

A. KINGSBURY AND H. A. S. HOWARTH.
BEARING.

APPLICATION FILED MAR. 22, 1917.

1,409,552.

Patented Mar. 14, 1922.

2 SHEETS—SHEET 1.

Fig. 1.

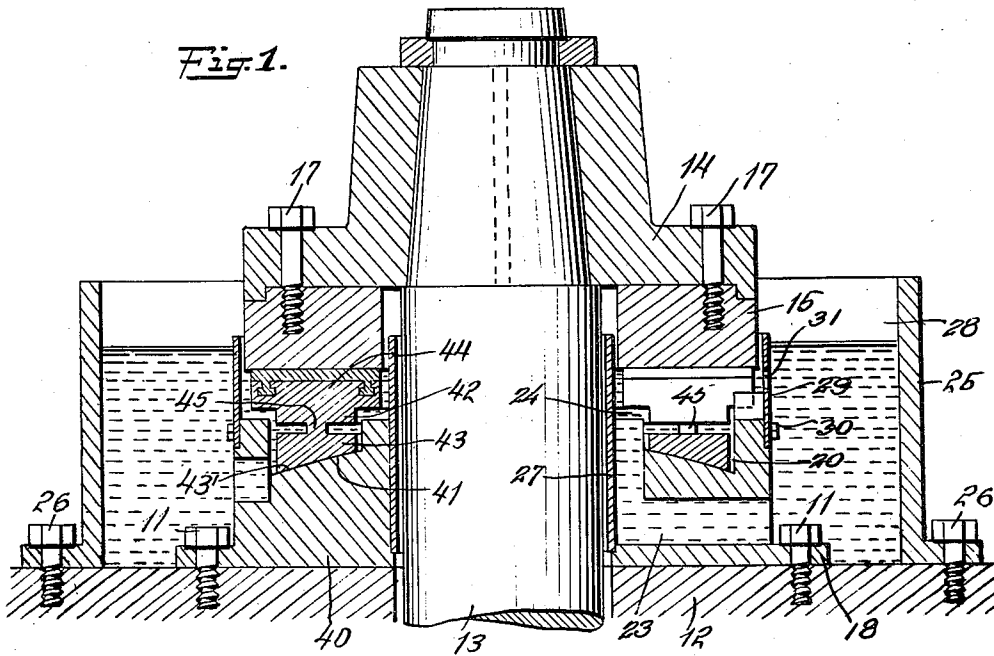


Fig. 2.

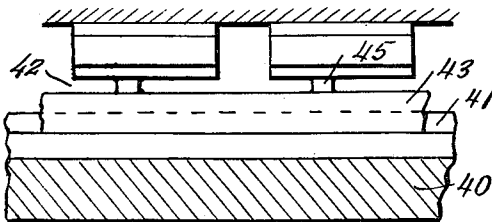


Fig. 3.

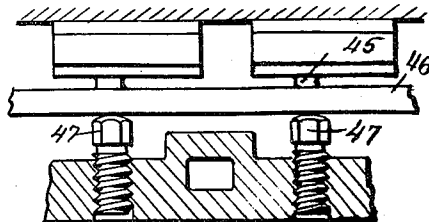


Fig. 4.

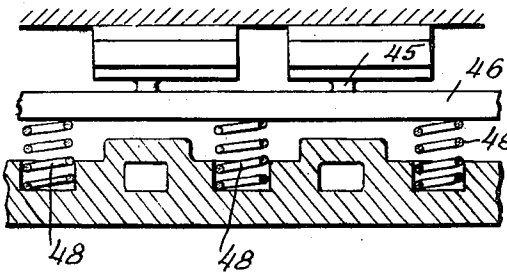
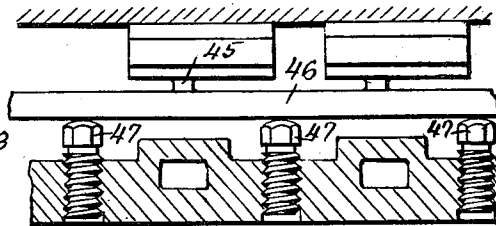


Fig. 5.



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2 SHEETS—SHEET 2.

Fig. 6.

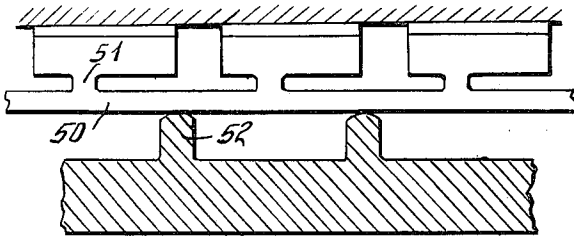


Fig. 7.

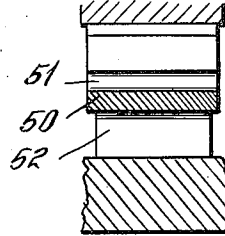


Fig. 8.

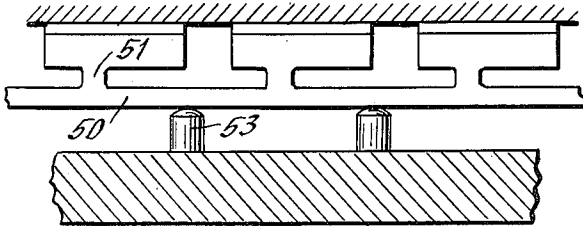


Fig. 9.

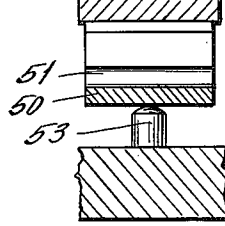


Fig. 10.

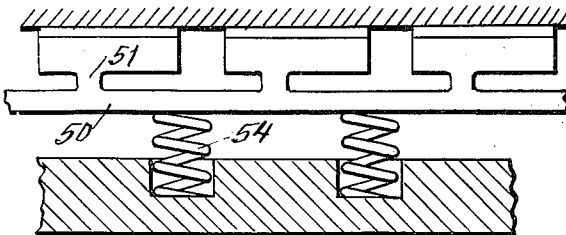
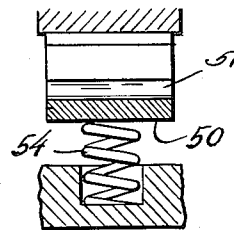


Fig. 11.



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UNITED STATES PATENT OFFICE.

ALBERT KINGSBURY AND HARRY A. S. HOWARTH, OF PITTSBURGH, PENNSYLVANIA;
SAID HOWARTH ASSIGNOR TO SAID KINGSBURY.

BEARING.

1,409,552.

Specification of Letters Patent. Patented Mar. 14, 1922.

Application filed March 22, 1917. Serial No. 156,546.

To all whom it may concern:

Be it known that we, ALBERT KINGSBURY and HARRY A. S. HOWARTH, citizens of the United States, and residents of Pittsburgh, Allegheny County, and State of Pennsylvania, have invented certain new and useful Improvements in Bearings, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

Our invention relates to bearings, and particularly to thrust or footstep bearings, which are adapted to automatically maintain a film of lubricating fluid between the bearing surfaces.

One object of our invention is to provide a unitary bearing member comprising a plurality of segmental bearing portions which are adapted to act substantially like the tiltable shoes of the inventions covered by patents previously granted to Albert Kingsbury; for example, see Patent No. 947,242 granted January 25, 1910, and Patent 1,117,499 granted November 17, 1914.

In our copending application S#89,001 filed April 5, 1916, of which this application is in part a continuation, we have disclosed a bearing of this character comprising a unitary flexible member, and means for supporting it so as to permit a circumferential or tangential tilting of segmental portions thereof in response to the wedging action of the oil when the bearing is in operation, and a radial tilting of the said portions in order to equalize, when necessary, the pressure on the inner and outer zones of each tiltable segment. In this earlier application we have also disclosed various forms of supporting means for the unitary bearing member, which are capable of adjustment for the purpose of circumferentially equalizing the pressure upon the successive segmental bearing portions. Other forms of supports, which are adapted to automatically adjust and distribute the bearing pressure over the thrust engaging surfaces, are disclosed in our copending application S#235,063 filed May 17, 1918, which is in part a division of the above-named application S#89,001 and is in part a continuation of this application.

This application relates to certain embodiments of the aforesaid invention which are differentiated from the subject matter of the copending applications above referred to in

that it has special reference to bearing members relatively rigid portions that are connected to a base—which may be either rigid or flexible—by yielding resilient webs or necks. These webs or necks may be arranged to flex in only one direction or in all directions, so as to permit either a tilting of the shoes or segmental portions tangentially or circumferentially in response to the wedging action of the oil, or so as to also permit a radial tilting, when necessary, in order to equalize the pressure on different zones of the segmental surfaces.

Another object of this invention is to provide a bearing of the aforesaid character with means for automatically effecting an equitable distribution of the bearing pressure on the several bearing segments or shoes.

Other objects and advantages of our invention will be set forth hereinafter, and in order that our invention may be thoroughly understood we will now proceed to describe the same in the following specification and then point out the novel features thereof in appended claims.

The invention is capable of receiving a variety of mechanical expressions some of which are shown on the accompanying drawings, but it is to be expressly understood that the drawings are for purposes of illustration only and are not to be construed as a definition of the limits of the invention, reference being had to the appended claims for that purpose.

Referring to the drawings:

Figure 1 is a sectional elevation of a bearing arranged and constructed in accordance with our invention and constituting one embodiment thereof.

Figure 2 is a developed sectional view of the structure shown in Figure 1.

Figures 3, 4 and 5 are corresponding views of other embodiments of our invention.

Figures 6, 8, and 10 are each sectional developments corresponding to Figure 2 of other embodiments of our invention.

Figures 7, 9 and 11 are sectional views in radial planes at right angles to Figures 6, 8 and 10 respectively.

In the form shown in Figures 1 and 2 the structure comprises a base 40 secured by bolts 11 or other suitable means to a frame or foundation 12, a shaft 13 which extends

through suitable openings in the frame and base, a thrust block 14 on the shaft and relatively rotatable bearing members 15 and 42.

The thrust block 14 is keyed or affixed to the shaft 13 by any suitable means and one of the bearing members 15, hereinafter designated the thrust collar, is secured to the block 14 by bolts 17 or other suitable means.

The base 40 has a flange 18 through which the bolts 11 extend and is provided with an annular groove 20 near its upper surface. Lubricating fluid passages 23 are also provided in the base and extend radially there-through, as shown in Figure 1, and open axially upward into the annular space 24 within the bearing members.

An outer wall or flange 25 surrounds the bearing and is suitably secured to the frame or foundation 12, as by bolts 26. A sleeve 27 is attached to the base 40 and loosely surrounds the shaft 13, the same cooperating with the wall 25 to provide a fluid containing reservoir 28. We also prefer to utilize a baffle plate 29, having the form of a sleeve and suitably secured to the base as by bolts 30, which extends upwardly from the base beyond the plane of the bearing surfaces and is perforated opposite the bearing surfaces as indicated at 31.

The bearing member 42, with which the present invention is more particularly concerned, comprises, in the form shown in Figs. 1 and 2, a plurality of bearing segments or shoes 44 which are connected, preferably integrally, with a unitary ring 43 by means of flexible necks or webs 45. These webs or necks are sufficiently resilient or flexible to permit the necessary tilting of the shoes for the purpose of automatically maintaining oil films between the bearing surfaces. These webs may extend radially across the ring but they are preferably constructed to flex slightly in all directions so as to insure a proper distribution of pressure over the surface of each shoe even if the thrust collar 15 becomes slightly crowned or deformed owing to the normal heating of the bearing in operation.

In the form shown in Figs. 1 and 2 the ring 43 is relatively rigid and is provided with a spherically curved bottom surface 43' which cooperates with the correspondingly curved surface 41 of the base member 40. These cooperating spherical surfaces 41 and 43' insure the proper distribution of pressure among the several shoes by providing a pivotal mounting for the entire bearing member 42.

In place of a relatively rigid ring for carrying the bearing segments or shoes, the bearing member may comprise a flexible ring 46 as shown in Figure 3, and said flexible ring may be mounted on spherically-headed adjusting screws or supports 47 arranged as shown either in Figure 3 or Figure 5. In

these structures the flexibility not only of the webs 45 but also of the ring 46 cooperates in permitting desired tilting of the shoes in operation, while in the form shown in Fig. 5 the flexibility of said ring also automatically provides for an equitable distribution of the bearing pressure among the several bearing segments or shoes since said ring may flex or distort between successive screws 47 in response to unequal pressures until each of the bearing segments is carrying its proportionate part of the load.

In the form shown in Figure 4 springs 48 are substituted for the supporting screws 47, and they not only permit the flexing of the ring in such manner as to allow the shoes to assume slightly tilted positions as hereinafter explained, but also introduce an additional element of resiliency between the support and the bearing members which assists in equalizing the pressure among the several bearing segments or shoes.

When the bearing is at rest the surfaces of the bearing shoes are substantially in one plane in each of these embodiments. When the bearing is in operation the wedging action of the oil, with which the reservoir 28 is filled, causes the shoes to tilt slightly with reference to the cooperating bearing surface of the collar 15. This tilting permits the film of oil to be automatically maintained between the bearing surfaces during the operation of the bearing and the tilting is provided for by the flexibility of the webs 45 and, in the structures of Figs. 3 to 5, of the ring 46 which may be flexed or distorted when the bearing is in operation.

In the form shown in Figure 6 the bearing segments or shoes are connected to a flexible ring 50 by flexible webs 51 which extend radially and are adapted to flex to permit the shoes to assume a tilted position when the bearing is in operation but they are not depended upon to flex in a radial direction, the flexibility of the ring itself being depended upon for this result. The ring 50 may be mounted on projections 52 having cylindrically curved tops as shown in Figures 6 and 7, or upon projections such as 53 having spherically curved tops as shown in Figures 8 and 9. Springs 54 as shown in Figures 10 and 11 may be used instead of supporting projections, if desired.

In each of these embodiments of the invention, the bearing segments or shoes may flex or tilt circumferentially, owing to the flexibility of the webs or necks by which they are supported, so as to provide for the automatic formation of oil films between the bearing surfaces, and except where said webs or necks are elongated in a radial direction as in Figs. 6 to 11, they may also flex or tilt radially to equalize the pressure on the inner and outer zones of each segment. When said segments are also mounted on a flexible

connecting ring the flexibility of said ring facilitates the tilting of said segments, and additionally effects automatically an equitable distribution of the bearing pressure when said ring is supported at points intermediate the bearing segments. When the connected series of bearing segments is mounted on springs an equitable distribution of the bearing pressure is effected through the yieldability of said springs whether the connecting ring be flexible or not, but if said connecting ring be also flexible both the tilting of the segments and the equitable distribution of the bearing pressure are further facilitated. Thereby a bearing has been provided whereby each of the bearing segments may readily assume such position as to provide for the automatic maintenance of an oil film between the bearing surfaces and an equitable distribution of the bearing pressure between the several bearing segments and between the different zones of each segment in conformity with the principle of the Kingsbury bearings.

While we have shown the bearing member which comprises the flexible portion as a part of the stationary element of the bearing, this member may obviously be a part of the rotating member if desired, the thrust collar then forming a part of the stationary instead of the rotating member.

Structures of preferred form and construction have been illustrated and described for the purpose of showing ways in which this invention may be embodied, but the inventive thought upon which this application is based is broader than these illustrative embodiments thereof, and we therefore intend no limitations other than those imposed by the appended claims.

What we claim is:

1. A bearing comprising a support, a plurality of segment bearing portions, and interposed flexible necks arranged to permit the tilting of the said segments.

2. In a bearing, the combination of a bearing member comprising a ring with a plurality of bearing segments mounted thereon and connected thereto by flexible necks which extend between said ring and the rear of said segments, and means for supporting the ring.

3. In a thrust bearing, the combination of a bearing member comprising a ring with a plurality of segment bearing portions mounted thereon and connected thereto by axially-extending flexible necks, and a support for the ring.

4. In a thrust bearing, the combination of a bearing member comprising a ring with a plurality of bearing segments mounted thereon and connected thereto by flexible necks, and a flexible support for the ring adapted to equalize the pressure on said segments.

5. A bearing member comprising a sup-

porting portion with bearing shoes mounted thereon and connected thereto by necks extending between said supporting portion and the rear of said shoes, said necks being yieldable to permit tilting of the shoes.

6. A bearing member comprising a flexible ring with bearing shoes mounted thereon and connected thereto by flexible necks, the said ring and necks being adapted to yield to permit tilting of the shoes.

7. A bearing member comprising a ring with shoes mounted thereon and connected thereto by necks that are adapted to flex so as to permit both a circumferential and a radial tilting of the shoes.

8. A bearing comprising in combination a bearing member consisting of a flexible ring with a series of bearing shoes mounted thereon and connected thereto by flexible necks, and means for supporting the flexible ring between the necks, whereby the flexibility of the necks and the flexibility of the ring cooperate to permit the tilting of the shoes.

9. In a thrust bearing, the combination of a member with bearing segments mounted thereon and connected thereto by flexible necks, and a series of resilient supports for said member adapted to equalize the pressure on said segments.

10. A bearing member comprising a ring with bearing shoes mounted thereon and connected thereto by axially-extending flexible necks.

11. A thrust bearing comprising in combination, a bearing member composed of a flexible ring with bearing segments connected thereto by flexible necks, and yieldable means for supporting said bearing member.

12. A thrust bearing comprising in combination a bearing member composed of a flexible ring having segment bearing portions with flexible necks joining the segment bearing portions to the ring, and means for automatically effecting an equitable distribution of the bearing pressure on said segments.

13. A thrust bearing member composed of a flexible ring, ring segments or shoes having bearing surfaces substantially in the same plane, and axial necks joining the segments to the ring, the said necks being adapted to yield to permit the segments to assume a tilted position when the bearing is in operation.

14. A thrust bearing comprising in combination a bearing member composed of a flexible ring with ring segments or shoes having bearing surfaces substantially in the same plane and with transverse necks joining the segments to the ring, whereby the segments are permitted to assume a tilted position when the bearing is in operation, and yielding means for supporting the ring.

15. A thrust block for a thrust bearing

comprising a mounting ring having a plurality of integral flexible arms extending parallel with the axis of the ring and terminating in bearing shoes having flat bearing faces at right angles to the arms, the point of connection between the arms and the shoe being disposed eccentric to the bearing faces.

16. A thrust bearing comprising a stationary member, a rotatable shaft, a bearing member on the shaft, and a bearing block comprising a ring surrounding the shaft and mounted on the stationary member having a plurality of axially-extending flexible arms terminating in bearing shoes capable of independent movement and adapted to engage the said bearing member.

17. A bearing comprising in combination a bearing member consisting of a flexible ring with a plurality of bearing segments mounted thereon and connected thereto by flexible necks, and resilient means for supporting the flexible ring between the necks.

18. A thrust bearing comprising a rotatable shaft, a stationary member for absorbing the longitudinal thrust of said shaft, a bearing member mounted on said shaft, a plurality of thrust imparting shoes engaging said bearing member, and a separate integral resilient mounting arm singly supporting each shoe and located eccentrically of the shoe and mounted on said stationary member.

19. A thrust bearing comprising a stationary member, a rotatable shaft, a bearing member mounted on said shaft, a plurality of segmental shoes engaging said bearing member, a separate yielding mounting arm integrally formed with the rear of each shoe and a supporting ring mounted on said stationary member and integrally formed with each of said arms.

20. A thrust block for a thrust bearing comprising a mounting ring having a plurality of integral flexible arms extending parallel with the axis of the ring and terminating in bearing shoes capable of independent movement.

21. A thrust block for a thrust bearing comprising a base member and a plurality of bearing shoes integrally connected to one another by resilient integral arms mounted on the said base member.

22. A thrust bearing comprising relatively rotatable members, a plurality of segmental shoes engaging one member, and a separate single resilient supporting arm for integrally joining each shoe to the other member.

23. A thrust receiving member for a thrust bearing comprising a mounting ring having a plurality of flexible arms extending parallel with the axis of the ring and terminating in bearing shoes.

24. In a thrust bearing, the combination of a bearing member comprising a ring with

a plurality of bearing segments mounted thereon and connected thereto by axially extending flexible necks, and means mounting said ring and cooperating therewith to effect automatically an equitable distribution of the bearing pressure on said segments.

25. In a bearing, the combination of a bearing member comprising a supporting portion with a plurality of bearing segments mounted thereon by means of flexible necks connecting the rear of said segments with said supporting portion, and means for equalizing the pressure on said segments.

26. In a bearing, a bearing member comprising a flexible supporting member and a plurality of bearing segments connected to said member by flexible necks.

27. In a bearing, the combination of a bearing member comprising a flexible supporting member, a plurality of bearing segments connected to said member by flexible necks, and means for equitably distributing the pressure on said segments.

28. In a bearing, the combination of a bearing member comprising a flexible supporting member, a plurality of bearing segments connected to said member by flexible necks, and a plurality of springs for equitably distributing the pressure on said segments.

29. In a bearing, a bearing member comprising a flexible supporting member, a plurality of bearing segments, and flexible necks connecting said segments to said flexible supporting member and permitting tilting of said segments in all directions.

30. In a bearing, a bearing member comprising a flexible supporting member, a plurality of bearing segments, flexible necks connecting said segments to said flexible supporting member and permitting tilting of said segments in all directions, and flexible means for mounting said bearing member.

31. In a bearing, a plurality of bearing segments, and a flexible neck connected with the rear of each segment by which said segments are mounted.

32. In a bearing, a plurality of bearing segments and a single axially-extending flexible neck on which each of said segments is mounted.

33. In a bearing, a plurality of bearing segments, flexible necks connected with the rear of said segments by which said segments are mounted, and means connecting said flexible necks to form a unitary bearing member.

34. In a bearing, a plurality of bearing segments, flexible necks by which said segments are mounted, and a flexible member connecting said flexible necks to form a unitary bearing member.

35. In a bearing, a plurality of bearing segments, flexible necks by which said segments are mounted, and a flexible member connecting said flexible necks to form a unitary bearing member.

ments are mounted, a flexible member connecting said flexible necks to form a unitary bearing member, and means mounting said unitary member at points intermediate
5 said flexible necks.

36. In a bearing, a plurality of bearing segments, flexible necks by which said segments are mounted, a flexible member con-

necting said flexible necks to form a unitary bearing member, and flexible means mounting said unitary bearing member. 10

In witness whereof, we have hereunto set our hands this 20th day of March, 1917.

ALBERT KINGSBURY.
HARRY A. S. HOWARTH.