(No Model.

# H. HOWARD.

## BALL BEARING.

No. 463,833. Patented Nov. 24, 1891.

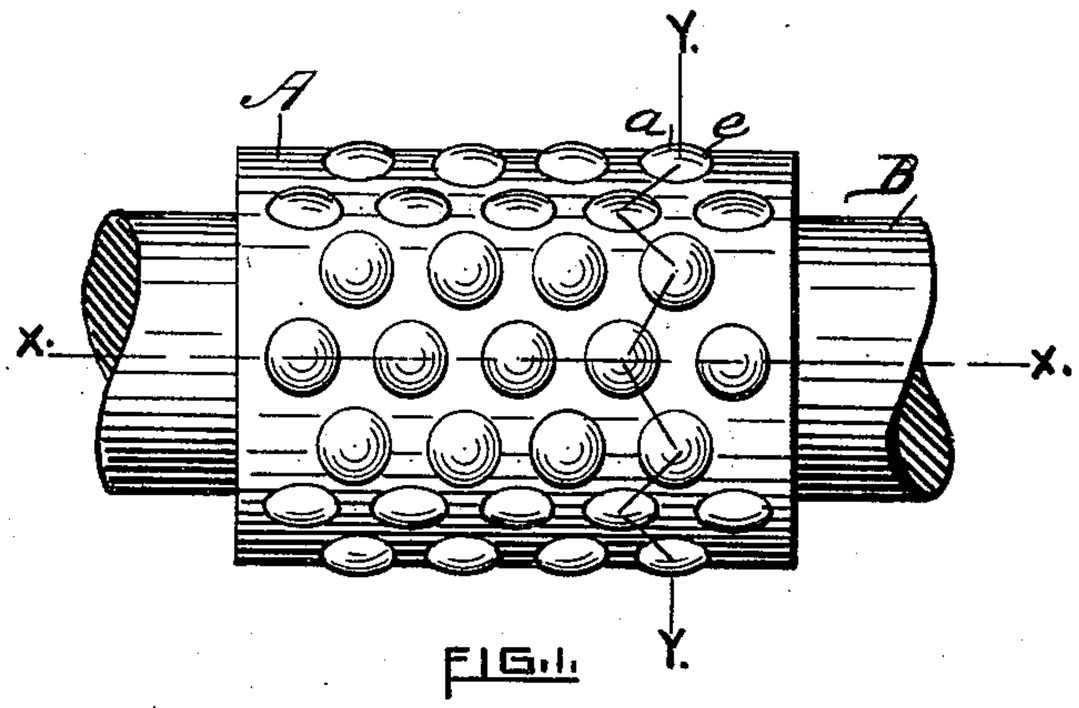


FIG. 1.

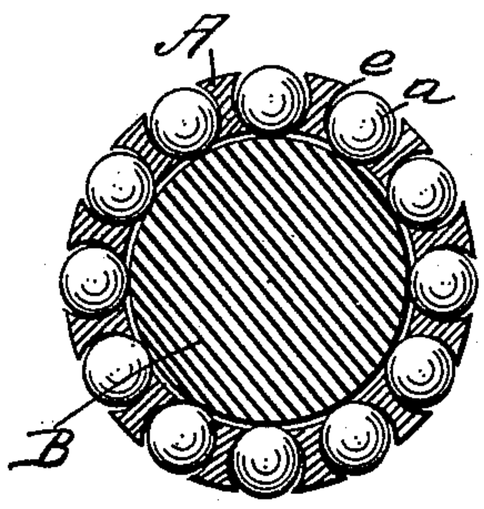


FIG. 2.

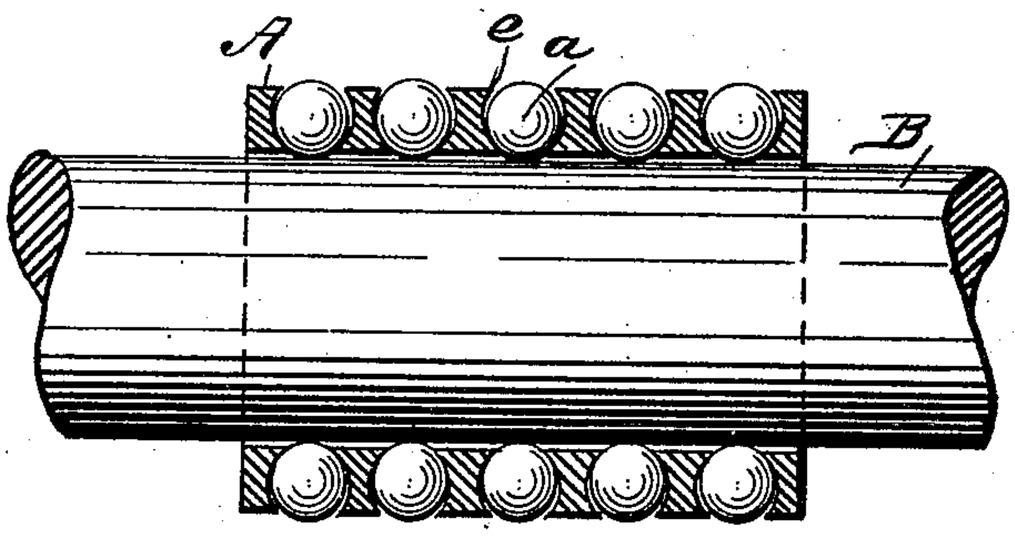


FIG. 3.

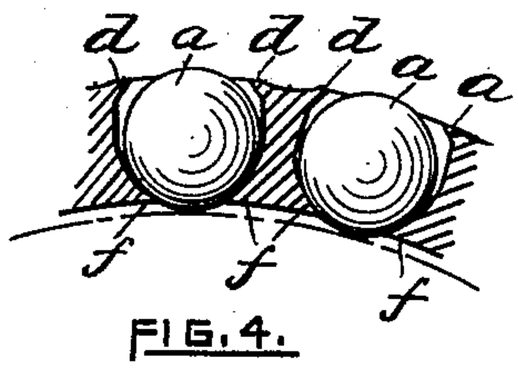


FIG. 4.

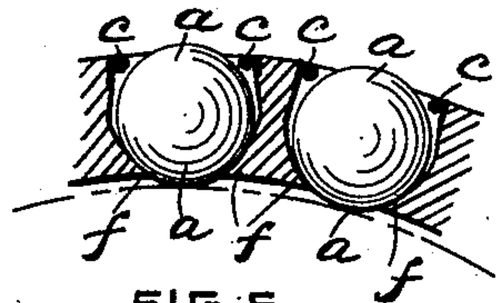


FIG. 5.

WITNESSES.

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# UNITED STATES PATENT OFFICE.

HENRY HOWARD, OF PHENIX, RHODE ISLAND.

## BALL-BEARING.

SPECIFICATION forming part of Letters Patent No. 463,833, dated November 24, 1891.

Application filed August 22, 1891. Serial No. 403,404. (No model.)

*To all whom it may concern:*

Be it known that I, HENRY HOWARD, of Phenix, in the county of Kent and State of Rhode Island, have invented certain new and useful Improvements in Ball-Bearings; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This improvement relates to that class of inventions that have for their purpose the lessening of the friction of bearing-surfaces moving upon each other by placing balls between them to change a rubbing to a rolling action, as set forth in my United States Patent, No. 439,877, dated November 4, 1890, the subject of this specification being an improvement upon and a modification of the invention described in that patent. It is fully illustrated in the accompanying drawings.

Figure 1 shows a side elevation of the case or shell containing the balls with a short piece of an axle or shaft in it. Fig. 2 is a cross-section of the case shown in Fig. 1, taken on line *y y*, the balls and axle or shaft being in elevation. Fig. 3 is a longitudinal section of the case that holds the balls, taken on line *x x*, Fig. 1, with the balls in elevation. Figs. 4 and 5 are enlarged cross-sections of portions of the case, showing different methods of keeping the balls in their places, with the balls in elevation.

The balls are held in the bearing in a case or shell that is perfectly free to turn and which is constructed in the following manner: It consists of a tube A, having the hole through it a little larger than the diameter of the axle or shaft B that is to turn in it, and its outside diameter is a little smaller than the hole in the hub or bearing it is to turn in. A series of radial holes *e* to hold the balls *a* are made through the sides of the case *a* a little larger than the diameter of the balls that they may have room to move freely in them, and they may be arranged in any order with regard to each other or vary in number, as may be desired. When the case and balls are intended for transportation, the holes *e* are partially closed at their inner and outer ends, so that the balls will not fall out of them when the case is held separate from the axle or shaft and the bearing. The inner ends of the holes are preferably made partially closed by boring them with a drill having a round or beveled end a little larger than the diameter of the balls and not running the drill clear through the full size, so as to leave projecting edges *f f*, (see Figs. 4 and 5,) that partly close the holes, so that the balls *a* will not fall out when the axle or shaft is taken out of the case. In Figs. 4 and 5 two ways of partly closing the outer ends of the holes are shown. In Fig. 4 the metal around the hole is swaged in so as to project over and make a ridge *d d*, the aperture through which is smaller than the diameter of the balls, and consequently will not let them drop out. In Fig. 5 is shown a method of keeping them in by pressing in rings *c c*, made just large enough to fit tightly in the holes, and then swaging the metal outside over slightly to hold the rings in place, the aperture in the rings being too small to allow the balls to come out. The ends of the holes may be partly closed in other ways well known to those skilled in the art of working metal; but however the closing may be done it is essential that the balls should be allowed to project somewhat beyond the case both on its inside and outside and have perfect freedom to turn in their places. It is obvious that the tubes may be divided lengthwise for convenience in putting them on shafts with fixed collars.

By this method of holding the balls in a case they are entirely relieved when in action (that is, when sustaining the pressure of the axle) from all contact and pressure of the other balls and the resultant friction, and the disadvantage is also avoided that is met with in holding them separate by means of rods extending lengthwise of the case, which is that where there is a rod there will be a space for the whole length of the case without any balls; but in this case or shell they may be arranged so as to have balls always in position to take the whole pressure.

Having thus described my improvement, I claim as my invention—

1. In a ball-bearing, a case or shell with perforations for holding the balls separate

from each other and guiding them in any preferred way, said perforations being partially closed at their inner and outer ends to retain the balls thereon, substantially as set forth.

2. In a ball-bearing, a case for holding the balls, consisting of a tube having radial holes made in it for holding the balls, said holes being contracted or made smaller at their inner and outer ends than the diameter of the balls, substantially as described.

3. As a new article of manufacture, a case for holding balls in a ball-bearing, constructed substantially as described—that is, a tube having radial holes in it partly closed at their inner and outer ends and provided with balls held in said holes, as herein set forth.

HENRY HOWARD.

Witnesses:
HOWARD F. KING,
BENJ. ARNOLD.