

UNITED STATES PATENT OFFICE.

JOHN C. CROMWELL, OF CLEVELAND, OHIO.

BEARING.

No. 856,228.

Specification of Letters Patent.

Patented June 11, 1907.

Application filed July 7, 1905. Serial No. 268,613.

To all whom it may concern:

Be it known that I, JOHN C. CROMWELL, a citizen of the United States, and a resident of Cleveland, county of Cuyahoga, and State of Ohio, have invented a new and useful Improvement in Bearings, of which the following is a specification, the principle of the invention being herein explained and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

My invention relates to an improvement in bearings and particularly to anti-friction journal bearings which are not designed to sustain an axial thrust but serve to yieldingly oppose the side thrust and thus to steady the shafts which they carry, and to compensate for distortions induced by the operating mechanism. Said invention consists of means hereinafter fully described and specifically set forth in the claims.

The annexed drawing and the following description set forth in detail certain mechanism embodying the invention, such disclosed means constituting but one of various mechanical forms in which the principle of the invention may be used. Said annexed drawing represents a vertical sectional view of my invention, serving to guide the lower end of the bowl-shaft of a centrifugal separator, partial elevational and partial sectional views of connected parts of a centrifugal separator being also shown, and in connection therewith a vertical sectional view of a second bearing described and claimed in a companion application for United States Letters Patent, Serial No. 249,215, filed March 9, 1905.

My improved bearing is capable of use in a great many situations, but I shall illustrate the invention by reference to and description of only one of such uses, that one being in connection with centrifugal separators, the adaptability of the invention to which I shall now describe in detail by the aid of the accompanying drawing.

Carried in the frame A of a centrifugal separator of any approved type is the separating-bowl B, to which rapid rotary motion is given by means of the worm-wheel C, gearing with a shaft b of the separating-bowl and with the driving mechanism (not shown). During the rapid rotation of the bowl B both it and the shaft b vibrate considerably and this is especially true when the speed at which the

separator is balanced to run is changed materially, as is the case in starting up the machine.

I have provided two flexible ball-bearings for the reception and guidance in the frame A of the two-ends of the shaft b, such bearings being so arranged as to properly take care of the vibrations of the bowl B and not in any way disturb the paths of travel of the balls. The vibrations of the bowl are mainly caused by its unbalanced condition before it arrives at its normal speed and by the variations in the thrust between the driving worm-wheel and the spindle, caused by the hand operation. Said flexible ball-bearings comprise the bearing D' forming the subject matter of this invention and serving to guide the lower shaft-portion, and also the upper bearing D, forming the subject-matter of the above-mentioned companion application, and serving to guide the upper shaft-portion.

In order that my invention may be fully understood and the application of it, herewith shown, clearly described, I have fully shown in the drawing said upper bearing of the companion application and shall hereinafter describe its construction and function.

The vibrations of the bowl and shaft above referred to serve to distort both of the bearings D and D' and it is my object to so arrange said bearings that they will mutually compensate for the distortions of each other and thus maintain centralization between the axes of the bearings and the separating-bowl.

My invention comprises the lower bearing D' which consists of the two annular parts d^5 d^6 , suitably carried and retained in the frame as shown, and a third part b' adapted to be revolved by the shaft which the bearing carries and here shown as an integral portion of the lower part of the shaft b, said revoluble member b' being located centrally and symmetrically as regards the parts d^5 and d^6 , and having a surface adapted to contact with the balls E' carried in the three-point ball-race formed by the members d^5 , d^6 and b' . The parts d^5 and d^6 form one member of the lower bearing D', and the shaft-portion b' a second member, the parts d^5 and d^6 being entirely distinct from one another and capable of movement and adjustment relatively to each other, such movement and adjustment being automatically controlled, as will be hereinafter explained. Said parts d^5 and d^6 alone

are adapted to form a self-containing two-point ball-race, as hereinafter explained, and are grooved to receive between them the balls E', and the inner surfaces of these 5 grooves slope so as to form a two-point wedge-shaped ball-race, which forces the balls E' against the said revoluble member b' and tends to center the latter. The parts d^b and d^a are forced apart by the member b' 10 when the latter moves laterally in one direction or the other, due to the vibrations of the shaft and bowl. This relative movement of the parts d^b and d^a compresses a spring J, suitably seated in the frame under the bearing D'. The tension of this spring J, as soon 15 as the lateral thrust of the member b' is relieved, forces the parts d^b and d^a together again, and the sloping inner surfaces of these parts force the balls E' against the member b' and tend to center the latter as noted above. It will be noted that the parts d^b and d^a form in effect a ball-race, which is variable 20 in size, depending upon the amount of thrust of the revoluble member b', which is in turn dependent upon the amount of lateral movement of the shaft b. This lower bearing D' is self-containing for the balls E', even when the member b' of the bearing is removed, since the retaining lips d^b d^a provided upon 30 the parts d^b d^a, respectively, prevent the escape of the balls from the two-point ball-race. This feature is especially serviceable when the separator is dismantled for cleansing and other purposes.

35 The lower bearing D' forming the subject-matter of this invention, carries none of the weight of the bowl and shaft but serves only to steady the latter and to compensate for the distortions of the upper bearing D, forming the subject-matter of the above-named 40 companion application, which will now be described.

This upper ball-bearing D comprises an upper annular sleeve-like member d surrounding the shaft b, to which it is revolubly fixed, 45 and having a spherical or convex surface d¹ adapted to contact with the balls E supported in a race formed in a lower member d', which will now be described in detail. This 50 member d' is an annular ring carried by means of a flange d² upon a guiding and supporting shoulder a of the frame A, over which shoulder said bearing is adapted to oscillate. Considerable lateral play is allowed to the member d' upon the shoulder a 55 as will be clearly seen from the drawing, so that the shaft and bearing may accommodate themselves to all swayings and vibrations induced in the separating-bowl by the operation of the machine. The flange d² and 60 shoulder a are provided with juxtaposed complementary curved surfaces formed into parts of the surface of the sphere of which the shaft, or to be precisely exact, so much 65 of the shaft as lies below the shoulder a, is a

radius, so that as the bowl and shaft move laterally the flange d² oscillates in this arc over the shoulder a, and there is very little friction between it and said shoulder. In order that the oscillation of the member d', 70 reinforced as it is by the weight of the bowl B, may not react upon the frame A, a compensating resilient spring F, shown in the drawing as an annular corrugated spring-steel ring, is interposed between said member 75 d' and the frame, and acts as a cushion or buffer between the same, taking up the movements of the member d' without communicating the same to the frame.

This upper bearing D is self-containing for 80 the balls E, even when the member d of the bearing is removed, since the lower member d' of the bearing is provided with a retaining lip d' which, in co-operation with a removable annular ring G adapted to form a second 85 retaining lip, holds the balls in place and prevents the escape of the same from their ball-race. It is obvious that many suitable equivalents of the retaining ring G, such as removable plugs riveted into the lower member d', 90 might be provided which would co-operate with the lip d' to render said member d' self-containing for the balls. As noted above in connection with the retaining lips d^b d^a of the lower bearing D', this feature is especially 95 serviceable when the separator is dismantled for cleansing and other purposes.

A pin H screwed in through the frame A from the outside engages a suitable notch d³ 100 in the flange d² and prevents the member d' from rotating upon the shoulder a. The balls E are prevented from climbing by the annular ring G, as clearly indicated in the drawing.

It is obvious that in adaptations of the 105 bearing D to uses other than that of utilizing it in a centrifugal separator, suitable equivalents of the shoulder a, over which said bearing D oscillates, may be provided, said shoulder being shown in the drawing as an integral 110 part of the separator frame. It will be noted that this ball-bearing D carries all the weight of the rotating parts and sustains all the axial thrust, whereas the lower bearing D', forming the subject-matter of this invention, 115 serves to yieldingly oppose the side thrust and to guide the lower shaft-portion and to compensate for the lateral movements of the upper bearing D, as noted above.

Having described my invention in detail, 120 that which I particularly point out and distinctly claim is:

1. In combination a journal and two independent members forming a ball race, balls in said race, said members being adapted to 125 be moved away from each other by lateral pressure of the journal.

2. In combination a journal and two independent members forming a ball race, balls in said race, said members being adapted to 130

be moved away from each other by lateral pressure of the journal and means tending to oppose such movement.

3. In combination a journal and two independent members forming a ball race, one of said members being movable toward and away from the other member, balls disposed in said race, the race being so constructed that lateral pressure of the journal will cause the balls to separate the said members.

4. In combination a journal and two members forming a ball race, one of said members

being movable to and from the other, balls in said race, the race faces of said members being so shaped that movement of one toward the other tends to thrust the balls against the journal and yielding means tending to cause one of said members to approach the other.

Signed by me this 1st day of July 1905.

JOHN C. CROMWELL.

Attested by—

JNO. F. OBERLIN,
G. W. SAYWELL.