(No Model.)

J. B. BOWDEN & H. V. BERNHARDT.

METHOD OF FORMING RINGS.

No. 432,365. Patented July 15, 1890.

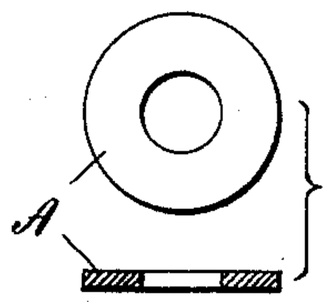
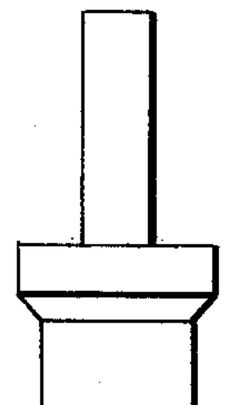
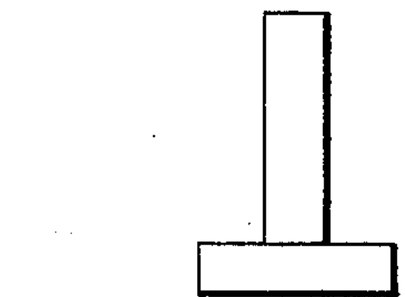


Fig. 1.





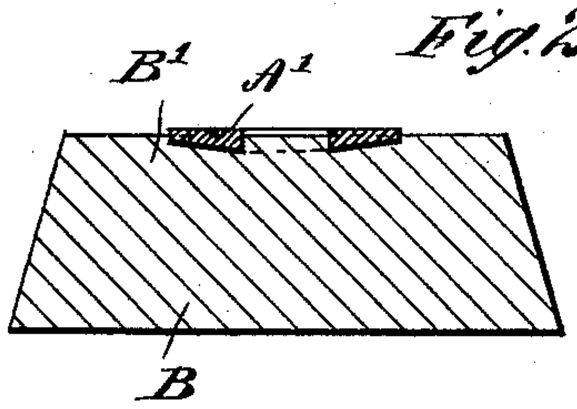


Fig. 2.

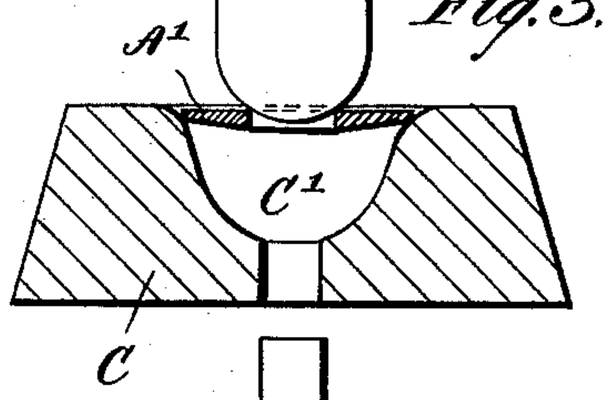


Fig. 3.

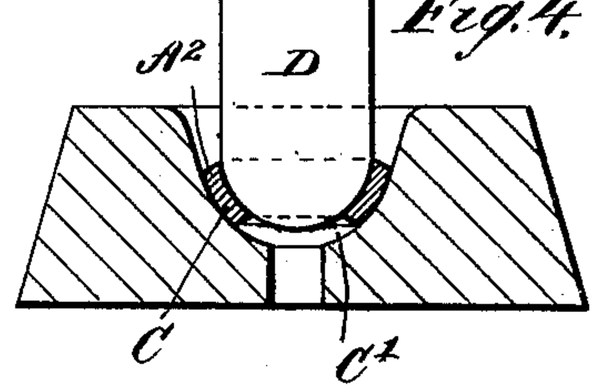


Fig. 4.

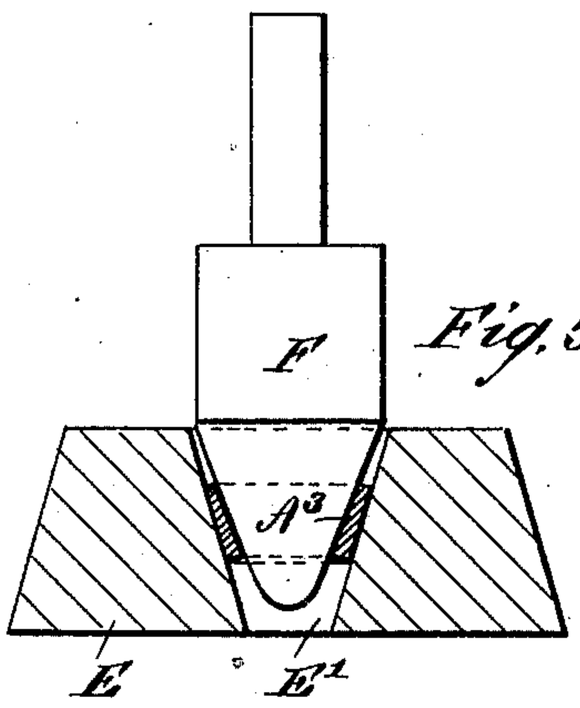


Fig. 5.

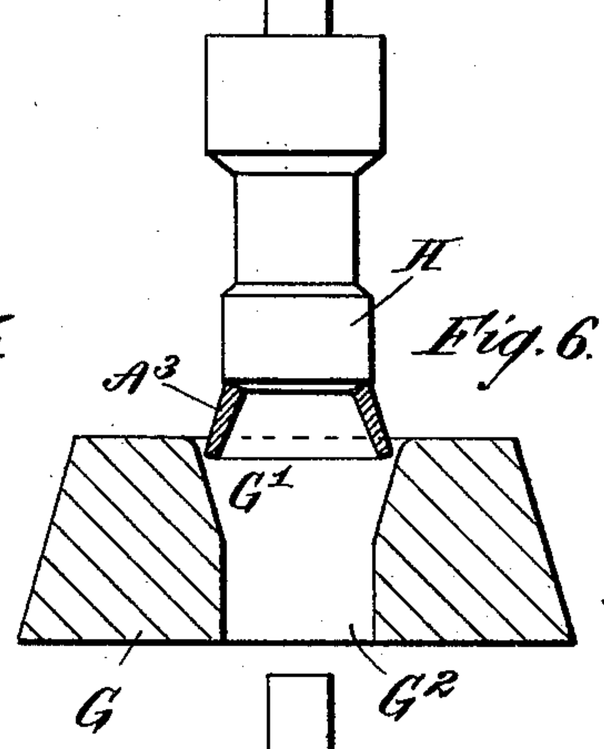


Fig. 6.

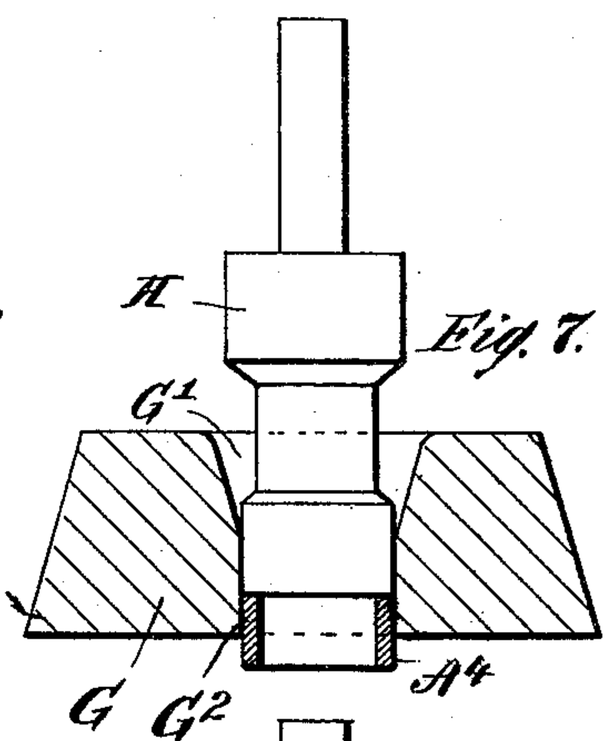


Fig. 7.

Fig. 9.

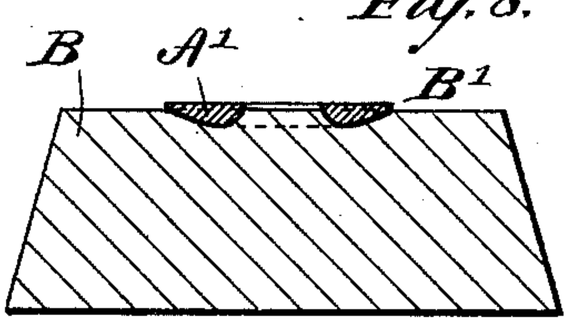


Fig. 8.

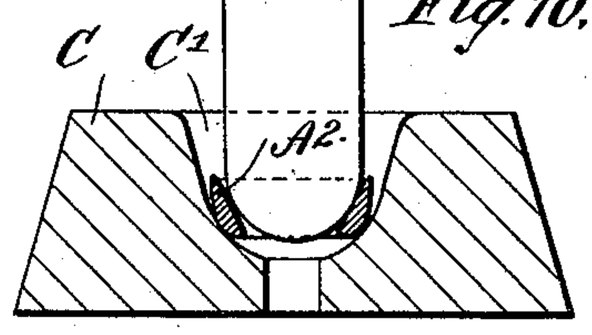


Fig. 10.

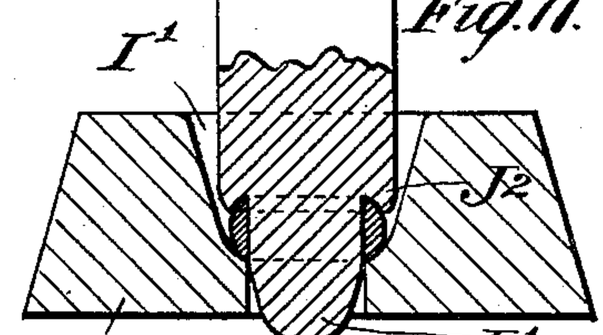


Fig. 11.

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UNITED STATES PATENT OFFICE.

JOSEPH B. BOWDEN AND HERMANN V. BERNHARDT, OF BROOKLYN, NEW YORK; SAID BERNHARDT ASSIGNOR TO SAID BOWDEN.

METHOD OF FORMING RINGS.

SPECIFICATION forming part of Letters Patent No. 432,365, dated July 15, 1890.

Application filed May 26, 1890. Serial No. 353,209. (No model.)

To all whom it may concern:

Be it known that we, JOSEPH B. BOWDEN and HERMANN V. BERNHARDT, of Brooklyn, in the county of Kings and State of New York, have invented a new and Improved Method for Forming Rings, of which the following is a full, clear, and exact description.

The invention relates to a method for forming rings, such as shown and described in the United States Letters Patent, dated April 2, 1889, No. 400,541, and granted to Joseph B. Bowden, one of the above-named parties.

The object of the invention is to form flat or rounded-off seamless rings of substantially uniform density and to prevent detrimental undue compression and undue expansion of the metal during the several operations in forming the ring from the annular blank.

The method consists in first forming a ring having a decreasing thickness from the inside to the outside, and then subjecting the ring thus formed to the action of a series of graduated swages, all as will be hereinafter more fully described, and pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a plan view and section of the flat annular blank from which the flat rings are formed. Fig. 2 is a sectional side elevation of the matrix with the flat ring in place. Figs. 3, 4, and 5 are sectional side elevations of graduated dies and swages with the partially-formed rings in place. Fig. 6 is a sectional side elevation of the finishing die and swage with the ring and swage in place at the beginning of the operation. Fig. 7 is a like view of the same with the ring and swage in place near the end of the operation. Fig. 8 is a sectional side elevation of the matrix with a rounded-off ring in place. Fig. 9 is a sectional perspective view of the rounded-off ring after leaving the matrix. Fig. 10 is a sectional side elevation of the die and swage with a partly-formed ring in place, and Fig. 11 is a like view of the finishing die and swage with the ring in place.

In order to produce flat rings, a washer A is first formed by suitable machinery, the said washer being of a uniform thickness, as is plainly illustrated in Fig. 1. The washer is then placed into an annular groove B′, formed in the top of a matrix B, the said annular groove having a beveled bottom, so that the inner edge is deeper than the outer edge, as is plainly illustrated in Fig. 2. The washer A is pressed into this annular groove B′, so as to assume its shape, thereby producing a ring A′ having a decreasing thickness from the inner edge to the outer edge, as is plainly shown in Fig. 2. The top of this ring A′ is flat, while the bottom is beveled, as shown. The ring thus produced is now transferred to a die C, having a bell-shaped opening C′, into which the ring A′ is pressed by a rounded-off swage D. The ring A′ is by this operation changed from its annular form into a conical form A^2 with slightly-curved sides, as is plainly shown in Fig. 4. The ring A^2 thus formed is now transferred to a die E, having a conical opening E′, and is subjected therein to the conical die F, which forms a ring A^3 of conical form, but of decreasing thickness from the small edge to the large one, as is illustrated in Fig. 5. The ring A^3 is now transferred to a finishing-die G, having a conical opening G′, leading to a cylindrical opening G^2. The ring A^3 is placed into the large end of the conical opening G′, with the small edge touching the sides of the small opening, as is plainly illustrated in Fig. 6. The cylindrical swage H is now placed on the small end of the ring A^3, resting on the large edge of the said ring. By now driving the swage H downward the ring A^3 in passing through the inclined sides of the opening G′ is shaped to circular form. At the same time the power applied to the swage H and the resistance offered by the die G cause the ring to assume a uniform thickness, so that when the ring A^4 leaves the cylindrical opening G^2 its thickness and density are uniform throughout.

It is understood that by subjecting the ring to the action of the several swages and dies D C, F E, and H G the ring receives equal expansion and compression, so that the ring A^4 finally produced is uniform throughout, and all breakage during the several operations of the dies and swages is practically prevented.

In order to form a ring having a convex outer side, the ring A′, instead of having its under side beveled, is slightly curved; but the thickness of the inner edge is considerably greater than the thickness of the outer edge, similarly to the ring A′, as plainly shown in Figs. 8 and 9. The ring A′ thus formed on the matrix B, having its groove B′ correspondingly shaped, is then transferred to the dies C to be acted on by the swage D, which forms the ring A^2, of a slightly conical shape, with the outer side rounded off, as is plainly shown in Fig. 10. The ring A^2 is then transferred to the finishing-die I, having a conical opening I′, slightly rounded in the bottom, as is plainly shown in Fig. 2. The ring A^2 is set in this die similarly to the one shown in Fig. 6, and then a swage J is employed having a reduced portion J′, adapted to pass into the smaller end of the ring, so that the upper heavy edge of the ring passes under the shoulder J^2. In driving the swage J downward the ring A^2 is formed with a straight inner side by the reduced portion J′ of the swage J, and a convex outer side by being in contact with the inclined walls of the conical opening I′. The ring in passing down the opening I′ is formed with a universal thickness and density, thus producing a rounded-off ring of perfect shape.

It will be seen that by changing the form of the dies and swages rings of different cross-sections can be produced in the same manner as above described.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. The herein-described method for forming rings from flat annular blanks, which consists of first forming a ring having a decreasing thickness from the inner edge to the outer edge, and then subjecting the ring to the action of a series of graduated swages and dies, so that the inner side is in alignment with the axis of the ring, substantially as shown and described.

2. The herein-described method of forming rings from flat annular blanks, consisting in first forming a ring having a decreasing thickness from the inner edge to the outer edge, then subjecting the ring to the action of a series of graduated swages and dies to more closely align the inner side with the axis of the ring, then placing the ring in an upside-down position onto a finishing die and swage, and then subjecting the ring to the action of this finishing die and swage, substantially as shown and described.

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HERMANN V. BERNHARDT.

Witnesses:
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E. M. CLARK.