No. 714,670. Patented Dec. 2, 1902.

C. H. CHAPMAN.

APPARATUS FOR HARDENING THE CUPS AND CONES OF BALL BEARINGS.

(Application filed Mar. 21, 1901.)

(No Model.)

Fig. 1.

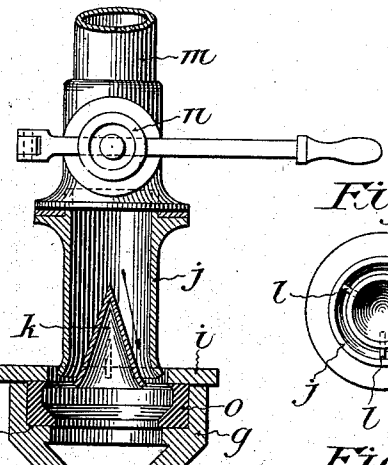


Fig. 3.

Fig. 2.

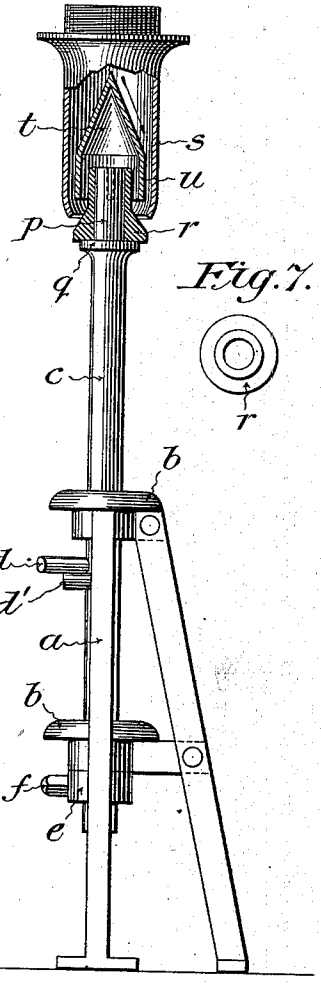


Fig. 5.

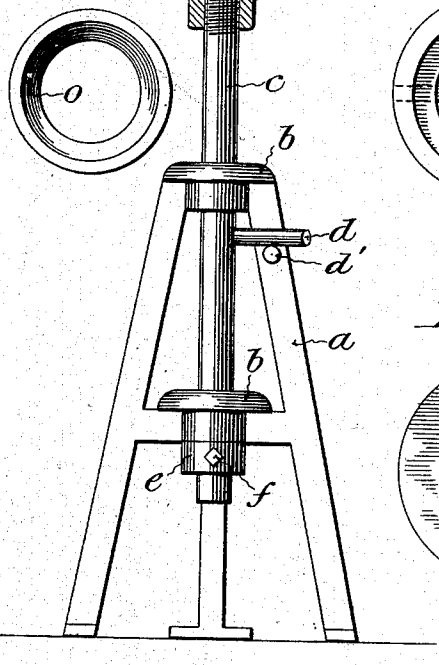


Fig. 4.

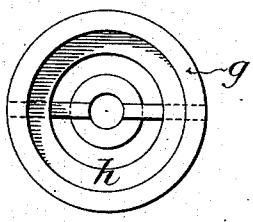
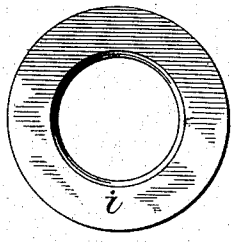


Fig. 7.

Fig. 6.



Witnesses:
A. M. Young.
E. A. Finnell.

Inventor.
Charles H. Chapman
by Wm. H. Finnell
Atty.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

CHARLES H. CHAPMAN, OF GROTON, MASSACHUSETTS.

APPARATUS FOR HARDENING THE CUPS AND CONES OF BALL-BEARINGS.

SPECIFICATION forming part of Letters Patent No. 714,670, dated December 2, 1902.

Original application filed June 4, 1900, Serial No. 19,041. Divided and this application filed March 21, 1901. Serial No. 52,249. (No model.)

To all whom it may concern:

Be it known that I, CHARLES H. CHAPMAN, a citizen of the United States, residing at Groton, in the county of Middlesex and State of Massachusetts, have invented a certain new and useful Improvement in Apparatus for Hardening the Cups and Cones of Ball-Bearings, of which the following is a full, clear, and exact description.

This invention comprises the apparatus shown and described in my application for patent originally entitled "Process of hardening the cups and cones of ball-bearings," filed June 4, 1900, Serial No. 19,041, and to that extent is a division of said application.

The invention consists of an apparatus by means of which the hardening agent may be applied to those portions only of the object to be hardened which receive immediately the wear of use, so that the remainder may be left soft or unaffected by the hardening process, as I will proceed now more particularly to set forth and finally claim.

In the accompanying drawings, illustrating my invention, in the several figures of which like parts are similarly designated, Figure 1 is a sectional front elevation, the parts being adjusted for operation. Fig. 2 is a sectional side elevation of a modified form, the parts also being adjusted for operation. Fig. 3 is an end view of the nozzle. Fig. 4 is a top view of the holder. Fig. 5 is a top view of a cup to be hardened. Fig. 6 is an under side view of the cover. Fig. 7 is a top view of a cone to be hardened.

As shown in Fig. 1, *a* is a suitable frame, such as a tripod, having bearings *b*, which receive a vertical rod *c* and permit its longitudinal adjustment therein by a handle *d*, the adjustment being limited by an adjustable collar *e*, secured to the rod by a set-screw *f* and retained by pin *d'*, engaged by the handle when turned over it. On the upper end of this rod is fitted, as by a screw-threaded joint, a skeleton holder *g*, having a seat *h* to receive the cup *o* and protect the under side and outer surface thereof against the action of the hardening fluid while being treated and provided with a cover *i* to protect the upper side of the cup and having an overhanging flange to engage the interior of the cup to a greater or less extent, the said cover also projecting over the outer edge of the holder, thereby leaving the wearing-surface only of the cup exposed to the action of the hardening fluid. A nozzle *j*, having an outwardly-flaring mouth, is adapted to be mounted above this holder, and it contains a conical distributer *k*, mounted concentrically in said nozzle and connected therewith, as by wings *l*, so as to leave an annular space between itself and the nozzle, whereby a tubular stream is caused to flow therefrom. The nozzle is adapted to be connected fluid-tight with a pipe *m*, having a valve *n* to supply the fluid to the object to be treated.

In Fig. 2 I have shown an apparatus for hardening the wearing-surface only of a cone *r*, in which the holder is merely a spindle *p* on the end of the rod *c* to snugly fit the opening in the cone and having a shoulder *q*, upon which the cone rests, and the nozzle *s* has an inwardly-flaring mouth and a cone *t*, provided with a cylindrical skirt *u*, which covers in and protects the upper end of the cone *r* from the action of the hardening fluid.

The apparatus will be modified to suit the construction of the bearing-piece to be treated.

The operation of the apparatus is as follows: The steel cup *o* is heated to a low red heat and placed in the seat *h* of the holder *g*, and the cover *i* is then placed on top the cup, with its projecting lip entering the cup *o*. The cup and the weight of the cover are sustained in the bottom of the holder *g* and prevent the water, oil, or hardening solution from coming in contact with the outside part of the cup, which it is desirable not to harden. The parts being in their normal position, with the holder *g* resting upon the upper bearing *b*, the upright rod *c* is then raised to the position shown in the drawings by the handle *d* until the collar *e* comes up against the lower bearing *b*. The collar is adjustable up and down on the rod *c* to bring the cup into the most desirable position with relation to the nozzle. The valve being opened, the hardening solution rushes through the nozzle and strikes the point of the cone *k* and is forced out of the nozzle, as indicated by the arrows, in a tubular stream and comes in contact

with the cup at the point where it is to be hardened with a pressure of from ninety to one hundred pounds to the square inch, after which it passes down through the shell and holder and out of the way.

In the apparatus shown in Fig. 2 the hardening solution rushes out, as indicated by the arrows, around the cone t in a tubular stream and comes in contact with the cone r at the point which it is desired to harden, and as the cone r enters the cylindrical portion u of the cone t above the point of discharge of the hardening fluid and as the cone projects and hangs over the shoulder it is obvious that the hardening solution cannot come in contact with the upper end and the inside of the cone, which it is desirable not to harden.

The operation of hardening the cups and cones is substantially the same, with the exception that with the cups the hardening solution strikes and hardens the inside or wearing-surface of the cup and leaves the outside soft and with the cone the hardening solution strikes and hardens that part or wearing-surface of the outside of the cone which it is desirable to harden and leaves the inside and upper end of the cone soft.

It will be seen that by covering that part of the cups and cones which it is desirable not to harden, so that the hardening solution cannot come in contact with it, and by applying a stream of the hardening solution under a high pressure to that part of the cup and cone which it is desirable to harden I am enabled to get a very even and extremely hard wearing-surface, which can afterward be drawn to a color, which will greatly increase the durability and wearing capacity of the cup and cone, and as by this invention that part of the cup or cone which does not come in contact with the balls can be left soft the liability of the cups and cones being broken in use is greatly, if not entirely, overcome.

Another very important feature in this invention is that the cups and cones will retain their proper shapes much better than when immersed in a bath of hardening solution.

A great difficulty in the ordinary process of hardening a large cup or cone, such as is used in a heavy bearing, is that the great heat is very liable to propel the solution away from its surface, leaving steam-cells, which prevent the cups or cones from being evenly hardened, resulting in soft spots, which destroy the usefulness of the cup or cone. By applying the hardening solution to the surface of the heated steel under a high pressure the heat cannot repel the solution, and the result is that the steel is instantly chilled and hardened. The depth of the hardening can also be regulated to a great extent by the length of time the hardening solution is applied.

The pin d' may be adjustable, so as to provide for the retention of the holder at any desired elevation.

What I claim is—

1. Apparatus for hardening the wearing-surfaces of the bearing-pieces of ball-bearings, consisting of a holder adapted to receive and support the bearing-piece to be treated and expose only that portion of the object that is to be hardened and covering up that portion which may remain unaffected by the hardening process, a conical distributer arranged above the holder, and a discharge-nozzle surrounding the distributer and serving with the distributer to confine the hardening fluid to the surface to be hardened, substantially as described.

2. The combination of a supporting-frame, a longitudinally-movable rod arranged therein, a holder mounted upon said rod and having a seat to receive the object to be treated and to protect the under and outer surfaces of such object against the action of the hardening fluid, a cover having an overhanging flange similarly to protect the upper portion of the object, a conical distributer mounted above the holder, and a fluid-discharging nozzle surrounding the said distributer and with it serving to discharge the hardening fluid upon that portion only of the object which it is desired to harden, substantially as described.

In testimony whereof I have hereunto set my hand this 19th day of March, A. D. 1901.

CHARLES H. CHAPMAN.

Witnesses:

OSCAR E. STEVENS,

W. E. PUTNEY.