(No Model.) 2 Sheets—Sheet 1.

P. W. GATES.

Mode of and Means for Making Chilled Ball Bearings.

No. 243,546. Patented June 28, 1881.

Fig 1.

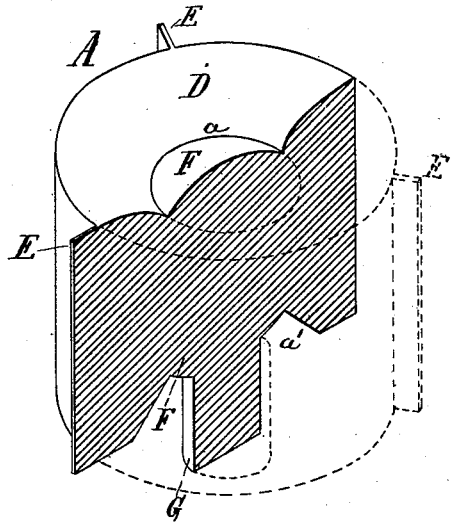


Fig 2.

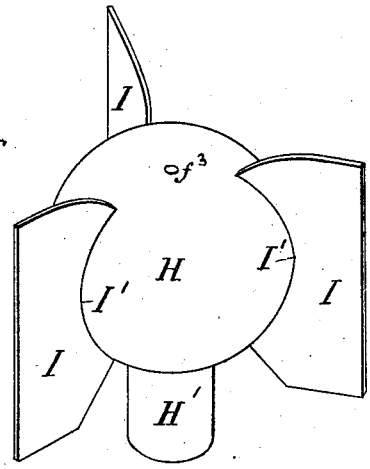
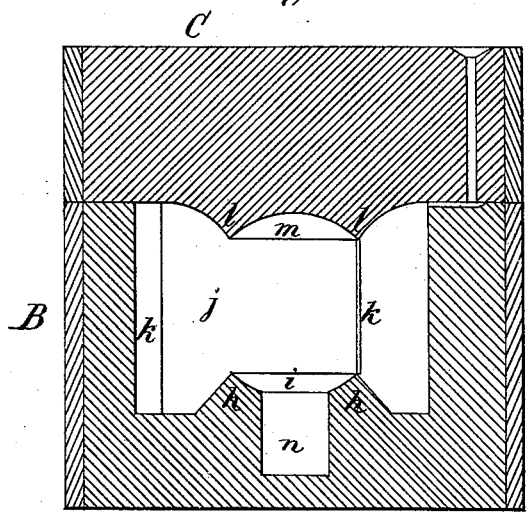


Fig 3.



Witnesses:
J. F. Theodore Lang.
Stephen A. Smith

Inventor:
Phileteus W. Gates
by his attys
Mason Fenwick & Lawrence

(No Model.) 2 Sheets—Sheet 2.

P. W. GATES.

Mode of and Means for Making Chilled Ball Bearings.

No. 243.546. **Patented June 28, 1881.**

Fig 4.

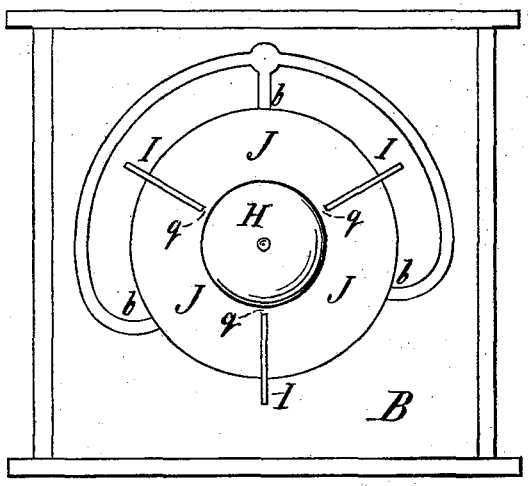


Fig 5.

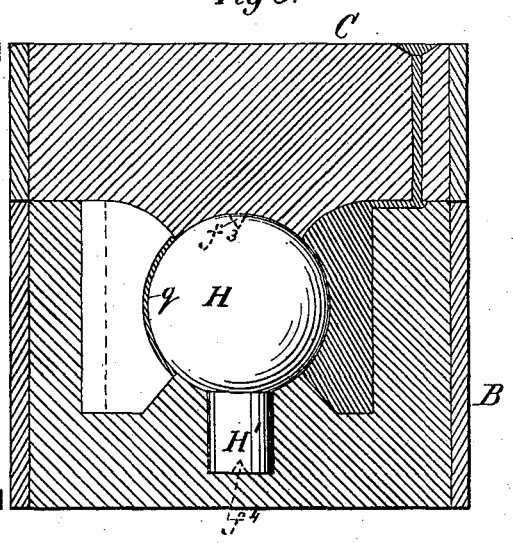


Fig 6.

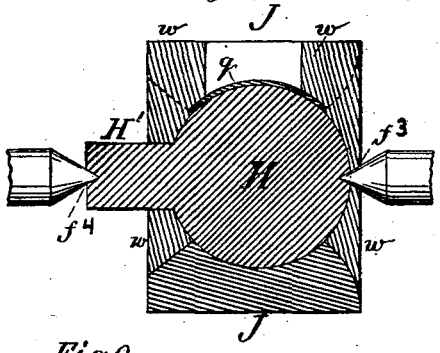


Fig 7.

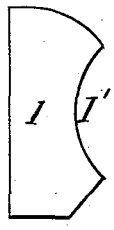


Fig 8.

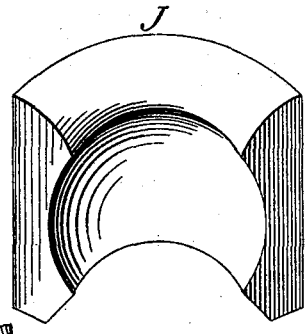


Fig 9.

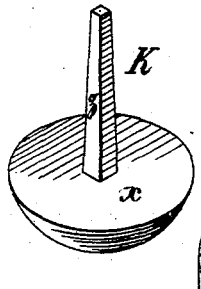


Fig 10.

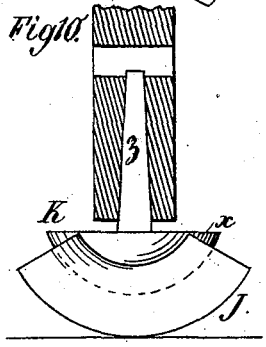
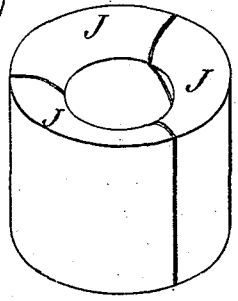


Fig 11.



Witnesses:
J. P. Theodore Lang.
Stephen A. Smith

Inventor:
Philetus W. Gates
by his attys
Mason Fenwick & Lawrence

UNITED STATES PATENT OFFICE.

PHILETUS W. GATES, OF CHICAGO, ILLINOIS.

MODE OF AND MEANS FOR MAKING CHILLED BALL-BEARINGS.

SPECIFICATION forming part of Letters Patent No. 243,546, dated June 28, 1881.

Application filed March 29, 1881. (No model.)

To all whom it may concern:

Be it known that I, PHILETUS W. GATES, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented an Improved Mode of and Means for Producing Chilled Ball-Bearings for Stone-Breakers and other Machines, of which the following is a specification.

My invention relates specially to the ball-bearings used in stone-breakers, such bearings being made with their outer surface cylindrical and their inner surface in form of part of a sphere, and also of several equal sections which form, respectively, a segment of a cylinder with an interior outline which is a true part of a sphere. A bearing of this description, but not chilled, is shown in Letters Patent No. 201,646.

The nature of my invention consists, first, in the mode hereinafter described, whereby bearings of the character above referred to are produced with a chilled interior bearing-surface in form of part of a sphere; second, in the means hereinafter described for producing the ball-bearings with interior chilled surface.

In the accompanying drawings, Figure 1 is a perspective sectional view of the pattern which is first employed to produce the impression in the mold and the cope. Fig. 2 is a perspective view of the chilling pattern-ball and parting-plates which are introduced into the mold after the pattern is withdrawn. Fig. 3 is a vertical section of the sand-mold and the cope as they appear after the pattern shown in Fig. 1 is withdrawn from the mold. Fig. 4 is a top view of the sand-mold and its flow-gates and sprue, the cope being removed and the pattern-ball and parting-plates with a bearing cast in the mold being shown. Fig. 5 is a vertical section of Fig. 4 with the cope in position upon the mold. Fig. 6 is a section of the chilled bearing and the chilling pattern-ball upon which it is cast, it being shown withdrawn from the mold, separated from the parting-plates, supplied with Babbitt sustaining-metal at its ends, and centered by means of sockets of the ball and its stem in a lathe for the purpose of having its unchilled exterior cylindrical surface turned true. Fig. 7 is a side view of one of the parting-plates separated from the chilled casting or bearing. Fig. 8 is a perspective view of one of the segments of the chilled casting or bearing. Fig. 9 is a perspective view of a lead spherical polisher having a hard-metal stem, whereby emery and oil are applied to the concave surfaces of the segments for the purpose of smoothing the same; and Fig. 10 is a top view and partial section, showing a segment of the chilled bearing, and also the polishing-tool and its stock. Fig. 11 is a perspective view of the finished chilled segmental bearing.

A in the accompanying drawings represents a pattern which is employed for producing the impression in the sand of a flask, B, and cope C. This pattern consists of a cylindrical body portion, D, with hollowed-out ends, *a a'*, radial wings E, extending beyond the circumference of said body portion D, spherical portions F F', and a cylindrical centering-stem, G. This pattern is centered by its stem G in any appropriate manner, and then sand is put into the flask and rammed around the pattern until the flask is full. Gates *b* are now formed, and the cope C is adjusted in position upon the mold, and sand also rammed into it until it is full. A sprue, *b*, is formed in the sand of the cope, and made to communicate with the gates.

By the above-described process a mold in sand is produced, consisting of a cylindrical chamber, *j*, narrow radial channels, *k*, a conical seat, *l*, concave or partly-spherical depression *m*, a cylindrical socket, *n*, a concave or partly-spherical depression, *i*, and a conical seat, *h*, as shown in Fig. 3. Into this mold is placed a perfectly smooth iron or steel ball, H, having a stem, H', and upon this ball are placed metallic plates I, which are very thin and have their inner edges concave, as shown at I', Fig. 2. The ball and its stem are formed with centering-sockets f^3 f^4, and the surfaces of the plates are japanned or otherwise suitably coated to prevent them from adhering to the cast metal of which the bearing is formed. The plates are adjusted by means of their concave edges upon the ball, as illustrated in Fig. 2, in order to be readily passed down with it into the sand-mold without touching the sand surrounding the channels *k*. The stem H' of the ball H sets into socket *n*, and the plates into the radial channels *k*, while the ball itself occupies the chamber *j*, as shown in Fig. 5. The ball occupies a true central posi-

tion and, the plates are radial to the ball, they being adjusted radially out into the channels *k* after being introduced into the mold, so that their concave edges I′ stand away from the ball just far enough to allow a narrow web of casting-metal from the gates to flow between them and the ball in the casting process, and thereby temporarily hold together the several segments which are being cast to form a bearing, J. In order to thus effect the temporary union of the segments of the casting or bearing J in the casting process the channels *k* are made deep enough radially to permit the plates to be moved the required distance away from the ball. It is important to thus have the segments of the bearing or casting remain united temporarily, as it is necessary to center the casting or bearing in a lathe for the purpose of turning off its cylindrical surface to a true circle.

The casting or bearing is produced by flowing molten metal in the usual manner along the gates into the vacant parts of the mold. In the casting operation the bearing has its outer surface and radial parting-surfaces left unchilled, the sand-mold and parting-plates not acting to chill these surfaces, while its interior or spherical surface is chilled, the hard-metal ball imparting the chill thereto. The bearing thus cast is removed from the mold with all its segments united in a temporary way by the webs of metal *q*, and when removed Babbitt or other suitable metal, *w*, is run into its hollowed ends and into the splits formed by the parting strips or plates I after said plates have been withdrawn. The Babbitt metal may be made to occupy more or less of the space of splits, and it may be applied in one or both of the hollowed ends of the casting or bearing. Its purpose is to form a sustaining support for the casting while it is centered in a lathe, and its cylindrical surface is being turned off true, as illustrated in Fig. 6 of the drawings. The segments of the casting are next properly broken apart at the webs *q*, and the rough or fractured edges of the several segments are ground off smooth with an emery-wheel; and, finally, the segments are polished on their concave or partly-spherical surface by means of emery and oil, and for accomplishing this operation a tool, K, consisting of a soft-lead head, *x*, of the form of part of a sphere, and a steel or iron shank, *z*, is provided and secured in the stock of an ordinary drill. With this tool and emery and oil the concave or partly-spherical surface of the respective segments is polished, being subjected for a few minutes to the action of the tool and emery and oil, the tool having a rotary motion with its stock and the emery embedding itself sufficiently into the soft lead to insure its polishing action.

By my invention a chilled ball-bearing is produced by the casting process, and at slight cost, and such bearing will, when in use but a short time, become very highly polished on its concave surface, it appearing as bright as a mirror; and it has been found that this bearing is capable of enduring the most powerful wearing action without any perceptible diminution of its diameter, whereas with other bearings not chilled, and used in the same place on a stone-breaker, the wear is so great that it has been found almost impracticable to employ such bearings, even when a compensating mechanism is provided for taking up the wear in connection with the same.

A given size bearing of this description, as heretofore constructed without a chilled surface, required about one week's time to make it, whereas by my mode only a half-day is occupied in making my bearing, and besides this the ordinary bearing is of little use, as the great pressure required for breaking even limestone causes it to be crushed out in about sixty days; and in breakers for crushing granite and iron ore, where the pressure is immense, the bearing will hardly stand one day's use, while with my chilled bearing all pressures within ordinary range can be withstood, and without any perceptible looseness between the ball and its bearing occurring.

I have described in the aforegoing specification, and also shown in the accompanying drawings, the improved hollow chilled ball-bearing produced by my invention herein claimed; but under this patent only the mode of and means for producing such bearing is claimed, as I intend to apply for a separate patent for the bearing itself.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The mode, substantially as herein described, of producing bearings in segments, which respectively have their concave or partly-spherical inner surface chilled, consisting in forming a sand-mold, having radial channels, a cylindrical chamber, a stem-socket, and concave depressions in form of parts of a sphere, setting a ball and suitably coated radial parting-plates within this mold, and adjusting the plates so that a small space is formed between them and the ball, flowing the metal into the mold, so that radial webs of the casting metal unite the segments of the casting formed in the mold, removing the casting with its segments still united, withdrawing the parting-plates, flowing Babbitt or other metal upon the ends of the casting, turning off the cylindrical surface of the casting while the segments are still united by webs of metal, breaking apart the segments where united by the webs of metal, and dressing off the fractured edges, and polishing the concave surfaces of the segments with suitable polishing materials and tools, all as set forth.

2. The combination, with a sand-flask and its cope, of the pattern A, provided with surfaces in form of a cylinder, and parts of a sphere, and with a stem and radial wings, substantially as described.

3. The combination, with a sand-mold hav-

ing imparted to it the impression from the pattern, of the metal ball and coated radial parting-plates, substantially as and for the purpose described.

4. The metal ball having centering sockets in it and in its stem, substantially as and for the purpose described.

5. The casting for a chilled bearing consisting of segments of a cylinder having an interior chilled bearing-surface approximating to the form of a part of a hollow sphere, said segments being united by temporary webs of metal, and surrounding a chilling centering metal ball, substantially as and for the purpose herein described.

6. The detached coated parting-plates, having a concave edge, in combination with a metal chilling-ball, having a centering stem and sockets, substantially as and for the purpose described.

PHILETUS W. GATES.

Witnesses:
J. C. JONES,
L. W. HEWES.