No. 857,616. PATENTED JUNE 25, 1907.

J. H. GAULT.

FORMING SEAMLESS METALLIC HOLLOW VESSELS.

APPLICATION FILED SEPT. 17, 1904.

Fig. 1.

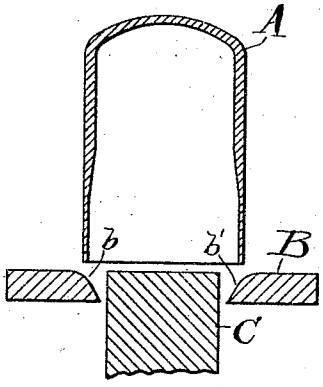


Fig. 2.

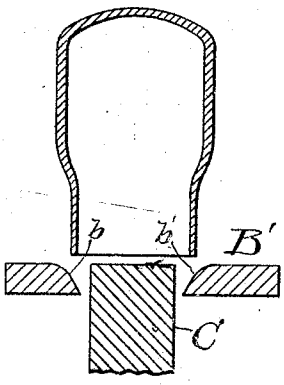


Fig. 3.

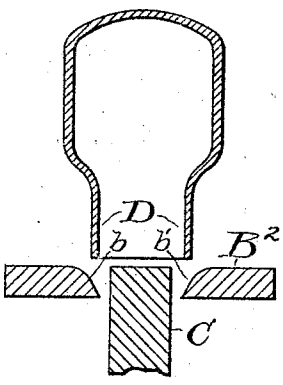


Fig. 4.

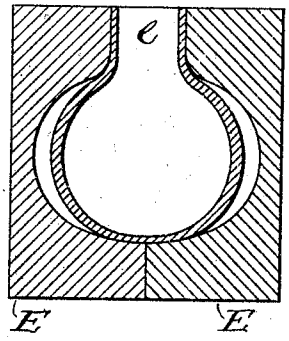


Fig. 5.

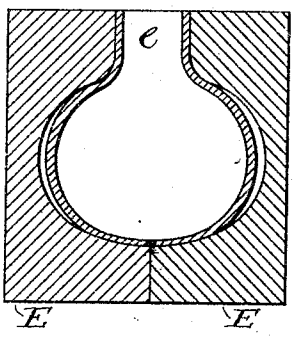


Fig. 6.

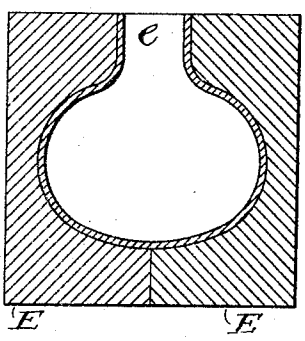


Fig. 7.

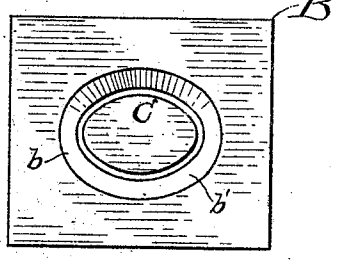


Fig. 8.

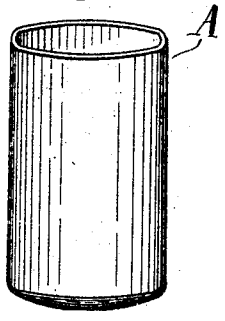
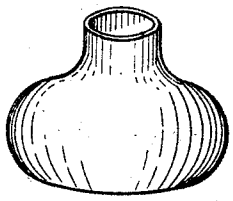


Fig. 9.



WITNESSES:

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BEST AVAILABLE COPY

UNITED STATES PATENT OFFICE.

JOHN H. GAULT, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE INTERNATIONAL SILVER COMPANY, A CORPORATION OF NEW JERSEY.

FORMING SEAMLESS METALLIC HOLLOW VESSELS.

No. 857,616. Specification of Letters Patent. Patented June 25, 1907.

Application filed September 17, 1904. Serial No. 224,861.

To all whom it may concern:

Be it known that I, JOHN H. GAULT, a citizen of the United States, residing at Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented a new and useful Improvement in Methods of Forming Seamless Metallic Hollow Vessels, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

The object of my invention is to produce a unitary metallic hollow vessel having contracted and expanded portions.

I will first describe my improved method. Speaking generally, I first form a hollow blank and then contract one portion thereof and then expand the remainder or a portion thereof.

In the drawings illustrating my method and article, Figure 1 is a sectional view of a blank and a die, also central supporting cylinder. Fig. 2 is a sectional view showing a step in the contracting operation. Fig. 3 shows another step in the contracting operation. Fig. 4 is a sectional view showing the blank in the mold and one step in expansion of blank. Fig. 5 shows another step in the expanding of blank. Fig. 6 shows the final expanding. Fig. 7 shows a plan view of the reducing die and central cylinder. Fig. 8 shows a blank ready for treatment. Fig. 9 shows a finished vessel made from the blank.

I form a hollow blank *a*, Fig. 8, in the ordinary and well known manner, from a sheet of metal. One portion of this blank is thicker than the other portion. One end of this blank, the end to be contracted, the end in which the metal is thinner, is then forced successively through the dies B, B′, B².

In Figs. 1, 2, and 3, C is a cylinder of width or diameter substantially equal to the space between the walls of the die, less the thickness of the metal to be treated, at the point of maximum desired contraction in any one die. By successive actions, I form a contracted portion D with the desired amount of contraction. The partially formed vessel is then surrounded by the two part mold E, having the contracted portion *e* of width substantially equal to the width of the contracted portion D of the vessel and with an enlarged portion of the desired shape of the expanded portion of the vessel. After the mold sections are securely locked together with the partially formed vessel between them an expander is forced against the inner wall of the partially formed vessel, partially expanding it. As this expander acts upon that portion of the blank which, as stated before, is of greater thickness than the remainder of the blank, the metal will better resist stretch under the expanding action and if stretch does occur there will not be a reduction of the thickness of the metal at that point beyond that of the remainder of the vessel. After this treatment of the partially formed vessel, it is removed from the mold, the metal treated and the vessel again replaced in the mold and the last action repeated. This action and treatment is repeated successively until the expanding action is sufficient to cause the metal at the point where the expanding action takes place to conform to the walls of the mold. In Figs. 4, 5, and 6, these successive actions are shown. The difference in thickness between the two portions of the blank, as before described, is but slight. In practice, I have found a thickness for the thinnest part of the blank of .040 and for the thicker part of the blank of .047 to be good working thicknesses. It is impossible to show this slight difference in thickness without exaggeration in the drawing and in the drawings I have shown this as exaggerated.

Metallic articles of the shape shown, comprising enlarged and contracted portions can readily be made, by my method, in a unitary structure as, by the successive actions of first contracting one portion and then expanding the other portion, the desired action upon the metal may be obtained without stretching the metal. Further, by using the cylinder C, I support the vessel at the point of contraction both within and without.

I do not limit myself either to the production of the specific article shown in Fig. 9, nor do I intend to limit my method to the production of such a specific article.

Having now fully described my invention, what I claim and desire to protect by Letters Patent is—

1. The hereinbefore described method of forming a seamless hollow unitary metallic vessel, having a portion of greater and a portion of lesser cross section, which consists in first forming a hollow blank, then reducing

the cross section of one portion only, and then expanding, in cross section, by internal action, a part or the whole of the remainder of the blank.

2. The hereinbefore described method of forming a seamless hollow unitary metallic vessel, having a contracted and an expanded portion, which consists in first forming a hollow blank, then forcing said blank at the open end partially through a die to contract it and supporting the interior of said blank, during said action, at the portion to be contracted, then expanding a part or the whole of the remainder of the blank.

3. The hereinbefore described method of forming a vessel of the character described, which consists in first forming a hollow blank, then contracting a portion only of said blank, then surrounding said blank by a mold, one portion of which conforms to the contracted portion of the blank, and the other portion of which is larger than the remainder of the blank and expanding said last mentioned portion of the blank.

4. The hereinbefore described method, which consists in forming a hollow metallic blank, the metal at one portion being thicker than the remainder of the blank and expanding in cross section the whole or a part of the portion of the blank having the thicker metal.

5. The hereinbefore described method which consists in forming a metallic blank, the metal at one portion being thicker than the remainder of the blank and expanding in cross section the whole or a part of the portion of the blank having the thicker metal.

6. The hereinbefore described method of forming a seamless hollow unitary metallic vessel, having a neck portion and a body portion, which consists in first forming a hollow blank of uniform cross-section in both that part thereof corresponding to the neck, and that part thereof corresponding to the body, of the vessel to be formed, then applying external reducing pressure to that part only of the blank corresponding to the neck of the vessel to be formed, thereby forming a partly shaped blank having a body portion of uniform cross-section and a neck portion also of uniform cross-section, but of smaller diameter, and then expanding, in cross-section, by internal pressure, the body portion.

7. The hereinbefore described method of forming a seamless hollow unitary metallic vessel, having a neck portion and a body portion, which consists in first forming a hollow blank, then drawing a part only thereof through a reducing die for a distance substantially exceeding the depth of the die and simultaneously supporting the part subjected to the reducing action and then expanding, in cross-section, by internal action, a part or the whole of the remainder of the blank.

8. The hereinbefore described method of forming a seamless hollow unitary metallic vessel, having a neck portion and a body portion, which consists in first forming a hollow blank, then drawing a part only of the blank through a plurality of dies of successively decreasing diameters, and then expanding, in cross section, by internal action, a part or the whole of that part of the blank which has not been subjected to the reducing action.

9. The hereinbefore described method of forming a seamless hollow unitary metallic vessel, having a neck portion and a body portion, which consists in first forming a hollow blank of uniform cross-section in both that part thereof corresponding to the neck, and that part thereof corresponding to the body, of the vessel to be formed, then drawing a part only of the blank through a plurality of dies of successively decreasing diameters, thereby forming a blank having a body portion of uniform cross-section and a cylindrical neck portion of uniform but smaller cross-section, and then expanding, in cross-section, by internal action, the body portion of the blank.

In testimony of which invention, I have hereunto set my hand, at Philadelphia, on this eighth day of September, 1904.

JOHN H. GAULT.

Witnesses:
M. M. HAMILTON,
W. I. RUTTER, Jr.