

J. S. SORENSEN.
SHAFT BEARING.
APPLICATION FILED JULY 16, 1912.

1,146,740.

Patented July 13, 1915.
2 SHEETS—SHEET 1.

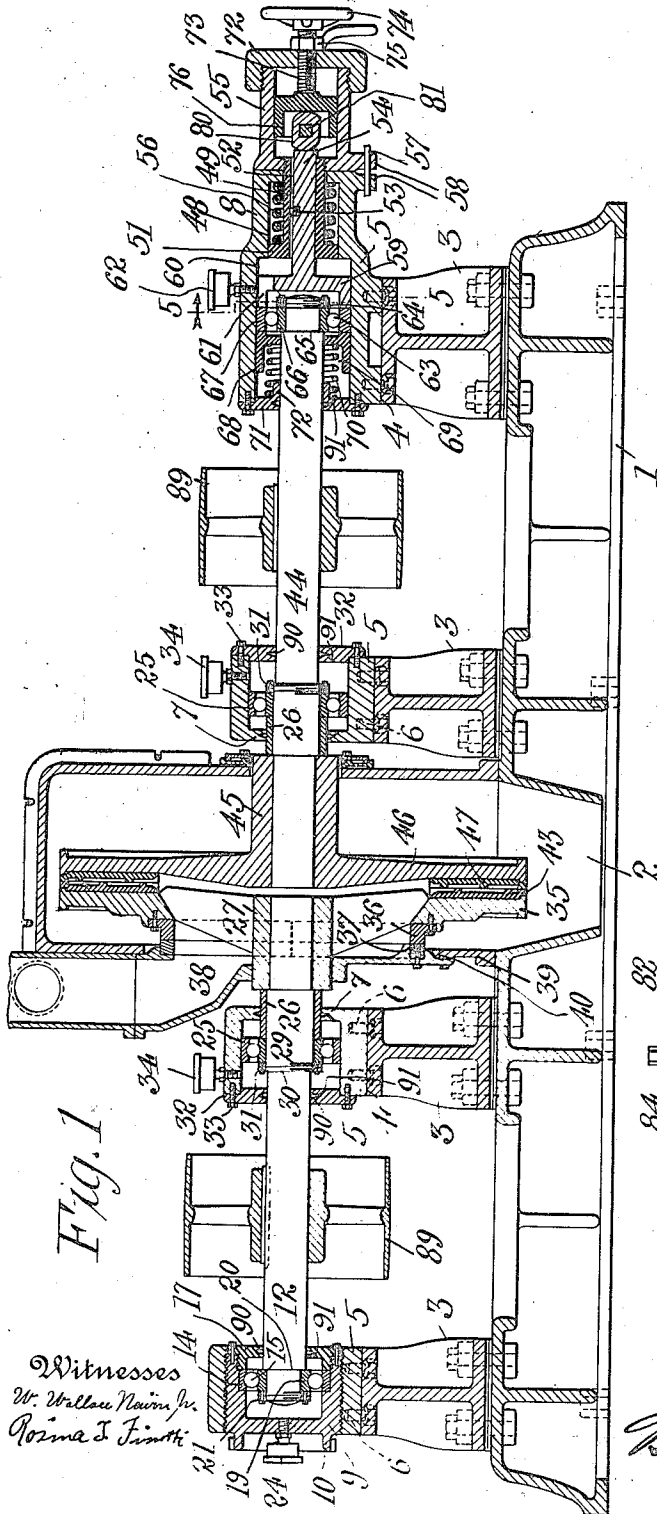


Fig. 1

Witnesses
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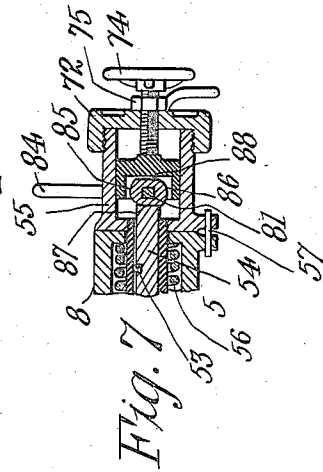


Fig. 7

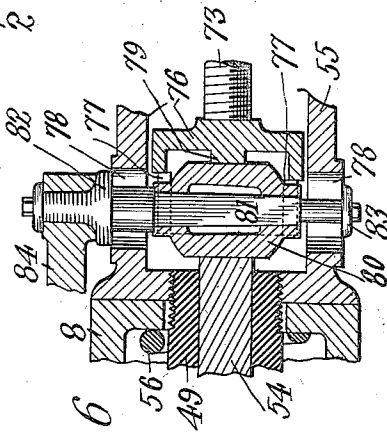


Fig. 6

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SHAFT-BEARING.

1,146,740.

Specification of Letters Patent.

Patented July 13, 1915.

Original application filed April 7, 1911, Serial No. 619,621. Divided and this application filed July 16, 1912. Serial No. 709,672.

To all whom it may concern:

Be it known that I, JOHN S. SORENSSEN, a citizen of the United States, residing at Muncy, in the county of Lycoming and State of Pennsylvania, have invented certain new and useful Improvements in Shaft-Bearings; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to shaft bearings, and is a division of my pending application for attrition mills, filed April 7, 1911, Serial No. 619,621. While the bearing constituting this invention is especially designed for use in connection with attrition mills, it may also be advantageously employed elsewhere.

One object of the invention is to provide improved anti-friction bearings, whereby the shaft may be run at a high speed for a long continued period without excessive wear on the parts.

Other objects are to so construct and mount the bearings on the shaft as to allow for axial movement or adjustment of the shaft through the medium of the bearings and to render the latter capable of resisting both radial and end thrust.

The invention will hereinafter be first fully described with reference to the accompanying drawings, which form a part of this specification, and then pointed out in the claims following the description.

In the drawings, Figure 1 is a central vertical longitudinal section of an attrition mill embodying my improved bearings; Fig. 2 is an elevation of the tail end of the machine; Fig. 3 is an enlarged vertical section of the head end bearing; Fig. 4 is a detail elevation of the same; Fig. 5 is an enlarged detail vertical section on the line 5-5 of Fig. 1; Fig. 6 is an enlarged detail section taken centrally and horizontally through the releasing cam and adjacent parts, and Fig. 7 is a central vertical longitudinal section of a portion of the tail end of the machine showing the cam in its released position.

Referring more particularly to the drawings, the operative parts of the attrition mill

there illustrated are mounted upon a base 1, which may be of any desired size and proportions, and is provided at or near its center with a discharge spout 2 for the ground material. Seated upon the base are a plurality of pedestals 3, two being shown to support each of the runner shafts. Each of the pedestals may be identical in construction except that the tail end pedestal is somewhat wider than the others in order to support the relief bearing. Each of the pedestals is suitably secured to the base and is concave at its upper end to provide seats 4 to receive the bearing shells 5, the latter being secured in said seats by bolts 6 or other suitable means. Each of the bearing shells is made in the form of a sleeve, corresponding in length to the width of its seat 4, and having its underside convex to fit snugly upon said seat, as clearly shown in Figs. 2 and 5. The bearing shell for the head-end bearing is internally threaded throughout its length, and has both ends open, while the bearing-shell for the intermediate bearings have smooth bores, and their inner ends partly closed by internal annular ribs or flanges 7, see Fig. 1. The shell for the tail end bearing is extended, as at 8, for a purpose which will hereinafter appear.

Referring particularly to the head-end bearing, it will be observed that a box or guide 9 is threaded into the shell 5. Said box or guide may be provided on its outer end with an axial annular flange 10 having on its outer face a series of lugs or notches 11, adapted to be engaged by a spanner or similar tool for turning said box or guide into the shell and for adjusting the runner shaft 12 to its proper initial position, or to take up wear. The bore of said box or guide 9 is smooth for the greater portion of its length, but is stepped, as at 13, to receive the outer race or ring 14 of an anti-friction bearing consisting of a pair of concentric rings or races having annular grooves in their opposed circumferential faces and a series of balls or rollers 15 seated in said annular grooves. The inner end of the box or guide 9 is internally threaded beyond the step 13, as at 16, and the cover 17, which

engages in said threaded portion, extends over the inner end of the box or guide and encircles the runner shaft 12, as clearly shown in Fig. 3.

5 The end of the runner shaft 12 is reduced, as at 18, and the inner race or ring 19 of the anti-friction bearing fits upon this reduced end of the shaft and against a shoulder 20 formed thereby, a securing nut 21 being threaded upon the extremity of the shaft 10 and turned up against said inner race or ring to clamp the same against said shoulder. As shown in Figs. 3 and 5, said clamping nut is split peripherally at opposite sides 15 of its center and through said split portions locking screws 22 are threaded. After the nut has been turned home against the race or ring 19, these locking screws may be turned up to clamp the split portions of the nut together, thereby causing the latter to 20 bind or lock upon the threads of the shaft, so that the nut cannot work loose and permit the bearing to move from its position relative to the end of the shaft.

25 It will be readily seen that the construction and arrangement of the parts described provide a bearing which will resist both the radial and the end thrust of the shaft, whereby said shaft will be held to its true 30 horizontal position, and axial displacement of the same during the operation of the machine prevented.

The cover 17 is held against accidental rotation by means of screws or bolts 23 inserted through openings provided therefor 35 near the outer edge of said cover and threaded into sockets in the end of the guide or box 9. By providing these fastening screws or bolts 23, movement of the cover relative 40 to the box or guide is prevented, and the accidental release of the bearing is obviated. An oil or grease cup 24 is carried by the box or guide 9 and is mounted in the end of the same where it will offer no interference with 45 the adjustment of said box or guide within its bearing shell.

Each of the inner bearings is similar in construction to the one just described, except that the box or guide 9 is omitted and the 50 anti-friction bearing 25 is mounted within the smooth bore of its shell and fits against a thrust collar 26 placed around the runner shaft and between the anti-friction bearing and the hub 27 or 45 of the corresponding 55 head runner. The runner shaft is enlarged diametrically, as at 29, to provide seats for said thrust collar and bearing 25. Said enlarged portion 29 of the shaft is threaded at 30 to receive a clamping nut 31, similar to the clamping nut 21 already described, 60 whereby said bearing 25 is held closely against the end of said thrust collar. The latter fits closely within the opening through the annular rib or flange 7 of the shell 5.

65 A cover 32 is secured over the open end of

the shell by bolts or fastening screws 33. A grease or oil cup 34 is secured to the top of the shell and leads to the interior of the same for supplying a lubricant to the bearing.

70 The hub 27 of the head runner 35 is shrunk upon or otherwise secured to the inner end of the head runner shaft 12. To the outer side of said runner there is secured a sealing ring 36 bearing against another sealing ring 37 fastened to the adjacent opposed 75 side of the spout 38, as shown in Fig. 1, the lower portion of said spout encircling said hub and being rigidly secured to the casing 39 for the runner heads. Said casing is provided with an opening 40 in one side to accommodate the end of the spout and the sealing ring 37 which is secured thereto. Said casing is preferably constructed of a 80 plurality of sections 41 secured together by locking levers 42 or other suitable devices, whereby it may be readily assembled around the runners, as will be readily understood upon reference to Fig. 2. The head runner 90 is, of course, equipped with a grinding plate 43, which may be of any well known or preferred design.

The inner bearing for the tail runner shaft 44 is a duplicate of the inner bearing for the head runner shaft, except that the cover 32 95 is arranged at the opposite side thereof. The inner end of said tail runner shaft, which extends into the casing 39, has the hub 45 of the tail end runner 46 shrunk thereon or otherwise rigidly secured thereto. 100 A grinding plate 47 is secured upon the face of said tail end runner and coacts with the grinding plate 43 carried by the head runner to grind the grain or other material passing through the mill. 105

The shell 5 for the tail end bearing, as heretofore stated, is provided with a cylindrical extension 8 having a central opening 48 through which a step box 49 projects. 110 The bore of this extension is angular, preferably hexagonal, as indicated by the dotted lines 50 in Fig. 5. The hub 51 of the step box is similarly formed so as to fit within said angular extension, whereby the step box may move longitudinally of the shell, but 115 will be held against rotation therein. Said step box is also provided with a longitudinal groove 52 in its bore, adapted to be engaged by a pin or projection 53 on a center guide plug 54 which extends through the step box, 120 whereby rotation of said plug in said step box is prevented, while relative longitudinal movement thereof is permitted.

The end of the step box is threaded to be secured in the end of a relief box 55, see Fig. 125 1. Between the outer end of the extension 8 of the shell and the hub 51 of the step box there is interposed a coiled end-thrust spring 56 which normally holds said step box inwardly away from the end of the shell and 130

also serves to normally retain the relief box in contact with the end of the extension of said shell. Said spring may yield, however, under an excessive pressure upon the same, as may be caused by the entrance of an unusually large quantity of material between the grinding plates, thereby causing the relief box to move away from the shell to accommodate the axial movement of the runner shaft. The tension of this spring may be adjusted by rotating the relief box upon the step box. After adjustment, said relief box is held against rotation with respect to the shell by means of a pin or key 57 inserted through aligned openings in lugs 58 on the shell and box.

The center guiding plug 54 has its inner end extended, as at 59, to form a head or piston fitting within the extended bore or chamber 60 of the shell. Said head or piston is provided at its top with a groove or opening 61 which permits the air within the chamber to pass from one side of said piston or head to the other for equalizing the pressure on the two faces of the same, thereby avoiding any tendency to choke or impede the movement of said plug in the operation of the device. A grease or oil cup 62 is mounted on the upper side of the shell immediately over the opening 61 so that the lubricant from said cup will pass on to the piston and find its way through said opening to the bearing 63 within said shell, the pin 53 serving as a stop to prevent the escape of the lubricant to and through the outer end of the shell.

The bearing 63 is preferably of the type previously described and is held on the end of the tail runner shaft by a clamp nut 64 engaging the inner race member 66 and pressing it against an annular shoulder 65 on said shaft. The outer race member 67 of this bearing has an external diameter which permits it to fit snugly within the smooth bore or chamber 60 of the shell, and this race member is held between the annular edge of the head or piston 59 and a safety-spring guide-sleeve 68 mounted within said chamber and encircling the end of the runner shaft. Said sleeve 68 is formed with an annular recess or socket 69 which receives one end of a safety-spring 70 coiled around the shaft and having its opposite end engaging the cover plate 71 secured to and extending across the inner end of the shell, see Fig. 1. Said cover plate is provided with a central annular rib or collar 72 which fits closely around the runner shaft and serves as a support for the end of the safety-spring.

The outer end of the relief-box 55 is closed by a removable cap 72 through which is threaded a tail screw 73 equipped with a hand-wheel 74 and a jam-nut 75. The inner end of this screw 73 bears against the outer side of a cam box 76 which is mounted con-

centrically within the relief box. In the sides of said cam box, at diametrically opposite points of the same, there are formed open-ended notches or slots 77 which register with horizontal elongated slots 78 in the sides of the relief box, see Fig. 6. The inner face of the back wall of the cam box is provided with a rib or bearing strip 79 between which and the outer end of the center guide plug 54 is arranged a release cam 80 which is mounted upon a shaft 81, the ends of which project through the notches 77 in the cam box and the slots 78 in the relief box, said ends being mounted to rotate and slide within said slots, as will be readily understood, for accommodating said shaft to the different positions of the cam. Longitudinal movement of the cam shaft is prevented by means of an annular shoulder or enlargement 82 on one end of the same and a retaining disk or stop 83 secured to the opposite end thereof, said collar and stop bearing against the opposite sides of the relief box. An operating lever 84 is secured to one end of the cam shaft so that the operator may readily throw said shaft to the released or the holding position when such action is necessary.

The cam 80 may be a substantially elliptical block so arranged as to provide opposite parallel faces furnishing straight bearings against the rib 79 and the outer end of the center guide plug, two of said opposite faces being at a greater distance apart than the others and said more distant faces being curved concentrically with the cam-shaft, as clearly shown in Figs. 1 and 7. Said curved faces are indicated at 85 and 86, while the intervening faces are designated 87 and 88.

Band pulleys 89 are secured upon both runner shafts intermediate of the ends thereof in order that motion may be imparted to said shafts for operating the mill.

The only adjustment required after the mill has been set up is the longitudinal adjustment of the runner shafts to compensate for wear upon the grinding plates and upon the sealing rings. To accomplish this adjustment of the head runner shaft, the box or guide 9 is rotated so as to move it longitudinally in the end shell 5 by reason of its threaded connection therewith. This longitudinal movement of the box or guide will be transmitted to the runner shaft through the medium of the race member 14, balls 15 and race member 19, inasmuch as said race member 14 is clamped to the box or guide by the cover 17 while the race member 19 is clamped to the runner shaft by the nut 21. The anti-friction bearing 25 of the inner support for the head runner shaft being mounted within a smooth bored shell, said bearing will readily follow the movement of the shaft within said shell, so that the engagement and relative positions of the run-

ner hub, thrust collar, and clamping nut with respect to said bearing will not be disturbed.

A similar adjustment of the tail runner shaft may be effected by rotating the tail screw 73, causing said screw to move the cam box 76 longitudinally of the relief box 55. This movement is transmitted directly to the runner shaft through the center guide plug 54 and the bearing 63. As the safety spring 70 acts through its guide sleeve 68 to hold the bearing against the hub of the center guide plug, the several parts will follow the movement of the tail screw in either direction. When the desired adjustment has been effected, the jam-nut 75 is turned home to hold the parts in the proper relation.

Should the material pass into the space between the grinding plates in an excessive quantity, the resistance of such material to the action of said plates, aided by the safety spring, will force the runners slightly apart against the tension of the end-thrust spring 56, whereby the material will gradually work out through the mill without injuring the working parts. It will be understood that when the runners are forced apart in this way the relief box is moved outwardly by the increased pressure applied thereto through the bearing 63, the center guide plug 54, the relief cam 80 and the parts co-acting therewith.

Should some foreign matter pass between the grinding plates and jar the mill, the operator may throw the lever 84 up to a vertical position causing the release cam to assume the position shown in Fig. 7, whereupon the safety spring will at once expand and move the runner shaft outwardly by the pressure exerted upon said shaft through the guide sleeve 68, the bearing 63, and the center guide plug 54. The runners will thus be separated sufficiently to permit the foreign matter to pass from the mill, the cam being subsequently returned to its normal position, as shown in Fig. 1, thereby moving the several parts in opposition to the safety spring to return the runner shaft and its runner to working position.

The moving parts of the mill are preferably lubricated by a thick lubricant fed into the bearing chambers from the respective grease cups 24, 34 and 62. This lubricant has a well known tendency to work around and along a moving shaft or other element, and by reason of this tendency will travel along the runner shafts toward the cover plates 17, 32 and 71, respectively. Each of said cover plates is provided with an annular groove 90 in its inner edge and an opening 91 leading therefrom into the interior of its bearing shell. When the lubricant reaches these grooves it will be caught therein by reason of centrifugal force and caused to travel around within them until an escape

is effected via the openings 91 at the lower portions of said grooves, the lubricant being returned by said openings to the chambers within said shells.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. The combination of an endwise movable shaft, a shell into which said shaft extends, a bearing on said shaft within said shell composed of concentric rings having annular grooves in their confronting bearing surfaces, the outer ring being slidably supported within the shell and the inner ring fixed on said shaft, balls between said rings confined in said grooves so as to hold the rings together and resist both radial and end thrust, a sleeve at one side of said bearing engaging the outer bearing ring, a plunger at the other side of said bearing having a head engaging the said outer ring, and means for moving said plunger and thereby imparting axial movement to the shaft through the medium of said bearing.

2. The combination of an endwise movable shaft, a shell into which said shaft extends, a bearing on said shaft within said shell composed of concentric rings having annular grooves in their confronting bearing surfaces, the outer ring being slidably supported within the shell and the inner ring fixed on said shaft, balls between the rings confined in said grooves so as to hold the rings together and resist both radial and end thrust, a sleeve at one side of said bearing engaging the outer ring, a plunger at the other side of said bearing having a head engaging the other side of said outer ring, and means for moving said plunger and thereby imparting axial movement to the shaft through the medium of said bearing; together with a spring acting on said sleeve to move the shaft in one direction and another spring tending to move the shaft in the opposite direction.

3. The combination with axially aligned shafts, one movable endwise, of a shell into which the movable shaft extends, a sleeve on said movable shaft slidably fitted in said shell, a spring bearing against said sleeve and one end of the shell, a plunger having a head and a stem slidably fitted in said shell, a sleeve on said stem having a flange at one end and a spring thereon bearing against said flange and one end of the shell so as to urge the shaft in a direction opposed to the action of the first mentioned spring, and an anti-friction bearing on the shaft between the piston head and said sliding sleeve comprising an inner annular bearing member fixed on the shaft, an outer annular bearing member slidably fitted in the shell, and roller elements between said bearing members, together with means acting on said stem for adjusting the shaft endwise.

4. The combination of a shaft, a bearing secured around the same, a piston acting against the outer side of said bearing, a sleeve fitting against the inner side of said bearing, a safety spring bearing upon said sleeve, an end thrust spring opposed to said safety spring, and cooperating devices whereby said end thrust spring will act upon said piston.

5. The combination with a bearing shell, of a shaft bearing within said shell, a chambered piston also within said shell, between said bearing and the end of the shell and in contact with said bearing, said piston having a passage leading from its chambered to its unchambered portion for lubricating the parts on both sides of the piston head, and means for supplying a lubricant to said passage.

6. The combination of a bearing shell, a shaft bearing within said shell, a chambered piston also within said shell, between said bearing and the end of the shell and in contact with said bearing, said piston having a passage leading from its chambered to its unchambered portion for lubricating the parts on both sides of the piston head, means for supplying a lubricant to said passage, together with means for imparting axial movement to said piston and bearing.

7. The combination with a bearing shell, of a shaft extending into said shell, a bearing within said shell secured around said shaft, a piston acting against one side of said bearing, a sleeve acting against the other side of said bearing, a spring bearing upon said sleeve, a second spring opposed

to said first mentioned spring, cooperating devices whereby said second spring will act upon said piston and means for adjusting said piston, bearing and shaft.

8. The combination with a bearing shell of a shaft extending into said shell, a bearing within said shell secured around said shaft and movable therewith within the shell, two opposed springs also within said shell and devices cooperating with said springs whereby said springs will act upon opposite sides of said bearing one spring tending to move the shaft in one direction and the other spring tending to move the shaft in the opposite direction.

9. The combination with a bearing shell of a shaft extending into said shell, a bearing within said shell secured around said shaft, two opposed springs also within said shell, devices cooperating with said springs whereby said springs will act upon opposite sides of said bearings, and means for adjusting said bearing and shaft.

10. The combination with a bearing shell, of a shaft-bearing within said shell, a chambered piston also within said shell between said bearing and the end of the shell and engaging said bearing, said piston having a passage leading from its chambered to its unchambered portion.

In testimony whereof I affix my signature in the presence of two witnesses.

JOHN S. SORENSEN.

Witnesses:

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CHAS. E. RIORDAN.