No. 650,926. Patented June 5, 1900.

E. F. CREAGER.

BALL RETAINER AND ITS PRODUCTION.

(Application filed Feb. 17, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

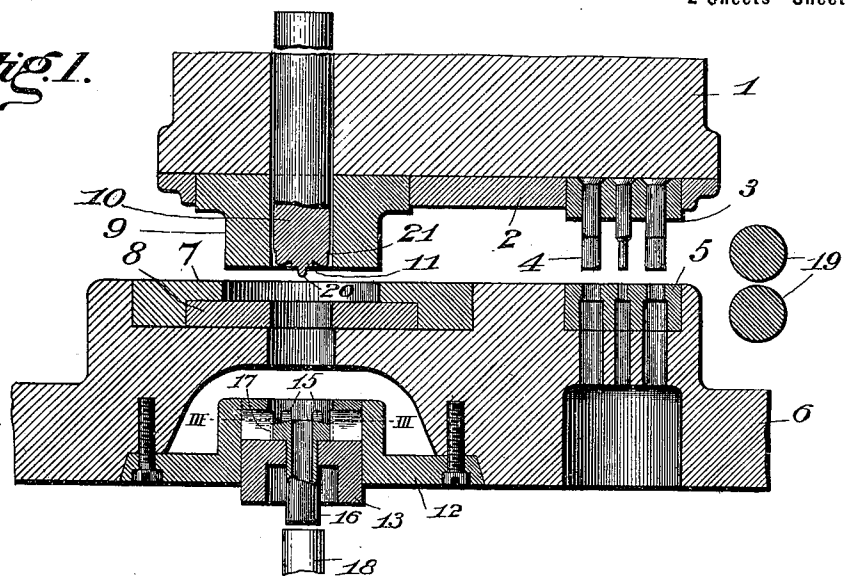


Fig. 2.

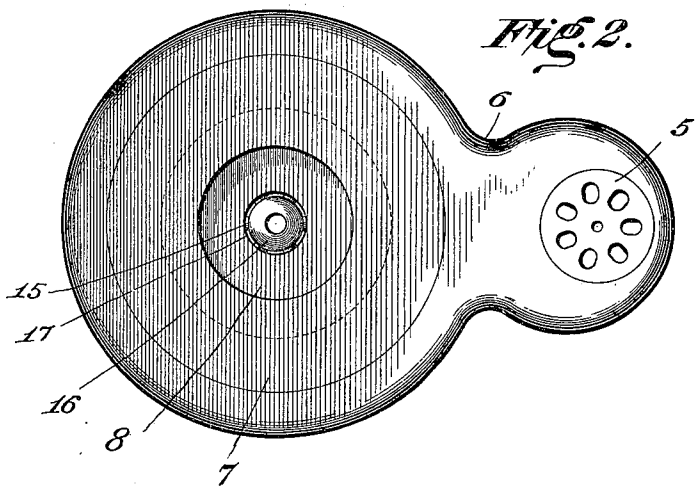
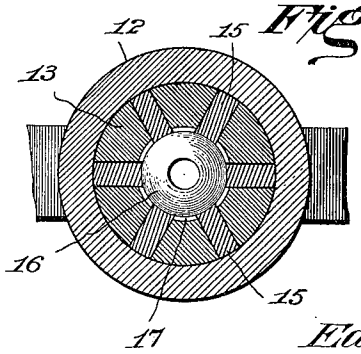


Fig. 3.



Witnesses
M. Forster
Jno. M. Rankin

Inventor:
Edwin F. Creager
by Walker & Rogers,
Attorney

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

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Fig. 4.

Place a strip of metal under the punches of the die of Fig. 1. The first effect is to punch the axial hole and the surrounding elliptical perforations.

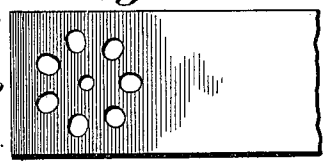
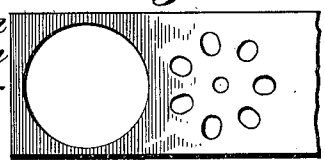


Fig. 5.

The strip is then moved in and a circular disk containing the holes is cut, another set being punched to the right as the die goes down.



The continued downward movement of the dies carries this perforated disk through the forming die

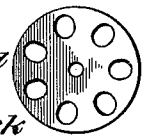


Fig. 6.

and draws up a cup with an axial perforation and surrounding oval perforations.

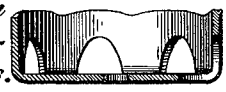


Fig. 7.

The further effect of the final downward movement is to press down the edge of the retainer and press up the top edges of the oval perforations, making them again elliptical.

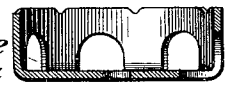


Fig. 8.

At the same time a depression may be formed in the bottom and the axial opening repunched, so that the retainer is ready for the balls.

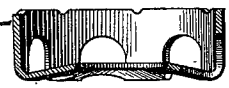
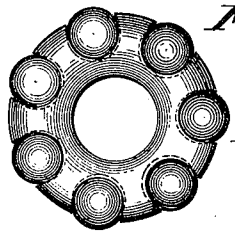


Fig. 9.

Fig. 10.



Witnesses

M. E. Fowler

Robt. M. Rankin

Inventor:

Edwin F. Creager

by Wallace L. Rogers.

his Attorney

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

UNITED STATES PATENT OFFICE.

EDWIN FRANCIS CREAGER, OF LANCASTER, PENNSYLVANIA.

BALL-RETAINER AND ITS PRODUCTION.

SPECIFICATION forming part of Letters Patent No. 650,926, dated June 5, 1900.

Application filed February 17, 1900. Serial No. 5,621. (No model.)

To all whom it may concern:

Be it known that I, EDWIN FRANCIS CREAGER, a citizen of the United States, residing at Lancaster, in the county of Lancaster and State of Pennsylvania, have invented certain new and useful Improvements in Ball-Retainers and Their Production; 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.

My invention relates to retainers for ball-bearings and their production. Its object is to produce a retainer of a certain order, hereinafter described; and it consists, essentially, of a ring or cup-shaped retainer having swaged or reset rims and perforations and a process for producing the improved retainer.

In the drawings, Figure 1 is a vertical section of a compound or gang die. Fig. 2 is a plan view of the bed-plate of the die. Fig. 3 is a like section on the line III III of Fig. 1, and Figs. 4 to 10 details of the sheet of metal being operated upon and the article in course of preparation.

In the drawings, 1 represents the press-ram; 2, the upper die-plate; 3, the punch-holder; 4, punches; 5, a die to receive the punches; 6, the lower die-plate, having an arch-shaped opening in the bottom; 7, a blanking-die; 8, a drawing-die; 9, a blanking-punch; 10, a drawing and swaging punch playing through the blanking-punch; 11, a supplementary or auxiliary punch; 12, a plate for holding the swaging-dies and holder; 13, a swaging-die holder or ring; 15, swaging-dies, and 16, a forming and repunching die which may serve also as a knock-out; 17, guide-ribs on the side of the repunching-die 16; 18, a moving element which may be brought up against the repunching-die 16, that it may knock out the finished retainer, and 19 feed-rollers.

I place a strip of metal of the proper width and thickness, such as shown in Fig. 4, in the die with its end beneath the punches 4. When the press-ram descends, a series of perforations are formed in the strip of metal. In this example I have shown a circular axial perforation with a series of elliptical or oblong perforations surrounding the axial perforation and about midway between the axial perforation and the side of the metal strip. It will be understood that the number, size, and relation of these perforations will vary according to the size or character of the retainer to be produced. When the perforations are formed, the dies are withdrawn and the strip is fed forward, either by hand or by the rollers 19 or by any suitable feed mechanism, until the axial perforation is in line with a guide-tip 20 on the end of the punch 10. Hereafter each stroke may produce a complete retainer. On the second stroke of the ram 1 the punches 4 again form perforations in the metal strip. The same downward movement of the ram carries the draw-punch 10 and the blanking-punch 9 down together. The blanking-punch cuts out the circular piece, including the perforations, as indicated in Fig. 5. The continued movement of the second ram carries down the punch 10, which pushes ahead of it the perforated disk of Fig. 6, centered by the guide-tip 20, so that it passes through the drawing-die 8. The disk is bent along a line which practically includes the minor axes of the elliptical perforations, thereby drawing up a cup, as shown in Fig. 7. When the disk is thus drawn up, the practical effect is to contract what may be termed the "upper" or "outer" poles of each elliptical perforation, so that a somewhat-pointed end is formed, the substantially-elliptical perforation being converted into practically an oval perforation. The ram continues in its downward movement, pushing the cup down until it is embraced by the swaging-die holder or ring 13. Each oval perforation embraces or straddles a swaging-die 15, the head of the retainer resting on the top of the forming and repunching die 16. These swages, it will be seen, pass through the swaging-die holder and project slightly into a space around the punch and die 16. They are backed by the plate 12 and serve as guides for the ribs 17 on the punch and die 16. The effect of this movement is to press downward the upper surface of the cup or ring by a shoulder 21 of the punch 10 and at the same time force upward and outward the upper or outer and lesser end of the oval perforation by the swages 15, so that the particles of metal are caused to move upon each other or in a certain sense to flow, there-

by swaging or resetting the upper or outer edge or rim of the retainer that is pressing the metal down and around that edge and also swaging and resetting the top of each perforation and bringing it back to the elliptical form. The aim especially in view is the hardening and strengthening in the described manner of the contact edge of each ball-receiving perforation. In use the edge which has been herein named as the "upper" or "outer" edge is that which receives almost all of the frictional contact of the ball and is subject to the greatest strain. It will be observed that this treatment is different in principle from the common modes used to harden points or tangs, which generally result in rendering the hardened edge or point brittle. The same movement forces the head of the retainer upon the head of the punching and re-forming die 16. This die has a punch-face which encircles the axial perforation and cuts out a larger opening for the finished article. This die may also have a convex or other form which may serve to depress the head of the retainer, as shown in Fig. 9, one of the forms which I may use. The retainer may be knocked out through the open arch in the die-plate 6 by a movable element, such as indicated at 18, being brought up against the stem, preferably hollow, of the punch and die 16, or if desired or in case of failure of 18 to act the finished retainer may be knocked off the punch 10 on the return movement of that punch by striking against the edges of the drawing-die 8, which project slightly over the perforation in the die-plate 6. The retainer is now ready to receive the balls, as indicated in Fig. 10. The general features and construction of this retainer are fully described in my applications filed May 1, 1899, Serial Nos. 715,225 and 715,226, which since the filing of this application have become Patents No. 645,714 and No. 645,715, dated March 20, 1900. As I have stated, this process and operation may produce a complete retainer at each stroke of the press-ram after the first stroke. While it is possible and practicable to complete a retainer by this manner or process, I have found it more practicable in some sizes and styles to divide the cycle of operations or steps in the process and to use two or more stages or operations, the process remaining the same in substance. In some instances it is more desirable as a matter of economy in operation to change the steps of the process—that is, for example, in the case of a very deeply-depressed bottom it will be more desirable to repunch the axial hole and depress the bottom before swaging the perforations to size and bringing the top to a proper level.

The advantages of the process as thus set forth are obvious and are especially economical. The distinct advantage in the final steps is the hardening of the edges of the retainer by the swaging and resetting operation, thus increasing the resistance to wear. I am also able by my process to eliminate the trimming of the edge of the retainer, a step usually necessary in the production of such devices.

The operations I have described can be performed by one die, so that the entire cycle is carried through at one stroke of the press-ram, or, if desired, a gang of dies can be used in the press to work consecutively, producing a complete retainer at either the second or the third stroke of the press and one at each stroke thereafter until the strip is used up, or the steps may be performed separately in separate dies and presses, using a stroke of the press-ram for each stage of the process not at any time exceeding three stages. When a compound or gang die is used, the retainer need not be set between the steps to register the perforations with the swaging-dies, as would be necessary if separate presses were used. When separate dies are used, the perforations may be made to serve as guides for teeth in the dies succeeding the first one.

A distinct advantage of this process of manufacture is that it is practicable and economical to make the entire process automatic, thus doing away with the great danger to the operator's hands, now generally present, in the manner of making such devices. I am thus enabled to reduce the skilled help to a minimum, while at the same time producing the most finished articles.

In Figs. 4 to 10 I have illustrated in the drawings briefly and with notes the process by which my article is produced.

Whether the dies described be compound or in gang or sequence, the principle of construction is substantially the same.

Having fully described my invention, what I claim is—

1. The process of producing ball-retainers which consists in drawing a perforated blank into a substantially cup-shaped form and then re-forming the ball-receiving perforations.

2. The process of forming ball-retainers by one stroke of a die, which consists in cutting out a previously-perforated blank, drawing the blank into a ring or cup form and re-forming the perforations.

3. The process of forming ball-retainers in one stroke of a die which consists in cutting out a previously-perforated blank, drawing up the blank into a ring or cup form, and pressing or swaging the rim and the contact edges of the ball-receiving perforations.

4. The process of forming a ball-retainer which consists in punching an axle-hole and surrounding oblong or elliptical perforations, cutting out the punched circular blank, drawing it up into cup or ring form having oval perforations, and then pressing from opposite directions the rim and the lesser end of the perforation to re-form the perforations so that they are again oblong or elliptical.

5. A ball-retainer comprising a cup or ring having ball-receiving perforations, and having the contact edges of the perforations

swaged or reset to harden or strengthen them.

6. A ball-retainer comprising a ring having ball-receiving perforations, and having the rim and the contact edges of the perforations swaged or reset.

7. The herein-described ball-retainer comprising a ring or cup having ball-receiving perforations drawn up from a blank, and having the rim and the contact edges swaged and reset so that the article is relatively hardened and stronger than the blank.

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

EDWIN FRANCIS CREAGER.

Witnesses:
H. K. MOWRER,
J. E. HERCHELROTH.