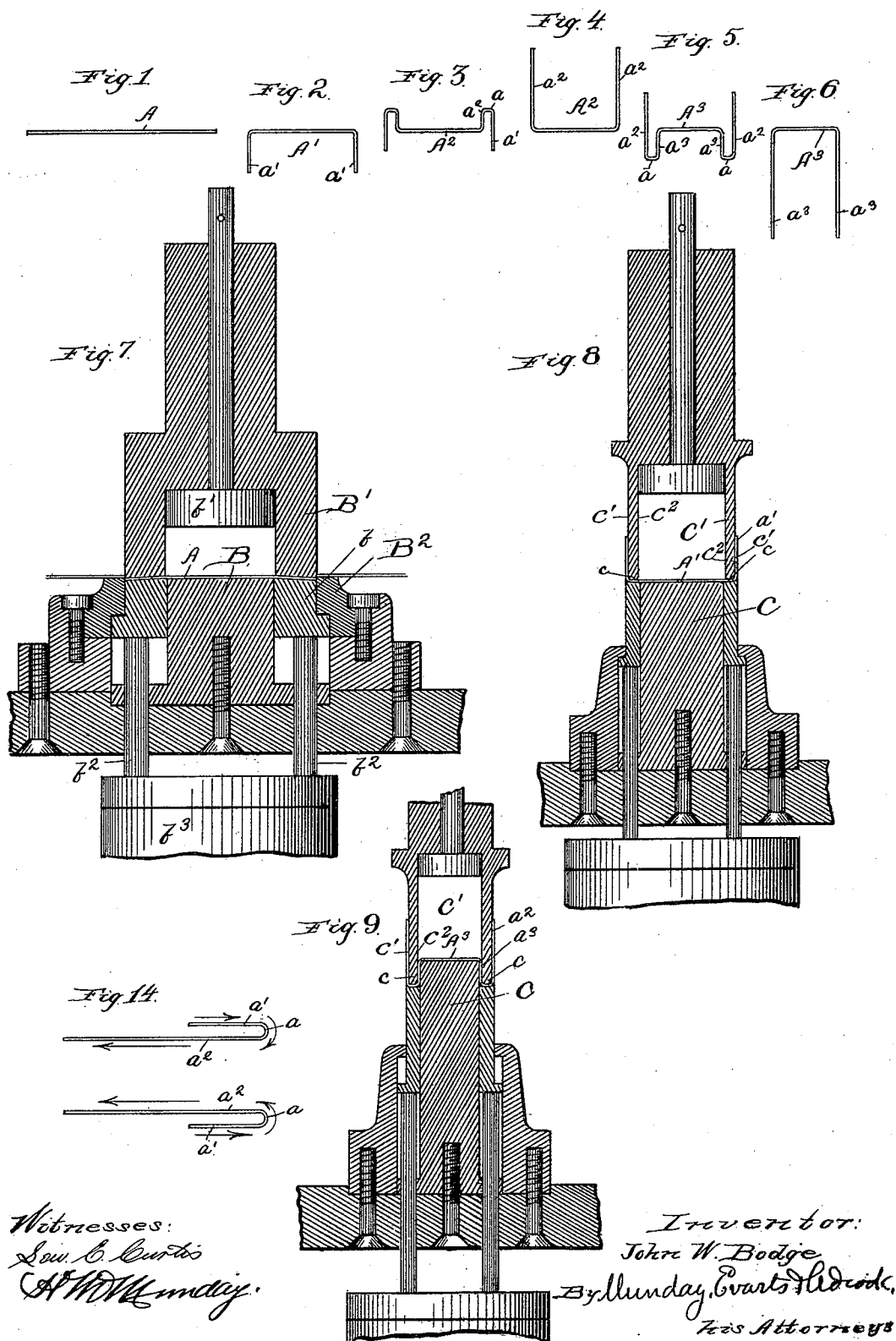


J. W. BODGE.
DIE FOR DRAWING SHEET METAL.

No. 460,551.

Patented Oct. 6, 1891.



Witnesses:
Law. C. Curtis
H. M. Munday.

Inventor:
John W. Bodge
By Munday, Curtis & Mudge,
His Attorneys

J. W. BODGE.
DIE FOR DRAWING SHEET METAL.

No. 460,551.

Patented Oct. 6, 1891.

Fig. 10

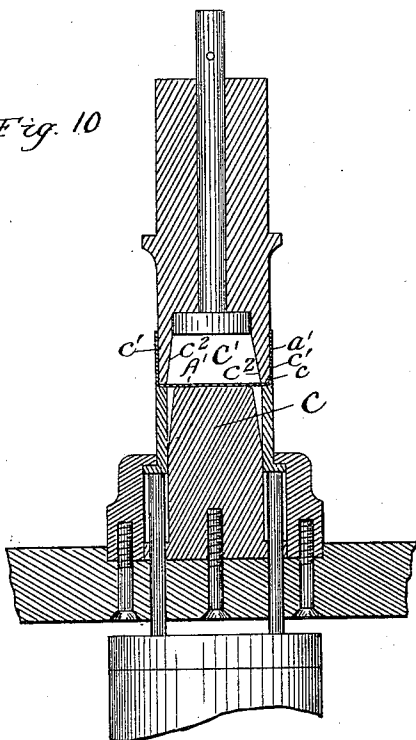


Fig. 12

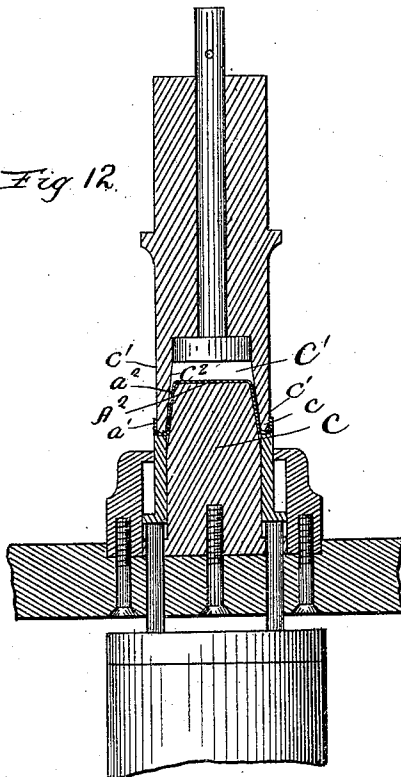


Fig. 11

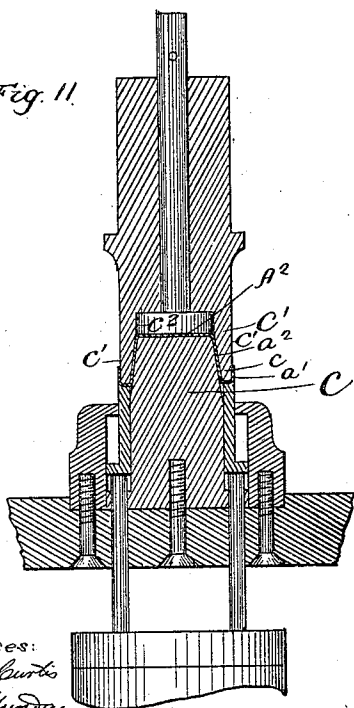
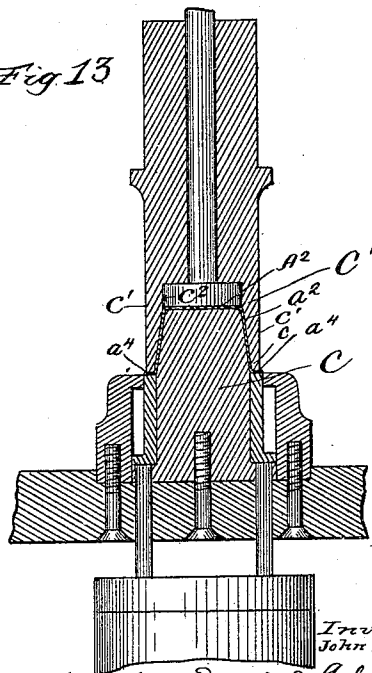


Fig. 13



Witnesses:
Lew. B. Curtis
H. W. Munday

Inventor
John W. Bodge
By Munday, Curtis & Adcock
His Attorneys

UNITED STATES PATENT OFFICE.

JOHN W. BODGE, OF CHICAGO, ILLINOIS, ASSIGNOR TO OLIVER W. NORTON,
OF SAME PLACE, AND EDWIN NORTON, OF MAYWOOD, ILLINOIS.

DIE FOR DRAWING SHEET METAL.

SPECIFICATION forming part of Letters Patent No. 460,551, dated October 6, 1891.

Application filed December 27, 1890. Serial No. 375,935. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. BODGE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Dies for Drawing Sheet Metal, of which the following is a specification.

My invention relates to improvements in dies for drawing or stamping sheet metal into cylindrical, cup, or disk shape forms.

Heretofore great difficulty has been experienced in drawing tin-plate or other metal sheets into cylindrical or cup shaped articles of any considerable depth or length. Heretofore this has been done by drawing the sheet metal entirely in one and the same direction by suitable drawing-dies constructed for the purpose, several sets of dies, each successively smaller than the preceding set, being employed to produce articles of any particular depth or length. In this old method of drawing there is great liability to stretch and crack or break the stock, and thus produce defective articles. The percentage of loss from this source is so great that it is customary to select the best, softest, and heaviest stock for the purpose, and even then there is always a large percentage of failures where the articles to be drawn have any considerable depth or length.

The object of my invention is to provide dies for drawing sheet metal into cylindrical shape, cup shape, disk shape, or other forms by means of which the work may be easily, successfully, and rapidly done without danger of cracking or breaking the stock, and thus producing defective articles.

I have discovered that tin-plate or other sheet metal may be readily and cheaply drawn into cylindrical or cup shape forms without danger of cracking or breaking the stock by drawing it successively in different directions—that is to say, I first draw the plain sheet into a shallow cup or disk shape in one direction, and I then turn this shallow cup inside out by drawing it in the opposite direction into a deeper cup of smaller diameter, which may be again turned inside out by drawing in the reverse direction, and thus produce a cup or vessel of still greater depth and still smaller diameter. By successively

reversing the direction in which the drawing is done, thus successively turning the vessel inside out, the sheet metal may be easily and successfully drawn into cylinders or cones of any suitable or desired depth or length and without danger of breaking or cracking the stock at any point. The means which I employ to thus reverse the direction of the drawing and turn the vessel first drawn inside out consists, in connection with a punch or male die of the required form to fit inside the smaller tube to be produced, of an annular die operating in conjunction with said punch, the exterior periphery of this annular die fitting inside the tube or vessel which is to be drawn into the smaller tube by turning it inside out. The punch operating in conjunction with this annular die thus causes the stock to flow, turn, or be drawn around the annular shoulder of the annular die. In other words, the stock flows from the outer periphery of the annular die to the inner periphery thereof, the outside tube fitting on the outside of the annular die, while the inside tube produced fits against the inner periphery or wall of the annular die. By this means the drawing operation is much facilitated, as the stock seems to naturally flow or curve around the annular corner which unites the outside large tube with the inside small tube in the process of drawing the large tube into the small tube. The tendency also seems to be to compact the metal upon itself and rather to close the pores in the metal than to separate the same and produce flaws or cracks therein.

In the accompanying drawings, which form a part of this specification, I have shown at Figures 1, 2, 3, 4, 5, and 6 a disk of tin-plate in several successive stages of being drawn into a cylindrical-shaped cup. The cutting of the disk shown in Fig. 1 and the drawing of it into the form shown in Fig. 2 are performed by the ordinary drawing and cutting dies now in use. To render the nature of my improvement in drawing-dies more clearly understood, I have shown at Fig. 7 a sectional view of these old drawing and cutting dies. Figs. 8 and 9 are sectional views of my improved drawing-dies, the same being represented in different positions and of different sizes, the

size shown in Fig. 8 being that used to draw the cup shown in Fig. 2 into the form shown in Fig. 4, and the size shown in Fig. 9 being that used to draw the cup shown in Fig. 4 into that shown in Fig. 6. Figs. 10, 11, 12, and 13 show the form of my improved dies which I use for drawing conical-shaped articles. Fig. 14 is a sectional view illustrating the operation of drawing a larger tube into a smaller tube.

In the drawings, A represents a blank of sheet metal—for example, tin-plate.

A' represents a shallow cup as produced by the ordinary drawing and cutting dies B, B', and B² now commonly in use. The drawing and cutting dies B B' B² have the usual follower or presser ring *b* and ejector *b'*. The follower-ring *b* is supported in the usual manner by pins *b*² on a rubber or other spring *b*³. After the shallow cup A' is formed in the usual way by the use of these old dies or other instrumentality it is ready for operation upon my new drawing-dies, which operate to reverse this cup A' or turn it inside out and draw it in the opposite direction into the deeper vessel A², of smaller diameter.

My new reversing drawing-dies consist of a punch or male die C and an annular female die C'. The exterior diameter of the annular die C' corresponds to the interior diameter of the shallow cup A', which is to be reversed or turned inside out, and the interior diameter of the annular die C' corresponds to the exterior diameter of the smaller cup or vessel A², so that the cylindrical side or wall *a'* of the larger vessel may flow or turn around the edge or face *c* of this annular die C', and thus unite with and form the cylindrical side or wall *a*² of the smaller and deeper cup A², produced by these dies. This operation is illustrated in Fig. 3, and also in the sectional view of the dies, Figs. 8, 9, 10, 11, 12, and 13.

The reversing-dies C C', which operate to turn a vessel previously drawn inside out, and thus produce a deeper vessel of smaller diameter, are provided with the customary follower or presser ring C², which is supported in the usual way upon pins C³, form a rubber or other spring C⁴. The dies C C' are also furnished with the usual ejector or plunger C⁵. The dies are operated in a press of any suitable form or construction known to those skilled in the art, just the same as ordinary dies, and I have not therefore thought it necessary to herein show or describe the press, as the press forms no part of my present improvement. My dies C C' may be applied to any press.

The operation illustrated in Fig. 3, and which is performed by the reversing-dies C C', may be indefinitely repeated by duplicate sets of dies C C', of smaller and smaller diameter. In Fig. 9 I have shown one such duplicate set of dies of smaller diameter, the same operating to reverse the cup A², (shown in Fig. 4,) and by turning it inside out draw

it into the smaller cup. (Shown in Fig. 6.)

This smaller cup is represented in the drawings at A³ and its cylindrical side or wall at *a*³.

In the act of turning, flowing, or drawing the larger outside tube or vessel into the smaller inside tube or vessel an annular curved shoulder *a* is formed between the two tubes *a'* and *a*² or *a*² and *a*³, and which unites the two tubes, and it is at this point that the work is done. Owing to the pulling or drawing of the two tubes *a'* *a*² in opposite directions, as is clearly illustrated in the diagram view, Fig. 14, and owing, also, to the curved annular shoulder *a*, uniting the larger and smaller tubes, it will readily be understood by those skilled in the art that the operation is a peculiarly easy and natural one, requiring a comparatively small amount of force and tending rather to compact the metal and close its pores than to crack or break or injure it. In curving or drawing the larger tube into the smaller one the curved shoulder *a* between the two tubes seems to act in the nature of a leverage, and thus to facilitate or render easy the drawing operation. In the act of drawing the larger tube into the smaller one, the outside periphery of the annular drawing tool or die C' serves to support the stock of the larger tube, which fits upon it, and to keep it smooth and cause it to flow or draw in proper lines. The annular shoulder or face *c* of the annular die C' is or should be made curved or rounded to facilitate the turning of the stock around it. This rounded shoulder *c* also serves to support and guide the stock in the act of flowing or drawing from the larger tube into the smaller one.

In Figs. 10, 11, 12, and 13 the invention is illustrated as applied to the drawing of conical or flaring vessels, the same being also left with a horizontal flange *a'*, as shown in Fig. 13. The dies used in these figures only differ from those shown in Figs. 8 and 9 by being made conical. Figs. 10 and 11 show the same pair of dies in different positions. Those shown in Figs. 12 and 13 are the same, excepting that the interior diameter of the hollow conical die and also its punch are somewhat smaller than those shown in Figs. 10 and 11. The use of two separate pairs of dies, where the dies are conical, to draw the cup shown in Fig. 10 into the shape shown in Fig. 13 is simply to better support the stock. If the small die shown in Figs. 12 and 13 were applied directly to the cylindrical cup shown in Fig. 10, there would be too much space left between the small end of the conical punch and the larger interior diameter of the hollow conical annular die to do the best work. For this reason I employ two sets of dies for performing one operation where the articles to be drawn have any considerable flare.

The die C', I call an "annular die," as both its outside periphery or wall *c'* and its inside periphery or wall *c*² are operative and serve to guide and support the flowing, turning, or

drawing of the metal, as does also the annular shoulder or end *c* of this die. In ordinary dies heretofore in use only the end and inner periphery of the die are operative—as shown, for example, in Fig. 7.

I claim—

1. The sheet-metal-drawing dies for turning a vessel or shape inside out and drawing it into a vessel or shape of smaller diameter, consisting of a punch or male die *C* and an annular die *C'*, upon the outer periphery of which the vessel to be reversed or turned inside out fits, substantially as specified.

2. The sheet-metal-drawing dies for turning a vessel or shape inside out and drawing it into a vessel or shape of smaller diameter, consisting of a punch or male die *C* and an

annular die *C'*, upon the outer periphery of which the vessel to be reversed or turned inside out fits, said annular die *C'* having a rounded edge or shoulder *c*, substantially as specified.

3. The sheet-metal-drawing dies for turning a vessel or shape inside out and drawing it into a vessel or shape of smaller diameter, consisting of a punch or male die *C* and an annular die *C'*, upon the outer periphery of which the vessel to be reversed fits, and a follower or presser *C²*, substantially as specified.

JOHN W. BODGE.

Witnesses:

W. C. TOLES,
H. N. NORTON.