May 8, 1951 R. W. SCHUCK 2,551,973

SLEEVE-BEARING ASSEMBLY

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Fig.1.

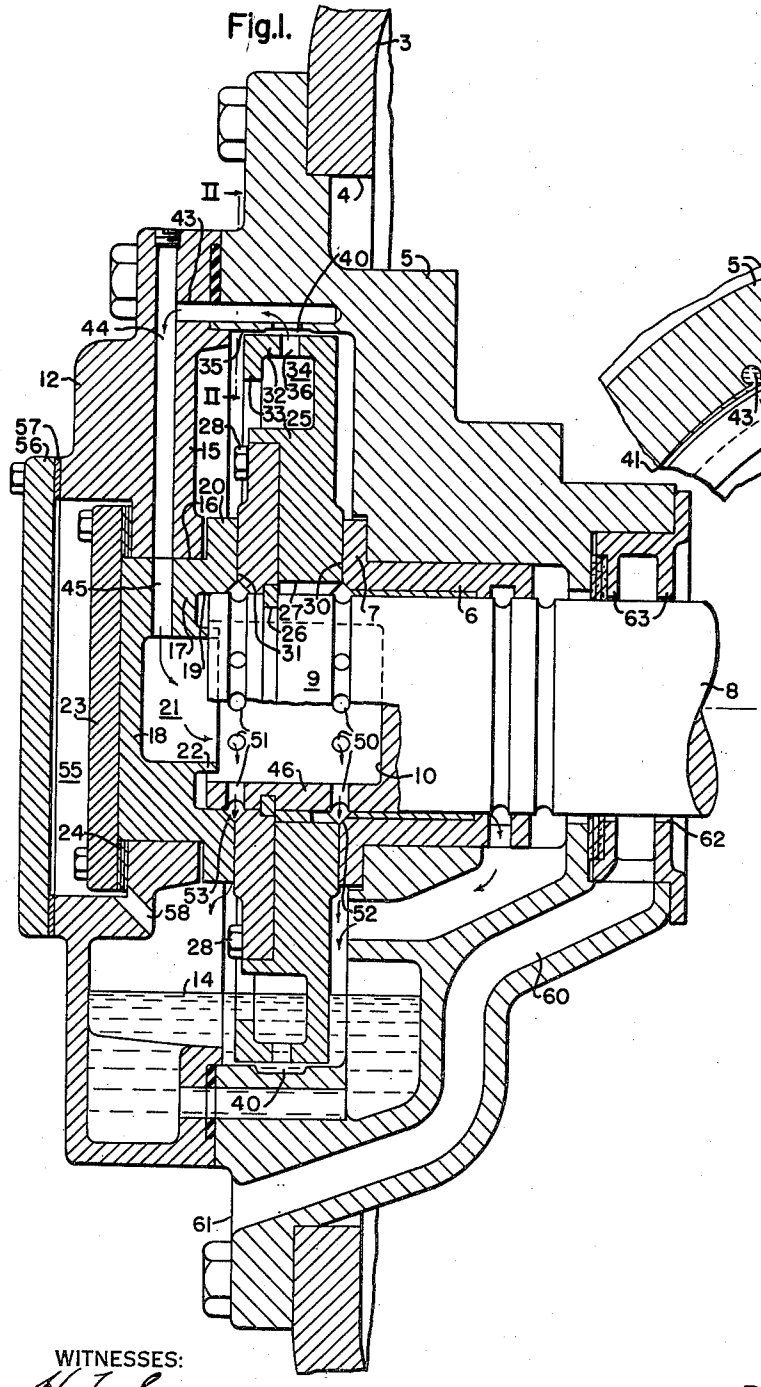
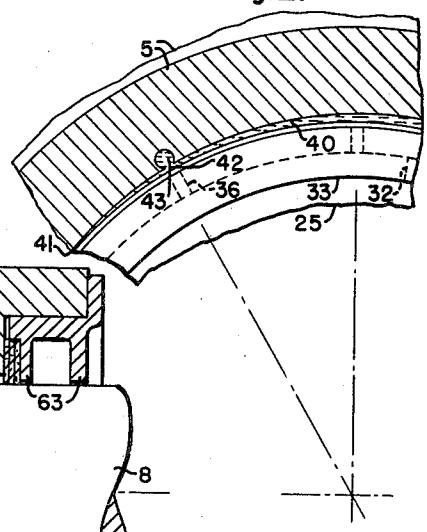


Fig.2.



WITNESSES:

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SLEEVE-BEARING ASSEMBLY

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3 Claims. (Cl. 308—127)

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My invention relates to a sleeve-bearing assembly, some aspects of which are of general application, but which is particularly adapted for electric motors or other dynamo-electric machines in which the rotating shaft has an end which does not extend through the casing of the machine.

An object of my invention is to provide such a sleeve-bearing assembly with a self-contained lubricating system which is positive and noiseless, considering "noiseless" in the sense of being quieter than oil-rings or conventional oil-pumps.

It is a further object of my invention to provide a sleeve-bearing assembly which will carry not only a radial load, but at the same time will carry an axial load which may be in either one of the two axial directions. More specifically, it is an object to provide such a bearing in which the amount of end-float can be readily adjusted to a fixed amount.

It is a further object of my invention to provide a sleeve-bearing assembly which will operate successfully at an angle as much as 25° from the vertical, in any direction.

More specifically still, it is an object of my invention to provide a sleeve-bearing assembly which will incorporate any or all of the foregoing features without permitting oil-leakage.

With the foregoing and other objects in view, my invention consists in the structures, combinations, systems, and methods of design, assembly and operation, hereinafter described and claimed, and illustrated in the accompanying drawing, wherein

Figure 1 is an axial longitudinal sectional view of a sleeve-bearing assembly embodying my invention in an illustrative form of embodiment, the section-plane being a plane which passes through the axis of the machine; and

Fig. 2 is a fragmentary cross-sectional view on a plane indicated by the section-line II—II in Fig. 1.

At the top of Fig. 1, I show a fragmentary part of an end bell 3, or like portion of a machine to which my invention is applied. This end bell 3 has a central bore 4 therein, within which is secured the bearing-housing 5 of my sleeve-bearing assembly. The bearing-housing 5 carries a sleeve-bearing 6, which is flanged, at its outer end, as indicated at 7, to permit it to carry thrust. Journaled in the sleeve-bearing 6 is a normally horizontal shaft 8, which has only a short shaft-end 9 extending beyond the sleeve-bearing flange 7, that is, extending out away from the center of the motor or machine. In accordance with my invention, the end of the shaft is hollowed out, providing a pocket 10, as shown.

Secured to the outside of the bearing-housing 5 is a bearing-cap 12, which cooperates with the bearing-housing, so that these two parts, together, afford or constitute a hollow enclosure surrounding the shaft-end 9. The lower portion of this enclosure constitutes an oil-reservoir 14. The bearing-cap 12 has a radially extending disc-like portion 15 having a central bore 16 which is larger than the diameter of the shaft-end 9. Seated within said bore 16 is an outwardly extending hub-portion 17 of an outer thrust plate 18. The inner end of this outer thrust-plate 18 is bored, as shown at 19, to receive the tip of the shaft-end 9, and it is flanged, as indicated at 20, to permit it to carry thrust. The hub-portion 17 of this outer thrust-plate 18 has therein a cup-shaped cavity 21 which faces the hollow 10 in the shaft-end 9, and which has a cup wall projection 22 which extends a little way into said hollow 10 in the shaft-end.

The axial length of the hub-portion 17 of the outer thrust-plate 18 is greater than the axial wall-thickness of the portion of the bearing-cap 12 which immediately surrounds the bore 16 in said bearing-cap. A retaining-plate 23 is bolted to the outer face of said bearing-cap 12, in abutting relation to the outer face of the hub-portion 17 of the outer thrust-plate 18. Interposed between the retaining-plate 23 and the bearing-cap 12 is a suitable end-float-adjusting annular spacer-means, which is shown in the form of a number of shims 24, the number of which may be varied so as to adjust the spacing, thus adjusting the amount of end-float of the shaft 8, as will be subsequently described.

Disposed inside of the enclosure which is provided jointly by the bearing-housing 5 and the bearing-cap 12, is an inner, or rotating, disc-like thrust-plate means 25, which is carried by the shaft-end 9, and which is immovably fixed to said shaft-end, as by means of keys 26 and 27. For convenience in manufacture, the inner thrust-plate means 25 may be made in two parts which are bolted together at 28, as shown. This inner thrust-plate means or rotor 25 has parallel inner and outer thrust-surfaces 30 and 31, cooperating respectively with the flange 7 of the sleeve-bearing 6 and the flange 20 of the outer thrust-plate 18.

In accordance with one feature of my invention, the inner thrust-plate means or rotor 25 is further provided with a cylindrical peripheral portion 32, which is flanged, as shown at 33, to provide a hollowed annular oil-pumping portion 34. The cylindrical peripheral portion 32 has a small radial clearance 35 with respect to the hollow enclosure which is provided by the bearing-housing 5 and the bearing-cap 12. Furthermore, this cylindrical peripheral portion 32 is provided with a row of holes 36 therethrough. Surrounding, or in radial alignment with, said holes 36, there is an annular groove 40 which is provided in the aforesaid enclosure so as to face said row of holes 36 in the oil-pumping portion 34 of the inner thrust-plate means 25.

The annular groove 40, in the enclosure which is constituted by the bearing-housing 5 and the bearing-cap 12, is stopped somewhere in the upper portion of said enclosure, as indicated approximately at the point 41 in Fig. 2, and preferably the depth of this annular groove 40 is tapered, so that the depth of the groove gradually tapers off to substantially nothing as said stop-point 41, so that, when the inner thrust-plate means 25 rotates, oil is rotated within the hollowed annular oil-pumping portion 34 in Fig. 1, and thrown out, by centrifugal action, through the row of holes 36, so as to fill the annular groove 40 in said enclosure, piling up a pressure therein, as the rotation of the rotor-member continues, until a point of maximum oil-pressure is reached, at a point somewhat as indicated at 42 in Fig. 2, this point being spaced back away from the stop-point 41 at which the annular groove 40 is stopped or vanishes. The machine may be designed for either direction of rotation: it is shown, in Fig. 2, however, for counter-clockwise rotation of the rotor-member 25.

At approximately the aforesaid point 42 of maximum oil-pressure in the annular groove 40 (this point being somewhere in the upper portion of the hollow enclosure which is provided for the rotating part 25), the bearing-housing 5 and the bearing-cap 12 are provided with an approximately axially extending hole 43, which is in communication with said annular groove 40 at approximately said maximum-pressure point 42, to tap off oil from said annular groove 40 before the stopped end 41 of said groove is reached, in the counter-clockwise rotation of the oil in said annular groove.

The disc-like portion 15 of the bearing-cap 12 is provided with an approximately radially extending hole 44 therein, in communication with the aforesaid approximately axially extending hole 43. In like manner, the hub-portion 17 of the outer thrust-plate 18 is also provided with an approximately radially extending hole 45 therethrough, in communication with the approximately radially extending hole 44 in the bearing-cap 12, and also in communication with the cavity 21 in said hub-portion 17.

The result of the foregoing construction is that the rotation of the inner disc-like thrust-plate means 25 causes the hollowed annular oil-pumping peripheral portion 34 thereof to pick up oil, from the oil-reservoir 14, and throw it out into the annular oil-catching groove 40, from which the oil escapes through the approximately horizontal axially extending hole 43, and thence drains downwardly through the holes 44 and 45, into the cavity 21 in the outer thrust-plate 18. The oil then drips from the inner rim of the side-wall 22 of this cavity 21, into the hollow 10 in the shaft-end 9. The annular peripheral wall 46 of the shaft-end 9, surrounding said hollow or cavity 10, is provided with two rows of holes 50 and 51 therethrough, one of said rows of holes being opposite each of the two thrust-surfaces 30 and 31 of the inner thrust-plate means 25.

In operation, therefore, the shims 24 constitutes an extremely simple and convenient means for adjusting the axial position of the outer thrust-plate 18, and specifically, the axial position of its thrust-bearing flange 20, thus providing a means for making a nice adjustment of the axial distance between the two stationary thrust-bearing flanges 20 and 7 of the assembly. By

chine, to give a maximum-end play of .015 inch, or any other desired amount.

A supply of oil is thus provided, for all of the bearing-surfaces, without requiring the use of oil-rings or a conventional oil-pump, which is a desirable feature, both because of the noise-problem and also because of other disadvantages which have been encountered in the previously known oiling-systems. In my oil-supply system, the oil is lifted by the rotating inner thrust plate means 25, and is delivered, through the annular groove 40 and through the pipes 43, 44 and 45, to the cavity 21 in the outer thrust-plate 18 and thence to the cavity 10 in the shaft-end 9, out of which the oil is thrown, by centrifugal action, through the holes 50 and 51, into the planes of the respective thrust-bearing surfaces 30 and 31. Preferably, suitable V-grooves 52 and 53 are provided in the stationary bearing-parts, opposite the two rows of shaft-holes 50 and 51, respectively, for receiving the oil as it is thrown out of said holes in the shaft. The oil which is thus provided on the shaft finds its way to all of the surfaces which are to be lubricated. The direction of oil-flow is indicated by arrows. It will be noted that the oil in the V-groove 52 lubricates the journal-bearing surface of the sleeve-bearing 6.

Preferably, the retaining-plate 23 is disposed within a hollow portion 55 of the bearing-cap 12, and this hollow portion 55 is hermetically closed by means of a closure-plate 56 and gaskets 57. If desired, the hollow space 55 may be drained inwardly, toward the oil-reservoir 14, by means of an opening 58.

In accordance with a well established practice in connection with motor-bearings, I provide an air by-pass channel 60 between the outer surface 61 of the bearing-housing 5 and the inner end 62 thereof. Also, in accordance with established practice, I provide an inner oil-sealing means 63 at said inner end 62 of the bearing-assembly.

In describing the hollow enclosure for the rotor-part 25, I have described this enclosure as being formed by the bearing-housing 5 and the bearing-cap 12, in cooperation, and I have then referred to the enclosure as an entirety, without distinguishing as to how much of the enclosure is afforded by the one part or the other part, in the two-part construction. I have done this, because it is obvious that the main portion of the hollow enclosure could be afforded by either one of the two parts, depending upon the particular shapes of the castings.

It will be obvious, from the foregoing description, in connection with the drawing, that I have provided a bearing-housing which is altogether oil-tight, even when the shaft is inclined at a considerable angle to the horizontal. It will also be obvious that my oil-pumping means remains operative, even though the shaft 8 is inclined at a considerable angle to the horizontal. Furthermore, since my oil-pumping means does not involve any rubbing parts, its operation is sufficiently noiseless to satisfy extremely exacting motor-operating requirements.

While I have shown my invention in but a single illustrative form of embodiment, and have described it in accordance with my present understanding of the same, I wish it to be understood that I am not limited to either the precise structural form or the stated theory of operation. I desire, therefore, that the appended claims shall be accorded the broadest construction consistent

I claim as my invention:

1. A sleeve-bearing assembly, comprising: a bearing-housing; a sleeve-bearing carried thereby, said sleeve-bearing being flanged at its outer end to permit it to carry thrust; a normally horizontal shaft journaled in said sleeve bearing, said shaft having only a short shaft-end extending beyond said sleeve-bearing flange, the end of the shaft being hollowed out; a bearing-cap secured to said bearing-housing and cooperating with the bearing-housing to afford a hollow enclosure surrounding said shaft-end, the lower portion of said enclosure constituting an oil-reservoir, said bearing-cap having a radially extending disc-like portion having a central bore larger than the diameter of the shaft-end; an outer thrust-plate having an outwardly extending hub-portion fitting within the bore of the bearing-cap, the inner end of said outer thrust-plate being bored to receive the tip of the shaft-end and being flanged to permit it to carry thrust, the hub-portion of said outer thrust-plate having a cup-shaped cavity facing the hollow in the shaft-end and having a cup-wall projection which extends a little way into said hollow in the shaft-end, the axial length of said hub-portion being greater than the axial wall thickness of the portion of said bearing-cap immediately surrounding the bore in said bearing-cap; a retaining-plate bolted to the outer face of said bearing-cap in abutting relation to the outer face of the hub-portion of the outer thrust-plate; an end-float-adjusting annular spacer-means surrounding the hub-portion of the outer thrust-plate and disposed between the retaining-plate and the bearing-cap; and an inner disc-like thrust-plate means carried by the shaft-end and immovably fixed to said shaft-end, said inner thrust-plate means having inner and outer thrust-surfaces cooperating respectively with the flange of the sleeve-bearing and the flange of the outer thrust-plate, said inner thrust-plate means further having a hollowed annular oil-pumping peripheral portion having a small radial clearance with respect to said hollow enclosure; the peripheral wall of said hollowed annular oil-pumping portion having a row of holes therethrough; said hollow enclosure having an annular groove facing said row of holes in said oil-pumping portion, said annular groove being stopped somewhere in the upper portion of said hollow enclosure; the upper portion of said hollow enclosure having an approximately axially extending hole therein in communication with said annular groove to tap off oil therefrom before the stopped end thereof; the disc-like portion of said bearing-cap having an approximately radially extending hole therein in communication with said approximately axially extending hole; the hub-portion of said outer thrust-plate having an approximately radially extending hole therethrough in communication with the approximately radially extending hole in the bearing-cap, and also in communication with the cavity in said hub-portion; and the peripheral wall of the hollow in the shaft-end having a row of holes therethrough opposite each of the two thrust-surfaces of said inner thrust-plate means.

2. A sleeve-bearing assembly, comprising: a bearing-housing; a sleeve-bearing carried thereby; a normally horizontal shaft journaled in said sleeve-bearing, said shaft having only a short shaft-end extending beyond said sleeve-bearing,

the end of the shaft being hollowed out; a bearing-cap secured to said bearing-housing and cooperating with the bearing-housing to afford a hollow enclosure surrounding said shaft-end, the lower portion of said enclosure constituting an oil-reservoir, said bearing-cap having a radially extending disc-like portion; means carried by said bearing-cap for providing a cup-shaped cavity facing the hollow in the shaft-end and having a cup-wall projection which extends a little way into said hollow in the shaft-end; and a disc-like rotor-member carried by the shaft-end and immovably fixed to said shaft-end, said rotor-member being disposed within said hollow enclosure and having a hollowed annular oil-pumping peripheral portion having a small radial clearance with respect to said hollow enclosure; the peripheral wall of said hollowed annular oil-pumping portion having a row of holes therethrough; said hollow enclosure having an annular groove facing said row of holes in said oil-pumping portion, said annular groove being stopped somewhere in the upper portion of said hollow enclosure; the upper portion of said hollow enclosure having an approximately axially extending hole therein in communication with said annular groove to tap off oil therefrom before the stopped end thereof; the disc-like portion of said bearing-cap having an approximately radially extending hole therein in communication with said approximately axially extending hole, and also in communication with said cavity of the bearing-cap; and the peripheral wall of the hollow in the shaft-end having holes therethrough for lubricating said bearing.

3. A sleeve-bearing assembly, comprising: a bearing-housing; a sleeve-bearing carried thereby, said sleeve-bearing being flanged at its outer end to permit it to carry thrust; a normally horizontal shaft journaled in said sleeve bearing; a bearing-cap secured to said bearing-housing and cooperating with the bearing-housing to afford a hollow enclosure surrounding said shaft-end, the lower portion of said enclosure constituting an oil-reservoir, said bearing-cap having a radially extending disc-like portion having a central bore larger than the diameter of the shaft-end; an outer thrust-plate having an outwardly extending hub-portion fitting within the bore of the bearing-cap, said outer thrust-plate having a bore receiving said shaft and being flanged to permit it to carry thrust, the axial length of said hub-portion being greater than the axial wall-thickness of the portion of said bearing-cap immediately surrounding the bore in said bearing-cap; a retaining-plate bolted to the outer face of said bearing-cap in abutting relation to the outer face of the hub-portion of the outer thrust-plate; and an end-float-adjusting annular spacer-means surrounding the hub-portion of the outer thrust-plate and disposed between the retaining-plate and the bearing-cap.

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