No. 845,632. PATENTED FEB. 26, 1907.

F. W. GURNEY.

BALL BEARING.

APPLICATION FILED MAR. 27, 1905. RENEWED FEB. 4, 1907.

2 SHEETS—SHEET 1.

FIG. 1.

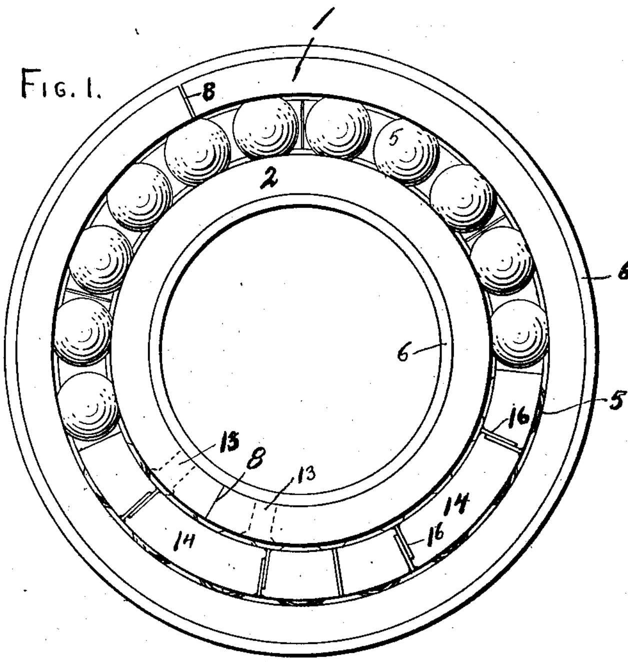


FIG. 2.

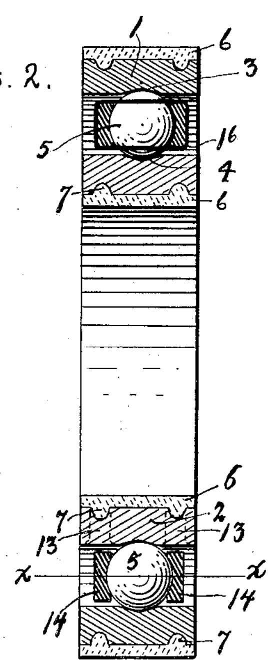


FIG. 3.

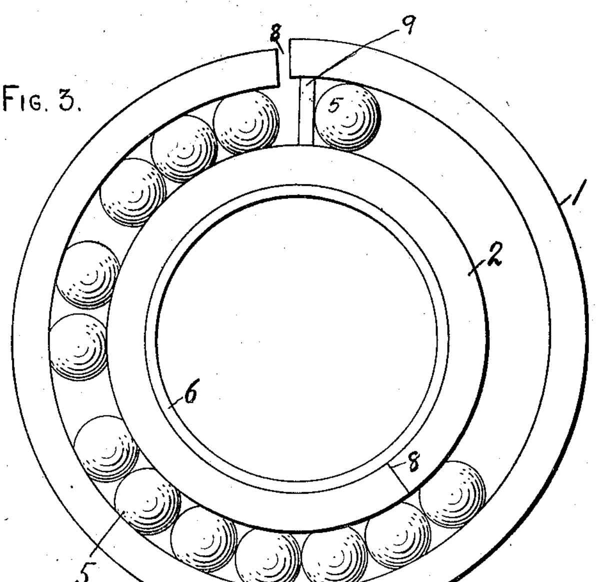
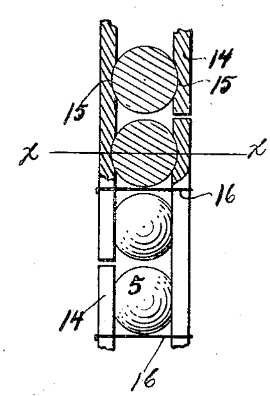


FIG. 4.



Witnesses

F. O. Baldwin

A. W. Kettle

Inventor

Frederick W. Gurney

By S. Arthur Baldwin

Attorney

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2 SHEETS—SHEET 2.

FIG. 5.

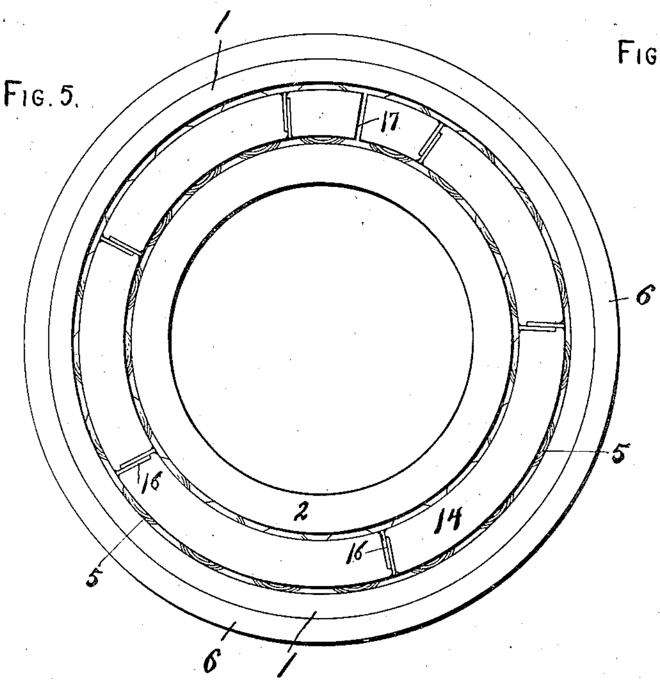


FIG. 6.

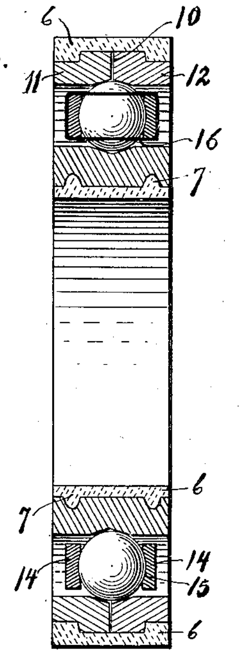
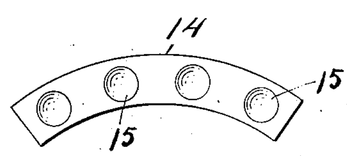


FIG. 7.



Witnesses

F. O. Baldwin

A. W. Kuhl

Inventor

Frederick W. Gurney.

By

S. Arthur Baldwin,

Attorney

UNITED STATES PATENT OFFICE.

FREDERICK W. GURNEY, OF JAMESTOWN, NEW YORK.

BALL-BEARING.

No. 845,632. Specification of Letters Patent. Patented Feb. 26, 1907.

Application filed March 27, 1905. Renewed February 4, 1907. Serial No. 355,732.

To all whom it may concern:

Be it known that I, FREDERICK W. GURNEY, a citizen of the United States, residing at Jamestown, in the county of Chautauqua and State of New York, have invented new and useful Improvements in Ball-Bearings, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

My invention relates to ball-bearings in general.

It consists principally in new means for assembling and holding in place the constituent parts of ball-bearings, and has for its objects the producing of a high degree of accuracy of adjustment or fit between the parts, an increased facility in assembling the parts, and an increase in antifrictional efficiency.

In the accompanying drawings, Figure 1 is a plan view showing one of my bearings with parts removed for the sake of clearness. Fig. 2 is a sectional view of a bearing cut in a plane through its axis of rotation. Fig. 3 is a detail sketch showing the usual manner of inserting the balls. Fig. 4 is a detail showing the construction of the ball-spacers. Fig. 5 and Fig. 6 show how the principal feature of my invention may be applied to a modified construction to accomplish the same results. Fig. 5 also shows a slight modification in the construction of my ball-spacer. Fig. 7 shows the reverse side of one of the spacer-segments.

In the several views like numerals refer to like parts.

In my bearing, as illustrated in the accompanying drawings, the numeral 1 indicates the outer race-ring.

The numeral 2 indicates the inner race-ring.

The outer ring 1 has an internal groove or ball-race 3. The inner ring has an external groove or ball-race 4. Between these two grooved race-rings run the balls 5.

It has hitherto been the practice to make the race-rings, of whatever type or design, of a simple steel construction turning and grinding the steel rings to the desired size, shape, and fit. In producing ball-bearings of high efficiency it is of great importance to make the parts with a very high degree of accuracy, working, if possible, to the ten-thousandth of an inch. To grind to such a degree of precision as this is exceedingly costly, necessitating prices that are practically prohibitive. In my improved bearing I realize this high degree of accuracy and by a means that is not costly. I secure my exact fit not entirely by grinding, but principally by the employment of a backing of soft and easily-fusible metal which I cast onto my race-rings, securing to them a fit that is practically exact and doing away with the necessity of the extreme accuracy of grinding, which is so costly and is not so accurate as my cheaper way.

The numeral 6 indicates the soft-metal backing cast to the rings. To secure the backing more firmly to the steel bodies of the rings, the latter are grooved, as 7 7, thus anchoring the soft metal onto the hard and making solid integral rings.

The steel body of one of my race-rings is ordinarily not a solid ring. It is essential that at least one of the two rings of a bearing be made with a joint or cleft to permit adjustment. I usually make this cleft as shown in Figs. 1 and 3, making a spring-ring; but I accomplish exactly the same results by splitting the ring flatwise through the center of the ball-race, as shown in Fig. 5. The object of these clefts is not only to secure adjustability, but also to permit the insertion of the balls.

In Fig. 3 is shown the manner of inserting the balls where I employ the spring-ring. Before casting on the backing the spring-ring is sprung open near its cleft enough to admit the balls, the block 9 being inserted to hold the ring open while the balls are being inserted. When the balls have been inserted thus, the block 9 is removed and the cleft steel ring springs together again. It is obvious that either the outer or inner ring may be cleft and sprung for the admission of the balls. The outer ring being the larger is preferred for this purpose; but there are places where it is preferred to cleave and spring the inner ring for admitting the balls. The soft backing 6 is then cast onto the steel body of the ring in a suitable mold, which is concentric with the bore and races of the bearing, and the cleft-ring is thus made a solid and continuous ring. The balls are securely retained in their races and cannot be lost out.

It can be easily seen that by this construction I can easily obtain a very high degree of accuracy. In grinding the race-grooves 3 and 4 I grind them to a fair degree of accuracy, but do not go to the expense of grinding them to the degree of accuracy that a bearing of high efficiency should have. I grind the outer race 3 with the cleft 8 held a little open. When the balls have been inserted, as described above the fit between the outer and inner ring and the intervening balls is probably not quite exact; but what little is lacking of a perfect fit I eliminate by springing the cleft-ring. If the space between the outer and inner rings is a little greater than the size of the balls, the ring is sprung in until it touches the balls all around, and if the space is less the balls themselves spring the cleft-ring out. The ring is sprung either out or in, as the case may be, until it touches the balls all around, and we have a practically perfect fit as between races and balls. This having been secured, I now cast the soft-metal backing 6 onto the outer ring, and this exact fit is made permanent and unchangeable. This exact fit of the races cannot be disturbed, and not only have I secured a perfect fit of the races, I have given to the outside of the ring a definite size. Like rings all have this backing cast onto them in the same mold, so they are all exactly of a size on their backing side. This, it will be seen, makes a perfect system of duplication. It makes very easy the standardization of bearings. They can readily be manufactured in standard or stock sizes, and the advantage of this is not only that I secure perfect interchangeability, but that a multiplicity of bearings may be used together and there will be a practical distribution of the load over each of the units of such a series. By such a multiplication of units it is entirely practicable to carry loads of any weight.

In Figs. 5 and 6 I show a bearing where the cleft 10 in the steel body of the ring is through the center of the race-groove. In this construction the steel body of the ring is in two separate pieces before they are bound together by the backing cast about them. In this case the method of inserting the balls is obvious. The raceway 3 is here formed by bevels on the inner edges of the two halves of the outer ring 11 and 12. When I grind these bevels, I leave them just a little small, so that when the two halves are put together with the balls in place they will not quite touch each other, as shown in Fig. 6. They touch the balls instead of each other, thus again getting an exact fit, and, again, when they are in position in perfect fit the soft-metal backing 6 is cast onto the outer ring—in this instance a double ring—and the fit is made permanent and the ring is made a single solid ring. I have practically the same bearing as in the other case where the cleft is transversely through the bar of the ring. The functions performed by the cast-on backing are the same in both cases, it seals, or binds together, a joint or cleft, making permanent and secure the fit obtained by means of that cleft, and it conforms to a predetermined size on the outside, thus making successive bearings exact duplicates, exactly alike in internal fit and in general dimensions. The outer edges of the half-rings 11 and 12 are rabbeted, that the backing 6 may clench or clamp them securely together.

In addition to the grooves 7 7, cut in the steel body of the rings to hold the backing 6 more securely in place, there may be holes 13 13, drilled near the cleft to afford further anchorage for the backing. This is especially desirable in the inner ring. It will prevent the cleft inner ring from springing away from the backing. Another advantage to this soft-metal backing in addition to those pointed out above is that it can be easily machined. The backing or lining to the inner ring can be bored readily to a desired size—something that cannot be done to hardened steel—and the backing to the outer ring can be turned off to alter the size, if desired. The lining to the inner ring performs one function that the outside backing does not ordinarily perform. It serves to protect the journal from the abrasive action of the hard-steel ring, which under the vibration that is unavoidable under heavy service is oftentimes quite severe. A lining of Babbitt or bronze or some suitable non-abrasive metal will effectually prevent this oftentimes very troublesome difficulty. A further advantage to this soft-metal backing is that it performs to some degree the functions of a cushion. It does not, of course, have the feature of elasticity. There is no spring to it. I am aware that cushions of elastic material have been used around the race-rings of bearings to absorb jar. I do not claim any such function for this backing. But in case of very excessive load being placed upon the bearing this soft-metal backing will yield slightly at any point where the strain is unduly severe, so as to relieve the undue strain and prevent breakage. It acts thus as a distributer of strains. It will yield before the strain reaches the breaking-point in any part of the bearing, and so in cases of emergency it acts as a safety-cushion, and in this it is but further carrying out its main function of securing a fit. When the backing is applied to the rings, it is applied in a molten or fluid state, securing for itself a perfect fit in this way. If under exceptional strain there is a yielding of this soft metal, that is in reality merely a further flowing of the metal to accommodate itself still further to its position or environment to secure, if possible, a still more perfect distribution of the strains put upon the bearing, a still more perfect fit.

While I preferably make both the outer and inner rings of this character, (a cleft steel body made solid by a soft backing cast upon it,) it is not essential to the purpose of my invention that both rings be of this type. It is obvious that the assembling and the adjustment or fit may be just as readily obtained if only one of the rings is of this type and the other is of the ordinary simple and solid type, as 2 in Fig. 5, or the latter ring may be a solid steel ring with a cast-in backing or lining, as the inner ring shown in Fig. 6, where the lining is used to facilitate the fitting to a given size of shaft or journal.

Between the outer and inner rings on each side of the balls are the ball-spacers 14. On the inner faces of these spacers are the sockets 15. These sockets are spaced a little farther apart than the diameter of the balls, so that when the balls are seated therein they will not quite touch each other, as shown in Figs. 1 and 4. Thus these spacers in keeping the balls from touching each other prevent cross-friction, of chafing, between the balls.

It will be observed that the spacers engage the balls at their axial or pivotal points. The axes of rotation of the balls in this style of bearing are parallel with the axis of rotation of the bearing itself. The ball-axis is shown by the line $x\,x$ in Figs. 2 and 4.

The advantages of holding the balls by the spacers at their axial or pivotal points are that they are held obviously with the least possible friction and that the spacers or separators do not come between the balls, thus encroaching on the space of the balls themselves. The full complement of balls can be used, only the slightest separation being necessary to avoid contact and friction between the balls. There is no sacrifice of the capacity of the bearing to the spacer.

The spacers 14 are held against the balls, on opposite sides thereof, by wire binders 16 or other suitable means, which bind the spacers to each other, with the balls in between, as shown in Figs. 2 and 4. These spacers are preferably made in sections or segments, as shown in Figs. 1 and 7, though they may be made as rings, as shown in Fig. 5. In the latter case the rings are preferably cleft, as shown, 17, that there may be a little spring to the spacers to insure perfect fit or adaptation of the spacers to the diameter of the race or set of balls. In fact, the spacers made up of segments, as shown in Fig. 1, may be regarded as made up of rings having multiple clefts.

I claim as new—

1. In a ball-bearing, an outer race-ring having an internal groove, an inner race-ring having an external groove, balls running in said grooves in between said race-rings, one of said rings having a parting or cleft, and a bond of fusible metal cast onto said parted ring concentric with the race thereof.

2. In a ball-bearing, an outer race-ring with an internal groove, an inner race-ring with an external groove, balls running in said grooves in between said race-rings, one of said rings being a spring-ring to admit said balls, and a bond of fusible metal cast onto said spring-ring concentric with the race thereof.

3. In a ball-bearing, an outer race-ring internally grooved, an inner race-ring externally grooved, both of said race-rings having a backing of soft metal concentric with the race thereof.

4. In a ball-bearing, an inner race-ring, a cleft outer race-ring, balls between said rings, said cleft outer ring sprung to a fit against said intervening balls, and a sealing backing of fusible metal cast upon said cleft ring concentric with the race thereof.

5. In a race-ring for ball-bearings, the combination of a hardened-steel ring having a raceway ground therein, said hardened-steel ring having a parting or cleft for adjusting or fitting said raceway, and a backing of fusible metal cast onto said steel ring concentric with said raceway to bind together said parting and secure or make permanent said fit.

6. Ball-bearings consisting of inner and outer race-rings, with balls intervening, said outer race-rings being covered or backed with cast-on soft metal molded to standard or stock sizes, for the purpose specified.

7. A ball-bearing consisting of an inner and an outer race-ring, with balls intervening, said outer race-ring being covered or backed with cast-on soft metal machined to the desired size.

8. In a race-ring for ball-bearings, a steel spring-ring having a raceway therein, the exact diameter of said raceway being obtained by springing said spring-ring, said exact diameter secured and made permanent by a backing of fusible metal cast onto said spring-ring to prevent further or subsequent springing, said cast backing being molded to the size desired for the bearing.

9. A journal race-ring for roller-bearings having a raceway in its outer face and a lining of non-abrasive material concentric therewith.

10. A roller-bearing ring having a raceway in its outer face and a lining of soft and non-abrasive metal concentric with said ring and permanently attached thereto.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FREDERICK W. GURNEY.

Witnesses:

S. A. Baldwin,

A. W. Kettle.