

Exhibit 1003

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(72) Inventor ALAIN CHIELENS



(54) DEVICE FOR SUPPORTING A ROTATING BODY

(71) We, FIVES-CAIL BABCOCK, a French Body Corporate of 7, Rue Montalivet, 75383 Paris Cedex 08, France, do hereby declare the invention for which we pray that a Patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

The present invention relates to a device suitable for use in supporting a rotating body, more particularly of large diameter, and if necessary taking up axial stresses whereto said body is subjected, which device comprises at least one shoe mounted on a fixed frame by means of a ball joint and sliding on a circular track provided on the rotating body, coaxially with its axis of rotation.

In previously proposed such devices, the centre of the ball joint has been situated spaced from and below a sliding surface of the shoe so that any deformation (bending, ovalisation, or expansion) of the supported body has caused a displacement of the shoe relative to the supported body which has brought about a shearing stress on a film of oil formed between the shoe and the rotating body, and such shearing effect may have been harmful to the stability of said film and may consequently have been detrimental to lubrication of the sliding surfaces. Furthermore, any axial force acting on the shoe has had a tendency to make the shoe rock, which has resulted in a non-uniform distribution of bearing pressures over the width of a sliding track. This is why these devices have not been generally used for taking up axial forces to which the rotating body have been subjected.

It is an object of the present invention to provide a device for supporting a rotating body, wherein the above-indicated disadvantages are eliminated or substantially reduced.

According to the present invention,

therefore, we provide a device for supporting a rotating body which device comprises at least one shoe mounted on a fixed frame by means of a part spherical member of the shoe locating in a corresponding recess in the frame, the centre of curvature of the part spherical member being at or adjacent a relatively slidable surface of the shoe and the ratio of the radius of curvature of the part spherical member to the maximum dimension of the shoe parallel to the intended axis of a rotating body being from 0.35:1 to 0.5:1.

In the present device for supporting a rotating body, when in use, lubrication of the relatively slidable surface of the shoe may be effected in known manner by means of oil introduced into a transverse channel extending substantially parallel to the axis of the rotating body formed on said surface and not opening on to sides of the shoe.

To take up axial forces, flanges or collars may, if desired, be provided on the rotating body, and may be arranged with a small clearance at each side of the shoe. The lubrication of the sides of the shoe can then be ensured by means of two circumferential grooves formed at the junctions of the flanges or collars with the rotating body and two passages opening on to the relatively slidable surface of the shoe and providing communication between the transverse channel and the two grooves, the cross-sectional areas of the orifices being partly defined by the slidable track of the rotating body so as to be equal when the shoe is centred relatively to the flanges and so that a said cross-sectional area increases when the shoe approaches the flange adjacent the respective passage in question; when the shoe abuts a flange, the other orifice may be completely masked. These passages can be constituted by sloping recesses formed in end walls of the transverse channel. The sides of the

shoe may be formed with recesses forming containers for oil.

By way of a variant, axial forces can be taken up by flanges of the shoes enclosing or bounding the slidable track of the rotating body.

The invention will now be more particularly described with reference to the accompanying drawings, wherein:—

Figure 1 is an elevational view of the present device for supporting a rotating body, certain parts of the device being shown in section;

Figure 2 is a longitudinal section through a shoe;

Figure 3 is a sectional view, taken along the line 3-3 of Figure 2, of the shoe shown in Figure 2;

Figure 4 is a view showing to a larger scale than that of Figure 3 a detail of the shoe shown in Figures 2 and 3;

Figure 5 is a perspective view of the shoe shown in Figures 2 to 4;

Figure 6 is a sectional view illustrating to a larger scale than that of Figure 1 a detail of the device shown in Figure 1 with the shoe shown in Figures 2 to 5 in a first position; and

Figure 7 is a view similar to Figure 6 showing a position of the shoe shown in Figures 2 to 5 in a position other than that of Figure 6.

Referring to the drawings, a supporting device shown in Figure 1 is intended to support a rotating body 12 of large diameter; an identical device is arranged symmetrically relatively to a vertical plane containing the axis of the rotating body 12.

The device illustrated is constituted by a shoe 10 on which the body 10 slides when the device for supporting the rotating body 12 is in use. Relatively slidable surfaces of the shoe 10 and the rotating body 12 are part-spherical and concentric with the axis of rotation. The shoe 10 comprises an extending portion 11 fitted into a central bore of an annular member 13 forming a ball joint. The member 13 has a part-spherical lower surface and a centre 30 situated on the sliding surface of the shoe 10. The lower surface of the member 13 bears on an upper, part-spherical surface of a seat 15 of annular cross-section fitted on to the frame 17.

The diameter of the ball joint is between 0.7 and 1.0 times the width of the shoe 10 (dimension as measured parallel to the axis of the rotating body 12). Instead of being situated exactly on the sliding surface of the shoe 10 the centre 30 of the ball joint may be situated above or below said surface at a distance therefrom equal to at most 1/10 of the width of the shoe 10.

Axial movements of the part 12 are limited by two flanges 14 arranged to be

integral with said body 12 the flanges 14 are arranged with a small clearance at each respective side of the shoe 10.

An upper face of the shoe 10 and an upper portion of sides thereof are covered with a lining 16 of anti-friction material Recesses 19 (Figure 5) forming containers for oil are formed in the sides of the shoe 10.

A transverse channel 18 is formed in the relatively slidable surface of the shoe 10; this channel 18 does not open on to the sides of the shoe 10, and a slight thickness of material remains at ends thereof. Oil may be introduced into the channel 18 by a duct 20 (Figure 2) and thus supplied to the channel 18.

Sloping recesses 22 (Figures 4, 6, and 7) are formed in two end walls of the channel 18, as is illustrated in Figures 6 and 7. These recesses 22 provide communication between the channel 18 and two circumferential grooves 24 formed at the junction of the flanges 14 with the rotating body 12. The cross-sectional area of two passages provided by each of these recesses 22 between the channel 18 and the respective groove 24 is at a maximum when the shoe 10 (Figures 1 to 3 and 5) abuts a corresponding one of the flanges 14 (Figures 1 and 3), as Figure 6 illustrates; communication between the channel 18 and the groove 24 is interrupted when the shoe 10 abuts the opposite flange 14 (Figure 7). In intermediate positions of the shoe 10 the channel 18 communicates with both of the grooves 24; more particularly when the shoe 10 is centred relatively to the flanges 14 the useful cross-sectional areas of the two passages are equal. The recesses 22 provide passages which open on to said relatively slidable surface of the shoe 10.

Orifices of these passages are partly masked by a slidable track of the body 12 so that cross-sectional areas of the orifices are equal when the shoe 10 is centred relatively to the flanges 14.

These recesses 22 allow the oil to flow from the channel 18 into the groove 24 and then into the lateral containers 19 for oil, to provide lubrication for the sides of the shoe 10.

An advantage of such an arrangement consists in that a flow of oil towards each side of the shoe 10 is larger in proportion as the corresponding flange 14 is nearer to this side. In fact, relative axial movement of the shoe 10 and the body 12 (Figures 1 to 3) has a result of increasing the cross-sectional area of each orifice allowing communication between the channel 18 (Figure 2) and the groove 24 (Figures 6 and 7) in a region where a bearing and the shoe 10 approach the flange 14 adjacent the orifice

concerned, and reducing this cross sectional area at another side. Therefore, this cross-sectional area is larger in proportion as that side of the shoe 10 is nearer to the flange 14, and lubrication must be more effective. Thus means are provided for bringing a lubricant in between the sides of the shoe 10 and the respective flanges 14.

In a limiting case, the recess 22 situated in the region of the side furthest from the respective flange 14 and the orifice of each passage may be completely masked as represented in Figure 7, in which case a maximum amount of oil is directed towards an opposite side of the shoe 10 when that side abuts the adjacent flange 14. Therefore by this means an optimum automatic distribution of lubricating oil is obtained for the sides of the shoe 10.

The present device for supporting a rotating body is applicable to all supporting and thrust-bearing devices for rotating parts sliding on shoes by means of a hydrostatic or hydrodynamic film of oil and more particularly, for example, bearings of tubular grinding mills and bearings supporting rotary oven wheels.

WHAT WE CLAIM IS:—

1. A device for supporting a rotating body which device comprises at least one shoe mounted on a fixed frame by means of a part spherical member of the shoe locating in a corresponding recess in the frame, the centre of curvature of the part spherical member being at or adjacent a relatively slidable surface of the shoe and the ratio of the radius of curvature of the part spherical member to the maximum dimension of the shoe parallel to the intended axis of a rotating body being from 0.35:1 to 0.5:1.

2. A device for supporting a rotating body, as claimed in claim 1, in which means are provided for supplying a lubricant to the surface of the shoe intended to undergo sliding relative to the rotating body.

3. A device for supporting a rotating body, as claimed in claim 2, in which device the shoe is formed with a transverse channel extending substantially parallel to the intended axis of the rotating body formed in the relatively slidable surface, arranged to be supplied with oil.

4. A device for supporting a rotating body, as claimed in claim 3 or claim 4, in which said channel is formed with sloping recesses in its end walls.

5. A device for supporting a rotating body, as claimed in any of claims 1 to 4,

in which device the sides of the shoe are formed with recesses forming containers for oil.

6. A device for supporting a rotating body, substantially as hereinbefore described with reference to the accompanying drawings.

7. An assembly comprising a device as claimed in any preceding claim and a body slidably supported by said device for rotation.

8. An assembly as claimed in claim 7, in which the rotatable body is provided with two integral circumferential flanges arranged with a small clearance at each respective side of the shoe, and means are provided for bringing a lubricant in between the sides of the shoe and the respective flanges.

9. An assembly as claimed in claim 8, in which the shoe is formed with a transverse channel extending substantially parallel to the axis of the rotating body formed in the relatively slidable surface thereof, arranged to be supplied with oil, two circumferential grooves being formed at the junctions of the flanges with the rotating body, and two passages opening onto said relatively slidable surface of the shoe and providing communication between the channel and the two grooves, the cross-sectional areas of the passages being partly defined by the slidable track of the rotating body so as to be equal when the shoe is centred relatively to the flanges and so that a said cross-sectional area increases when the shoe approaches the flange adjacent the respective passage.

10. An assembly, as claimed in claim 8, in which the cross-sectional area of a said passage is reduced to zero when a side of the shoe abuts the flange adjacent thereto.

11. An assembly of a device as claimed in claim 1 and a body slidably supported by said device for rotation, substantially as hereinbefore described with reference to Figs. 1 to 3, 6 and 7 of the accompanying drawings.

12. An assembly as claimed in any of claims 7 to 11, wherein the said body comprises a tubular grinding mill.

13. An assembly as claimed in any of claims 7 to 11, wherein the said body comprises a rotary oven.

STANLEY, POPPLEWELL, FRANCIS
& ROSS

Agents for the Applicants,
Chartered Patent Agents,
1, Dyers Buildings,
Holborn, EC1N 2JT.



