upwardly toward the top of the dam, and the threads 82 being so arranged that they tend to exert a downward pumping effect toward the reservoir interior. Thus, the threads 81 and 82 work together to oppose any suction effect developed by the propeller hub and tending to withdraw oil from the reservoir.

In Fig. 6, there is shown an alternative form of the air sealing apparatus. With this view, instead of relying upon pipes, such as the pipes 55 of Fig. 1, to place the space 53 in communication with the atmosphere, air is furnished to such space from a suitable point along the diffuser 61 of the blower by means of a pipe 84 which preferably connects, at its upper end, with one of the pipes 55, designated 55a, whereby the pipe 84 and the pipe 55a connected thereto form a passage connecting a source of super-atmospheric pressure to the space 53. The other pipe or pipes 55 are arranged as shown in Fig. 1 and, dependent upon the escape flow area thereby provided, a desired pressure below the supply pressure but above atmospheric may be maintained in the space 53.

While features hereof are shown applied to a propeller blower, it is to be understood they may be used with any apparatus in connection with which they would be advantageous.

While the invention has been shown 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 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 fluid translating apparatus of the vertical

propeller type, a body member having upper and lower walls; a drive shaft extending through the body member and having upper and lower overhanging end portions; upper and lower bearings cooperating with the drive shaft for sustaining radial and axial loads of the latter; a spacing element for the bearings; means utilizing said walls for supporting the bearings radially; means utilizing at least one of the walls and the spacing element for axially supporting the bearings and the drive shaft carried thereby; a motor including a rotor attached to the upper overhanging end portion of the drive shaft and a casing for the rotor and carried by the body member; and a propeller attached to the lower overhanging end portion of the drive shaft; said motor casing including upper and lower parts and the lower part and the upper wall of the body member having openings of sufficient size to permit of insertion and removal of the drive shaft, the bearings, and the spacing element for the latter.

2. In fluid translating apparatus of the vertically-disposed propeller type, a body member having upper and lower walls and utilizing the latter to provide an interior chamber for lubricating oil; a vertically-disposed drive shaft extending through the chamber and the upper and lower walls of the body member and having upper and lower end portions overhanging the upper and lower walls; upper and lower bearings; a spacing element for the bearings; means including the upper and lower walls for supporting the upper and lower bearings axially and radially and comprising structure extending upwardly from the lower wall for supporting the lower bearing and formed to provide for access of oil in the chamber to the lower end of the lower bearing; means including a viscosity pump provided by a helical groove formed in one of the bearing surfaces of the lower bearing and operative to effect circulation of lubricating oil from the chamber in series first through the lower bearing, then through the upper bearing, and from the latter back to the chamber; and a propeller attached to the lower overhanging end portion of the drive shaft; said upper wall having an opening for the upper bearing and which is of sufficient size to permit of insertion and removal of the drive shaft, the bearings and the spacing element for the latter.

3. In fluid translating apparatus of the vertically-disposed propeller type, a body member having upper and lower walls and utilizing the latter to provide an interior chamber for lubricating oil; a vertically-disposed drive shaft extending through the chamber and the upper and lower walls of the body member and having upper and lower end portions overhanging the walls; said drive shaft also having oppositely-facing thrust abutments spaced by journal portions from the overhanging end portions; upper and lower bearings having radial and thrust bearing surfaces cooperating with the journal portions and the thrust abutments; a spacing element for the bearings; means utilizing said walls to support the bearings radially and axially and including structure extending upwardly from the lower wall and cooperating with the lower bearing so as to provide for access of oil in the chamber to the lower end of the latter; means utilizing the lower bearing to secure circulation of oil first through the latter and then through the upper bearing; means for retaining lubricating oil in the chamber comprising an annular

channel formed in the drive shaft and extending axially upward from the lower end of the lower journal and a sleeve element joined to the lower wall and extending upwardly within said channel; a propeller including a hub attached to the lower overhanging end portion of the drive shaft; said propeller being located sufficiently close to the body that its suction effect, when rotating, would tend to draw lubricating oil through the retaining means from the chamber together with a plate having close clearance with respect to the drive shaft and cooperating with the lower wall to provide a space between the latter and the propeller and to which the drive shaft is peripherally exposed, and means for furnishing air to the space to satisfy said suction effect and thereby avoid the withdrawal of lubricating oil through the retaining means.

4. In combination, means providing a reservoir for liquid having a bottom wall; a vertical rotary shaft extending through the bottom wall; a rotor attached to the shaft, located below the bottom wall, and near to the latter; said shaft having formed therein an upwardly-extending channel of annular section open at its lower end to the reservoir below the normal liquid level thereof; a dam of annular section extending upwardly from the reservoir bottom, encompassing the drive shaft, and disposed in the channel; a wall element defining close clearance with respect to the shaft and cooperating with said bottom wall to define an air space between the latter and said rotor and to which the shaft is exposed; and means for supplying air to said space to satisfy the suction effect of the rotor and thereby to prevent the withdrawal of liquid through said channel and over the dam from the reservoir.

5. In combination, apparatus including a rotary vertical shaft; means providing a reservoir for liquid having a bottom wall formed with an opening through which the shaft extends; said apparatus being normally operative to create a reduced pressure condition in space about the shaft and below the bottom wall; a dam of annular section extending upwardly from the reservoir bottom wall, bordering the shaft opening formed in the latter, and encompassing the shaft; a sleeve element joined to the shaft above the upper end of the dam and telescoping over the latter to provide an intervening annular space whose lower end is open to the reservoir; means including a wall element cooperating with the shaft and said bottom wall to define an air space

in open communication with the lower end of the bottom wall shaft opening; and means for supplying air to said space to prevent said reduced pressure condition from exerting a suction effect at the lower end of the shaft opening.

6. The combination as claimed in claim 5 with means for supplying air to said space from a source of air under pressure above atmospheric.

7. The combination as claimed in claim 5 with means for supplying air to said space from a source of air under pressure above atmospheric and with means cooperating with the supply means to maintain a desired pressure in the space.

8. The combination as claimed in claim 5 wherein the sleeve element is formed with internal threads of such hand that, for the direction of rotation of the rotary shaft, a downward pumping effect is created in the intervening space to oppose upward flow of liquid therein from the reservoir.

9. In combination, apparatus including a rotary vertical shaft; means providing a reservoir for liquid having a bottom wall formed with an opening through which the shaft extends; a bearing within the reservoir; means for supporting the bearing in spaced relation with respect to and near to the bottom wall and including a retainer connected to the bottom wall and confining the bearing radially with respect to the latter with the lower end of the bearing exposed to the interior of the reservoir; said apparatus being normally operative to create a reduced pressure condition in space about the shaft and below the bottom wall; a dam of annular section extending upwardly from the reservoir bottom wall, bordering the shaft opening formed in the latter, and encompassing the shaft; a sleeve element joined to the shaft above the upper end of the dam and telescoping over the latter to provide a journal portion fitting the bearing and to provide, with respect to the dam, an intervening annular space whose lower end is open to the reservoir; means including a wall element cooperating with the shaft and said bottom wall to define an air space in open communication with the lower end of the bottom wall shaft opening; and means for supplying air to said space to prevent said reduced pressure condition from exerting a suction effect at the lower end of the shaft opening.

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