H. W. AVERY & W. S. JUDD.

METHOD OF FORMING BILGE BARRELS.

APPLICATION FILED JULY 27, 1912.

1,216,396.

Patented Feb. 20, 1917.

2 SHEETS—SHEET 1.

Fig. 1.

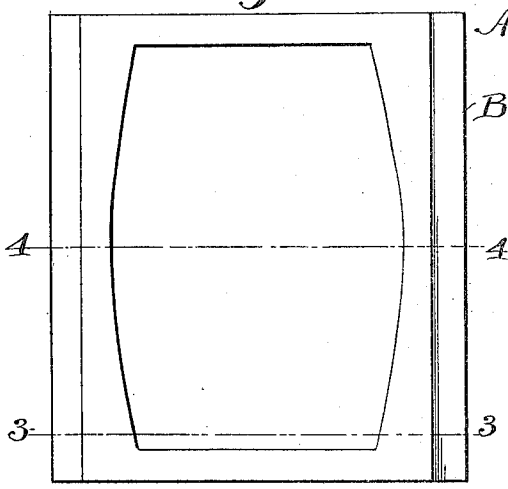



Fig. 5.

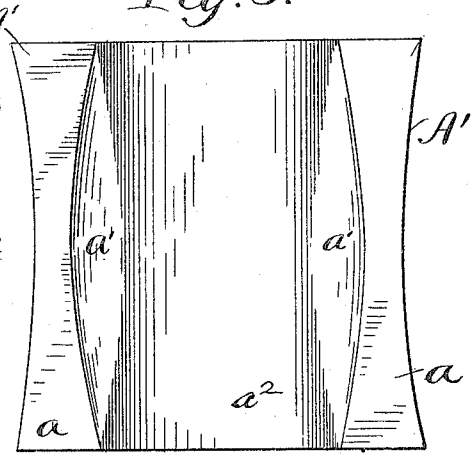



Fig. 2.

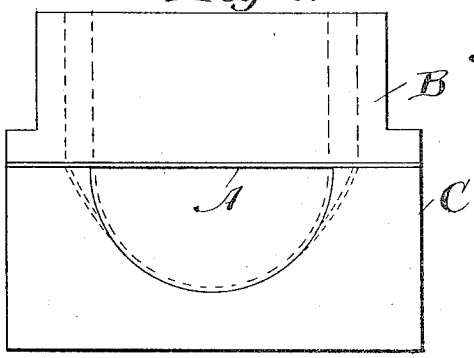



Fig. 6.




Fig. 7.

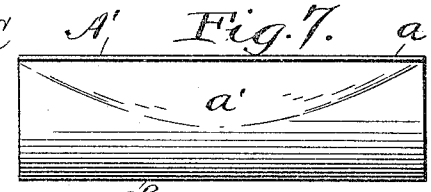



Fig. 3.

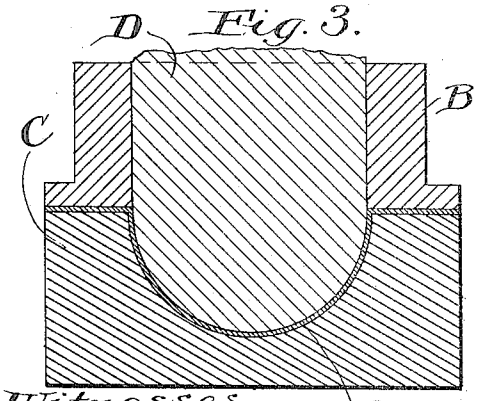
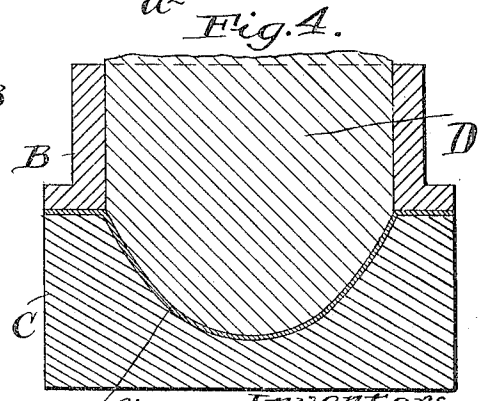



Fig. 4.




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2 SHEETS—SHEET 2.

Fig. 8.

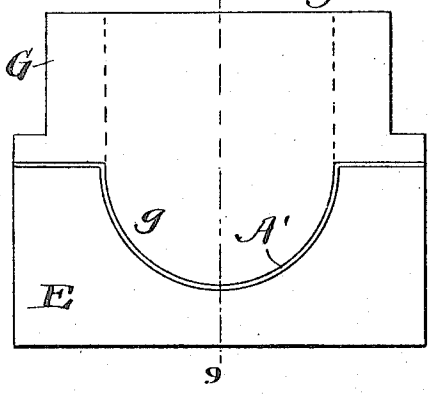



Fig. 9.

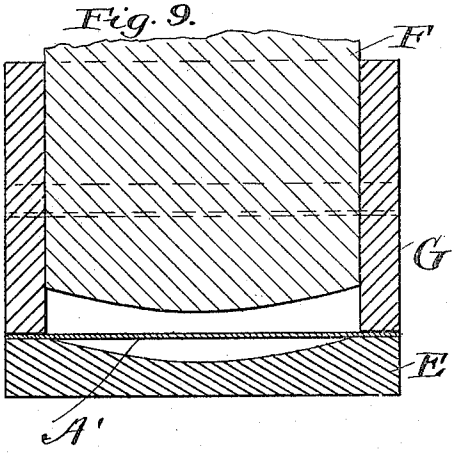



Fig. 11.

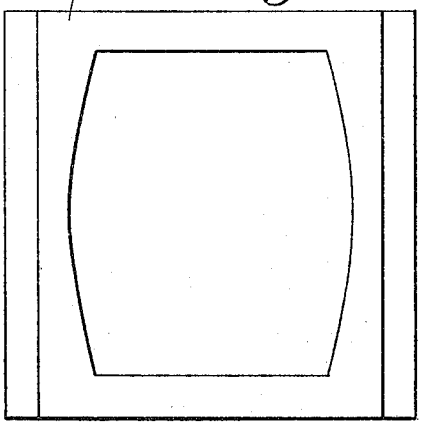



Fig. 10.

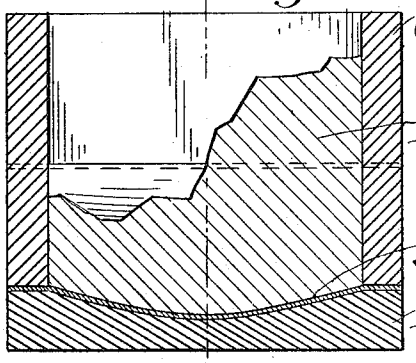



Fig. 13.

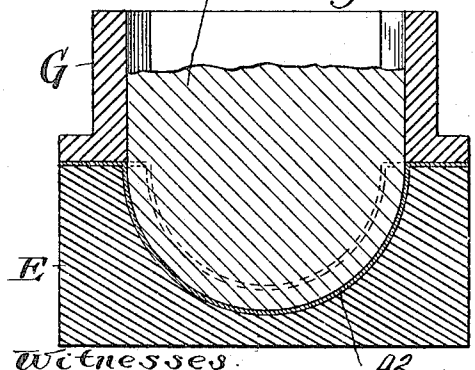



Fig. 12.

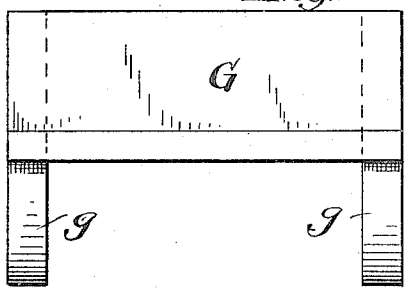



Fig. 14.




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# UNITED STATES PATENT OFFICE.

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## METHOD OF FORMING BILGE-BARRELS.

1,216,396. Specification of Letters Patent. Patented Feb. 20, 1917.

Application filed July 27, 1912. Serial No. 711,800.

*To all whom it may concern:*

Be it known that we, HENRY W. AVERY and WALLACE S. JUDD, citizens of the United States, and residents of Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Methods of Forming Bilge-Barrels, of which the following is a full, clear, and exact description.

This invention relates to a method of forming from sheet metal, bilge barrels and especially bilge barrel sections which when united along their longitudinal edges form the barrel body.

In the manufacture of metal bilge barrels of the general type shown in our Patent No. 972,797, issued October 18th, 1910, difficulty is encountered in drawing the bilge in the barrel section when known metal working processes are employed, by reason of the tendency for the sheet metal to wrinkle or buckle between the transverse center line of the section, and the two ends. The wrinkling of the metal which occurs when the bilge in the barrel section is formed with one set of dies or by one drawing or shaping operation is due chiefly to the fact that with this most obvious manner of bilge drawing, there is no way of holding the metal along its end edges, as well as along its side edges, for as is understood during the process of shaping the sheet into the form of a half bilge barrel, the end edges are changed from straight to semi-circular contour.

The chief object of our present invention is to provide a process of drawing or forming a bilge in a barrel section in a manner such that the barrel section with this bilge is formed in a very satisfactory manner, inexpensively, and without any wrinkling of the metal.

The above object is accomplished very effectively by our improved method, which in one aspect consists in drawing the metal into the shape of a section of a bilge barrel, not with a single set of dies or in one metal drawing operation, but in a plurality of steps or drawing operations.

Preferably the barrel section with its bilge is formed with two sets of dies and with two drawing operations, in the first of which the sheet of metal is held along its longitudinal edges, and the metal is formed into substantially semi-cylindrical shape, while at the same time a bilge is imparted to substantially one half of the section, or to portions adjacent the longitudinal edges.

In the second operation, the now substantially semi-cylindrical end edges are held or clamped, and the bilge is formed in the remaining portion between the bilges imparted to the side portions by the first operation. By this process, we are enabled to produce a barrel section of uniform thickness, without the formation of wrinkles as the metal is drawn in forming the bilge.

Our invention may be further briefly summarized as consisting in certain novel steps of an improved method which will be described more fully hereinafter, and set forth in the appended claims.

In the accompanying sheets of drawings wherein we have illustrated in as simple a form as possible the apparatus in which the steps of our method can be carried out successfully, and in the manner preferred by us, Figure 1 is a top plan view of a blank holder, between which and the female die employed in the first step of the method, the blank is clamped or held along its longitudinal edges; Fig. 2 is an end view of the blank holder shown in Fig. 1, and an end elevation of the female die of the set of dies employed in the first step of the method,—this view showing the flat sheet in position for the first drawing operation; Fig. 3 is a sectional view of the same and showing in addition, the male die, the parts being in the position they occupy at the completion of the first step of the process, and the section being taken, substantially along the line 3—3 of Fig. 1; Fig. 4 is a sectional view of the same taken substantially along the line 4—4 of Fig. 1; Fig. 5 is a top plan view of the partially completed half barrel section, after the first step of the shaping or drawing process; Fig. 6 is an end view of the same; Fig. 7 is a side elevation of the same; Fig. 8 is an end view of the female die and of the blank holder employed in the second step of the process, or in the step wherein the bilge is completed; Fig. 9 is a longitudinal sectional view substantially along the line 9—9 of Fig. 8, this view showing also the male die of the second set inserted in the blank holder, and in a position it occupies just prior to the second metal drawing operation; Fig. 10 is a similar view after the male die shown in Fig. 9 has completed its downward stroke, and has

completed the formation of the bilge; Fig. 11 is a top plan view of the blank holder shown in Figs. 8, 9 and 10; Fig. 12 is a side view of the same; Fig. 13 is a transverse sectional view substantially along the line 13—13 of Fig. 10; and Fig. 14 is an end view of the half barrel section after the bilge has been completed.

The bilge barrel section is formed from a flat sheet of metal A, which during the first step of the process is held along its longitudinal edges between a blank holder B and a female die C, with which there coöperates a male die D. The male and female dies have complementary portions so shaped as to "break down the metal" and to partially form the bilge. The bottom portion of the cavity of the female die and the lower portion of the male die are portions of two cylinders, but along the sides of the female die and of the corresponding portions of the male die, the two dies bulge outwardly so as to conform to the full curve of the bilge which is to be given to the barrel section. By reference particularly to Figs. 2, 3 and 4, it will be seen that the two dies are the widest at the transverse center plane through the dies, and from the center gradually taper toward the ends, where the corresponding portions of the two dies are narrowest. However, the depth of the concavity in the female die is the same from one end of the die to the other.

As a result of this die construction, the flat blank is changed to the shape shown particularly in Figs. 5, 6 and 7, wherein the partially formed barrel section is designated A′. It will be seen that this partially formed barrel section has outwardly projecting flat flanges $a$ at its longitudinal edges, bilge portions $a'$ adjacent such edges, and a bottom portion $a^2$ (as the section is viewed in Figs. 5, 6 and 7) which is cylindrical in formation, the blank or partially formed barrel section being at its ends bent in the form of a true semi-circle (disregarding the outwardly extending flanges), and being straight along the bottom, which as before stated, is not bilged in this step of the process. Preferably, substantially one half of the bilge of the barrel section is formed in this step of the process. That is to say, the bilge portions $a'$ at the center of a section extend circumferentially about 45° as is evident from Fig. 6.

It may be said before passing on to the description of the next set of dies and the next step, that the blank holder B which clamps the longitudinal edge portions of the blank A onto the top side edge portions of the female die C also serves as a guide for the male die D, as is apparent from Figs. 3 and 4.

For the second step of the process, there are employed a female die E, a complementary male die F, and a blank holder G. The side edges or flanges $a$ of the blank partially formed barrel section A′ are clamped between the side portions of the blank holder G, and the side top portions of the female die E. This blank holder also has semi-circular end flanges $g$ which extend down into the recess or concavity of the female die E so as to clamp the semi-circular ends of the partially completed blank against the correspondingly shaped ends of the female die or to hold said end edge portions during the second shaping or metal drawing step of the process.

The complementary portions of the dies E and F have their sides or side portions formed similarly to the complementary side portions of the dies C and D. That is to say, with their sides curved or bulged outwardly in conformity with the curve of the bilge. In addition, the complementary bottom portions of the dies E and G are curved in conformity with the curve of the bilge. In other words, the male and female dies E and G have substantially the shape of the half barrel or of the barrel section.

When the blank is placed between the female die and the blank holder, and the male die is given its downward stroke, there is formed the completed half bilge barrel section $A^2$ shown in Fig. 14. This barrel section has the same flanges $a$ along its longitudinal edges, but has a bilge portion $a^3$, which extends from end to end, and from flange to flange. By following out this method, we find that the bilge in the half barrel section is properly formed without wrinkling. Furthermore, the metal is so drawn in forming the bilge that the barrel section is of substantially uniform thickness at all points.

To complete the barrel, two of the barrel sections are united along their longitudinal edges, and then the heads are fitted and secured to the ends of the body thus formed. The two half-barrel sections may be united by folding the overlapping flanges in the form of double seams, substantially as shown in our prior patent above referred to. We may, however, trim off the major portion of the flanges, so that when the two half sections are fitted together, merely short flanges,—say about $\frac{1}{8}$ to $\frac{1}{4}$ of an inch—will extend outwardly beyond the barrel body. Then by means of the intense heat of an acetylene or oxy-acetylene torch, the two sections will be fused together, and the outwardly extending flanges will be burned off, leaving the fused or welded parts substantially flush with the surface of the other portions of the body. Thus we are enabled to obtain a butt weld without the necessity of employing additional metal placed at the point to be fused for the purpose of joining the abutting parts. For barrels designed for certain purposes,

this method is preferable to the method of uniting the sections by folding the outwardly projecting flanges in the form of a double seam.

Having thus described our invention, what we claim is:

1. The method of forming a half section of a bilge barrel from a flat sheet of metal, which consists in drawing the main portion of the sheet into substantially semi-cylindrical formation and simultaneously imparting a bilge to portions of the sheet along the side edges by one operation, and by a subsequent operation drawing the bilge in the intermediate portion.

2. The method of forming a section of a bilge barrel from a flat sheet of metal, which consists in holding the sheet along two opposite edges and by one operation drawing a bilge in the portions adjacent said edges, and then in holding the sheet along the other two opposite edges and by a second operation drawing a bilge in the portion between the bilge portions formed by the first operation.

3. The method of forming a bilge-barrel half-section from a flat sheet of metal, which consists in holding the sheet along its longitudinal edges, and in one operation drawing the sheet in substantially semi-cylindrical shape and simultaneously imparting a bilge to the portions adjacent the longitudinal edges, and then holding the sheet along its end edges, and by a subsequent operation drawing a bilge in the portion between the first-mentioned bilge portions.

In testimony whereof, we hereunto affix our signatures in the presence of two witnesses.

HENRY W. AVERY.
WALLACE S. JUDD.

Witnesses:
A. J. HUDSON,
A. F. KWIS.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."