May 9, 1944. D. W. THOMAS 2,348,663

METHOD OF FORMING SHEET METAL ARTICLES

Filed Sept. 19, 1940 2 Sheets-Sheet 1

Fig. 1.

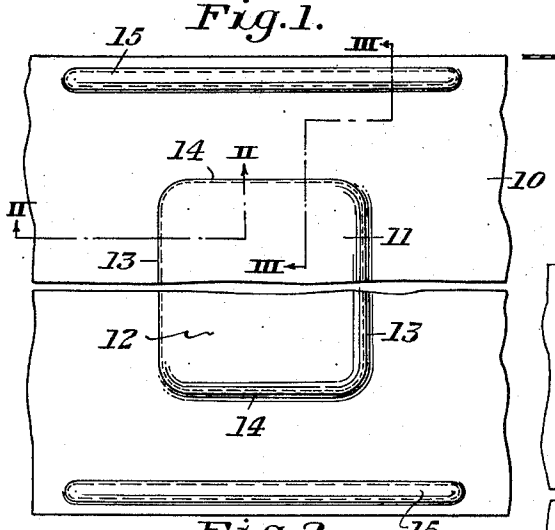


Fig. 2.

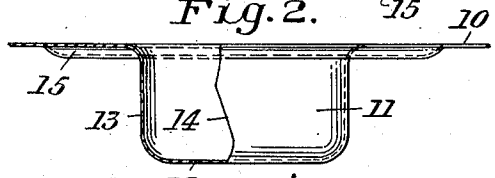


Fig. 3.

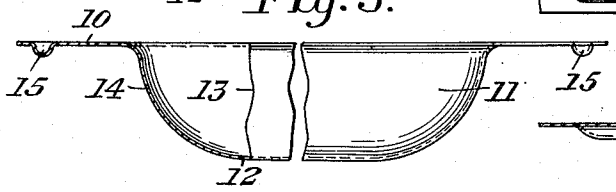


Fig. 4.

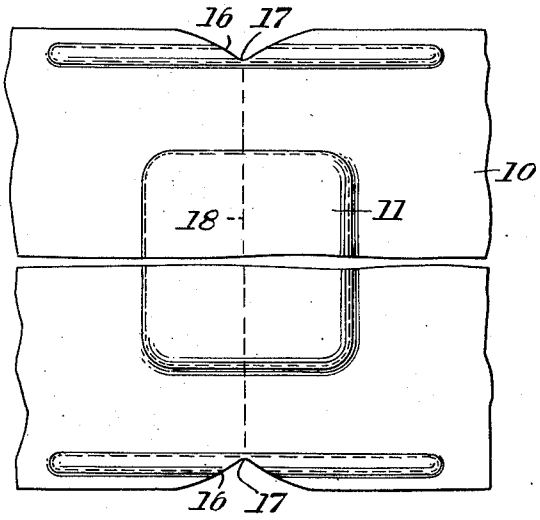


Fig. 5.

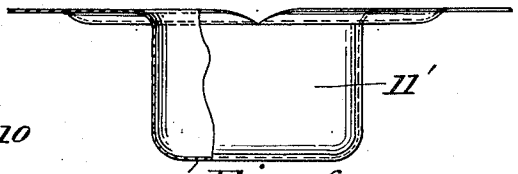


Fig. 6.

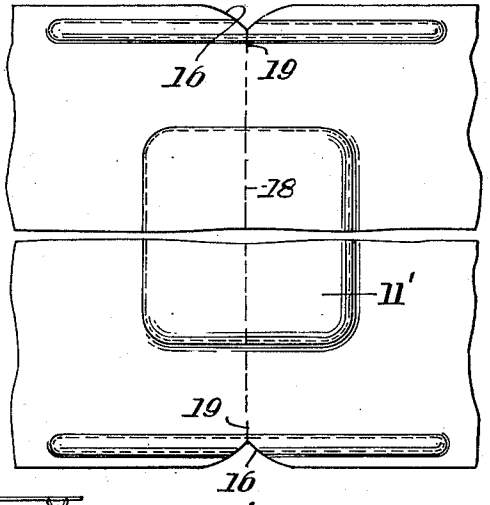
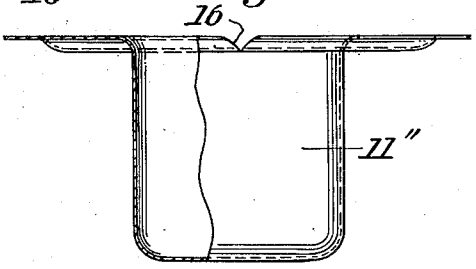


Fig. 7.



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METHOD OF FORMING SHEET METAL ARTICLES

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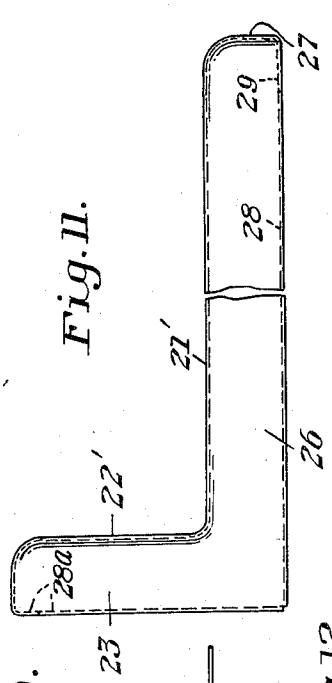


Fig. 11.

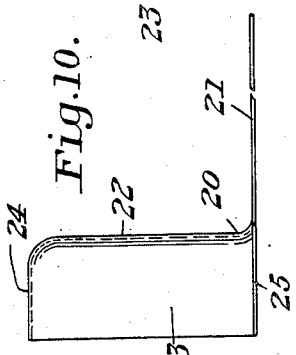


Fig. 10.

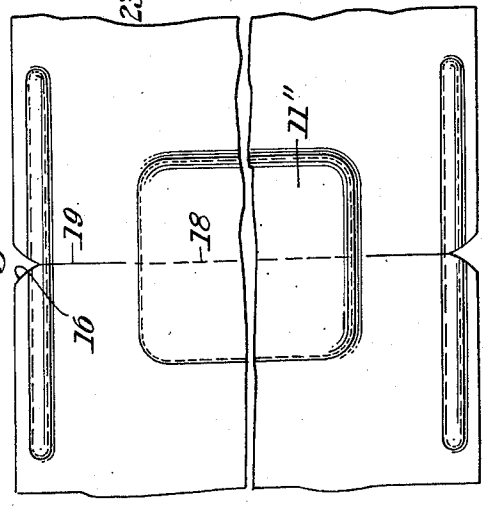


Fig. 8.

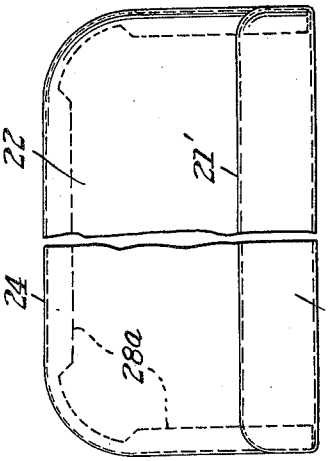


Fig. 13.

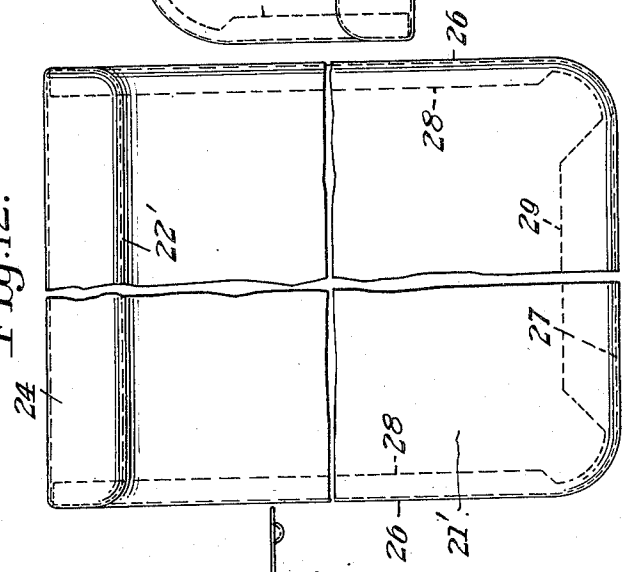


Fig. 12.

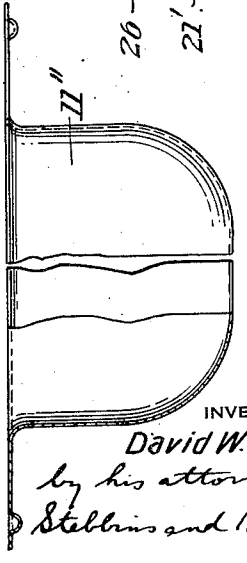


Fig. 9.

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Patented May 9, 1944 2,348,663

UNITED STATES PATENT OFFICE

2,348,663

METHOD OF FORMING SHEET METAL ARTICLES

David W. Thomas, Youngstown, Ohio, assignor to The Youngstown Metal Products Company, Youngstown, Ohio, a corporation of Ohio

Application September 19, 1940, Serial No. 357,375

3 Claims. (Cl. 113—116)

This invention relates to the manufacture of sheet metal articles and particularly to articles made by deep drawing. More specifically, the invention concerns the manufacture of articles such as stove tops, sinks, or the like, having angularly disposed portions, e. g., a horizontal working surface and a back at right angles thereto.

Sheet metal articles of the character specified have been made heretofore by drawing a sheet to form the back and working surface in a common plane, with continuous flanges bent downwardly therefrom, and subsequently bending the back up to the proper angular position relative to the supporting surface. It has been impossible, however, to prevent buckling or tearing of the flanges adjacent the line of bend between the back and the work support and it has, therefore, been the practice to slit the flanges adjacent the line of bend and to fill in the resulting notches with patch pieces as disclosed in Corrigan Patent 1,635,311. The welding on of such patch pieces increases the cost of the articles but a more serious objection is that the welded joints are very difficult to enamel satisfactorily.

I have invented a novel method of making articles of the type mentioned without the necessity of opening up notches in the flanges which have to be filled in subsequently with patch pieces. The invention also contemplates a novel method of preparing metal blanks for unusually deep draws, in such manner as to eliminate buckling or tearing of the sheet and to permit smooth flow of the latter over the forming die. In a preferred practice of the invention, I subject a sheet to successive deep-drawing operations to provide a raised portion thereon adapted to form the back of the finished article, and having side and top flanges. I then bend the side edges of the sheet to form flanges along the portion thereof which is to constitute the working surface, which flanges are substantially coplanar with the side flanges of the raised portions. I prefer to draw a pair of stove top blanks, for example, from a single sheet by forming a well substantially centrally thereof. Between successive drawing operations, I form wide V notches with rounded bottoms adjacent the plane along which the two blanks simultaneously formed are eventually severed. This facilitates flow of the metal as the drawing proceeds without buckling or tearing. At the same time, the slits remaining after the drawing operations are in the plane of severance and do not, therefore, appear in the finished articles.

The several stages of the preferred practice outlined above are illustrated in the accompanying drawings, as well as the finished appearance of one form of article, a stove top, for the manufacture of which the method is particularly adapted.

In the drawings,

Fig. 1 is a bottom plan view of a metal sheet after an initial deep-drawing operation has been performed thereon;

Fig. 2 is a view thereof partly in side elevation and partly in section along the plane of line II—II of Fig. 1;

Fig. 3 is an end elevation partly in section along the plane of line III—III of Fig. 1;

Fig. 4 is a view similar to Fig. 1 showing notches formed in the side edges of the sheet to facilitate further drawing thereof;

Fig. 5 is a view similar to Fig. 2 showing the appearance of the sheet after a further deep-drawing operation;

Fig. 6 is a bottom plan view of the sheet as shown in Fig. 5;

Fig. 7 is a view similar to Fig. 2 showing the sheet after a further deep-drawing operation;

Fig. 8 is a bottom plan view of the sheet after the third deep-drawing operation;

Fig. 9 is a view similar to Fig. 3 showing the article after the last deep drawing;

Fig. 10 is a side elevation of one of the blanks of the pair formed simultaneously, after severance;

Fig. 11 is a side elevation of a finished stove top made from the blank shown in Fig. 10;

Fig. 12 is a plan view thereof; and

Fig. 13 is a front elevation.

Referring now in detail to the drawings, a metal sheet 10 of suitable gauge and dimensions is subjected to a deep-drawing operation to form a well 11 substantially centrally thereof. The well has a bottom 12, sides 13 and ends 14. Alternatively, the well 11 may be described as a raised portion having a top 12, sides 13 and ends 14, depending on whether the sheet is viewed with the displaced portion extending upwardly or downwardly from the general plane thereof. The well or raised portion 11 is preferably elongated transversely of the sheet, as indicated in Fig. 3. According to the usual die-drawing procedure, the displaced metal is pressed downwardly from the original plane of the sheet.

During the initial deep-drawing operation, beads or grooves 15 are formed along the side edges of the sheet 10 by the usual splines and grooves in the dies to restrain inward flow of certain portions of such edges on subsequent

deep-drawing operations as will be more fully described hereafter.

The deep-drawing and grooving of the sheet 10 is effected by known apparatus which requires no illustration or description further than to state that it includes a suitable press, a die ring, a holding ring and a punch.

After the initially flat sheet of metal stock has been converted by the first deep-drawing operation to the condition illustrated in Figs. 1 through 3, I form notches 16 along the side edges of the sheet. The notches 16 have the shape of a wide V with their bottoms rounded as at 17. The notches 16 are located along the side edges of the sheet so as to be substantially symmetrical with the central transverse plane through the well 11, indicated at 18. The notches permit relatively easy flow of the metal in the side edges of the sheet adjacent said central transverse plane since they leave no excess which might tend to wrinkle or buckle. The metal in the side edges spaced from said plane is slightly restrained against flow by the grooves or beads 15, at least as compared to the metal adjacent the sides 13 of the well 11. The shape of the notches 16, furthermore, permits smooth flow of the metal adjacent the central transverse plane as further deep-drawing operations are performed. As shown in the drawings the portions of the sheet adjacent the notches are maintained in substantially their original plane as they are drawn in.

After the partially formed sheet, comprising a pair of blanks, has been notched at 17, it is subjected to a further deep-drawing operation to increase the depth of the well 11. Figs. 5 and 6 show the appearance of the sheet after the second deep-drawing operation. It will be observed that the resulting well 11' is deeper than the well 11 but otherwise has about the same dimensions as the latter. As clearly shown in Fig. 6, the second deep-drawing operation causes the notches 16 to close partially by reason of the flow of the metal of the side edges of the sheet into the ends of the well as the depth of the draw is increased. The sides of the notches 16, in fact, are actually brought into abutment over a portion of their length forming seams 19 lying substantially in the central, transverse plane 18. This results from shaping the notches to remove just the amount of metal necessary to avoid any excess which might cause wrinkling or buckling.

The partially drawn sheet shown in Figs. 5 and 6 is next subjected to a further deep-drawing operation to convert it to the condition illustrated in Figs. 7, 8 and 9. The third deep-drawing operation, like the second, further increases the depth of the well 11'' without materially changing the other dimensions thereof. The notches 16 are further closed and the seams 19 lengthened. In some cases, the second deep-drawing operation may be omitted and the sheet converted directly from the condition shown in Figs. 1 to 3 to that shown in Figs. 7 to 9.

After the final deep-drawing operation, the resulting article is trimmed along the side edges just inside the ribs 15 and severed along the central transverse plane 18, producing a pair of blanks 20 such as that shown in Fig. 10. As shown, each blank has a substantially plane portion 21 adapted to form the working surface of the finished article, i. e., stove top, sink, or the like. It also has an upwardly extending back 22 having side flanges 23 and a top flange 24. The side edges of the plane portion 21 extend rearwardly of the back 22 as shown at 25.

It is thus possible, by bending down these side edges into substantially coplanar relation with the side flanges 23 of the back, to form a finished stove top such as illustrated in Figs. 11, 12 and 13 havings continuous flanges 26 extending along the sides of the supporting surface 21' and the back 22', without the necessity of filling in any openings with patch pieces as has been the practice heretofore. In forming the finished stove top, the end edge of the plane portion 21 is bent downwardly as at 27 to form a front flange continuous with the flanges 26. The edges of the side flanges 26 and the front flange 27 are bent inwardly to form stiffening flanges 28 and 29. The rear edges of the sides 23 and top 24 of the back 22 are also flanged as at 28a to provide increased rigidity.

It will be understood from the foregoing description that the finished article produced by my invention has a supporting surface, the metal of which is for the most part in the same plane as it was in the original sheet of metal stock, and a back portion which has been drawn out of the general plane of the original sheet and extends generally at right angles to the supporting surface. This is in contrast to articles having a supporting surface and back formed by conventional practice, wherein the metal forming the back is in substantially its original plane and is simply bent up at right angles to the supporting surface.

It will be apparent that the invention is characterized by important advantages over the conventional practice in that it provides a simple, direct method of forming articles having a supporting surface and a back with continuous flanges, without the necessity of applying patch pieces to fill out notches opened up during the forming operations, thereby eliminating the cost of applying such pieces and the unsightly appearance presented by the resulting joints, even when enameled over. In addition, the invention is applicable generally in the deep drawing art to cause the proper flow of metal from the edge portions of a sheet into the deeply drawn portion, without buckling or tearing. While I have disclosed the invention in detail with special reference to the manufacture of stove tops, it may also be utilized in the manufacture of other articles such as sinks, bath-tubs, etc. In the manufacture of the last-named, particularly, the notching of the edges of a sheet as disclosed herein, is of particular advantage, because of the long deep draw which must be made in a sheet of stock to form the body of a tub.

Although I have described and illustrated a preferred practice of my invention, it will be recognized that changes in the procedure disclosed may be made without departing from the spirit of the invention or the scope of the appended claims. As an example, while I have disclosed a method of forming stove stop blanks in pairs, it is evident that they may also be formed singly by appropriately modifying the operations described.

I claim:

1. In a method of making sheet-metal articles, the steps including subjecting a metal sheet to a deep-drawing operation to form an elongated well therein spaced from the edges of the sheet, cutting V-shaped notches in the edges of the sheet at points adjacent the longitudinal central plane through the well to remove excess metal and prevent wrinkling or buckling on further drawing,

subjecting the well to a further deep-drawing operation and confining the portions of the sheet adjacent the notches substantially in their original plane so that the edges of each notch come together progressively as the metal adjacent the notches is drawn inwardly, without wrinkling or buckling.

2. In a method of making pairs of blanks by deeply drawing a metal sheet successively, the steps including subjecting the sheet to a die-drawing operation to form a well spaced from the sheet edges, forming opposed notches in the side edges of the sheet and substantially in alinement with a central transverse plane through said well, subjecting the well to a further die-drawing operation to increase the depth of the well, while maintaining the portions of the sheet adjacent the notches in their original plane whereby the edges of each notch gradually come together as the drawing proceeds and form short seams extending inwardly from each side of the sheet, and then cutting in two the sheet and the well formed therein, along said first mentioned plane.

3. In a method of forming a raised back integral with a sheet-metal working surface such as a stove top, the steps including deeply drawing the portion of a metal sheet spaced from the edges thereof to form a generally rectangular well extending transversely of the sheet and having a bottom, sides and ends, said sides and bottom forming said backs and horizontal flanges at the top thereof, respectively, for two such surfaces disposed back-to-back, cutting the sheet in two along the median longitudinal plane through said well, bending down the edges of the sheet adjacent said ends to form flanges along the side edges of said surface co-planar with the ends of said well, leaving a portion of each half of the sheet in its original plane to form said surface, and bending down the edge thereof parallel to the back.

DAVID W. THOMAS.

CERTIFICATE OF CORRECTION.

Patent No. 2,348,663. May 9, 1944.

DAVID W. THOMAS.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 7, for "havings" read --having--; line 64, for "stop" read --top--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 1st day of August, A. D. 1944.

Leslie Frazer

(Seal) Acting Commissioner of Patents.