

Nov. 6, 1934.

G. L. KELLEY

1,979,472

METHOD OF AND APPARATUS FOR DRAWING SHEET METAL

Filed March 18, 1931

FIG.2

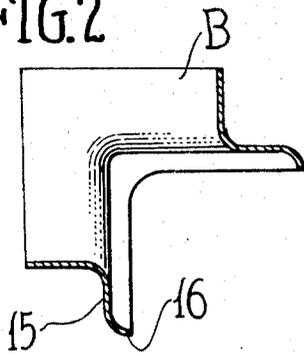


FIG.3

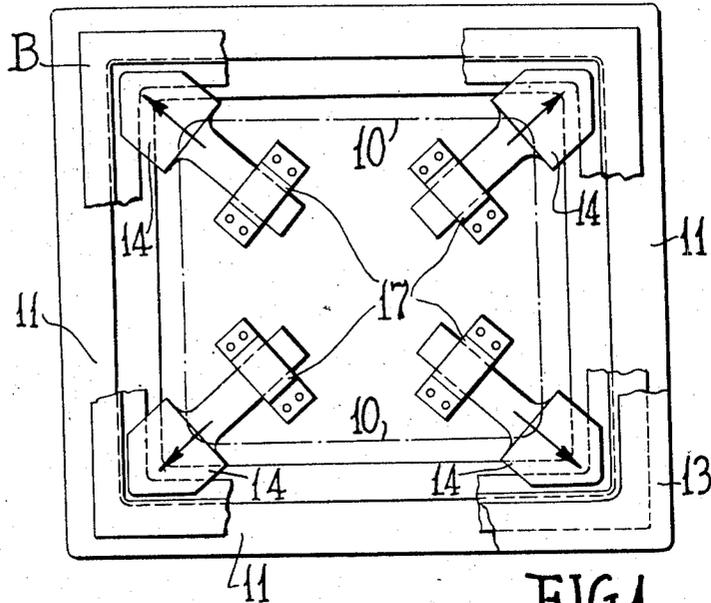
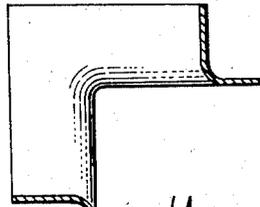


FIG.1

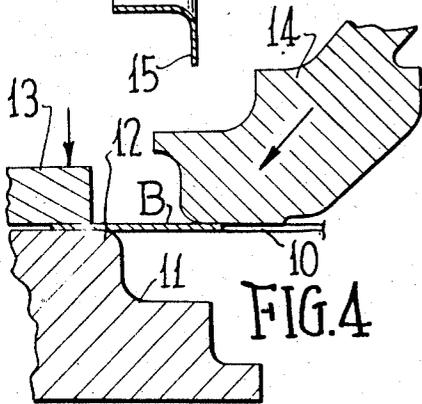


FIG.4

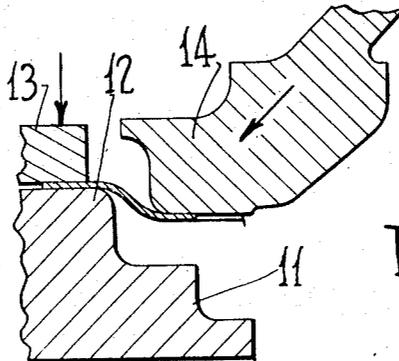


FIG.5

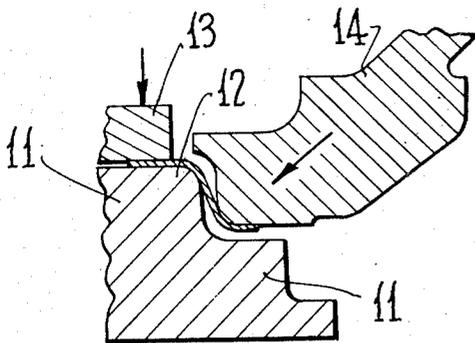


FIG.6

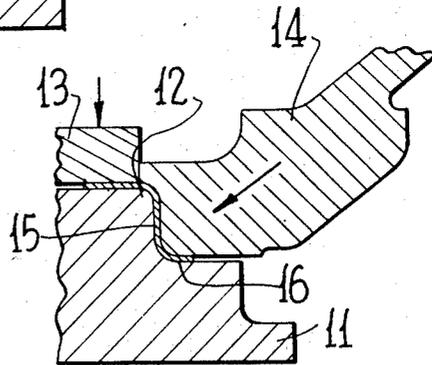


FIG.7

INVENTOR.

GEORGE L. KELLEY

BY



ATTORNEY.

Nov. 6, 1934.

G. L. KELLEY

1,979,472

METHOD OF AND APPARATUS FOR DRAWING SHEET METAL

Filed March 18, 1931

FIG.2

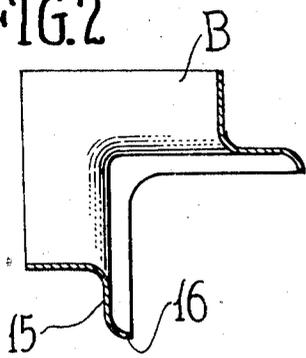


FIG.3

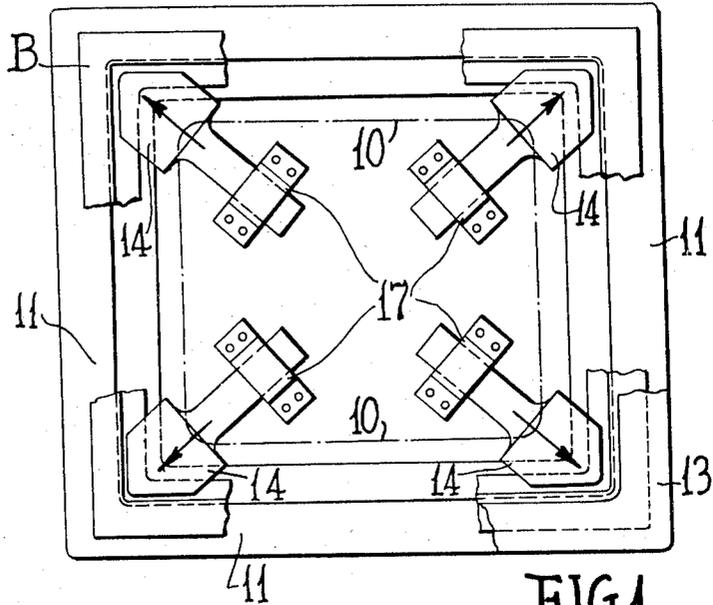
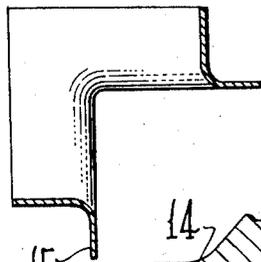


FIG.1

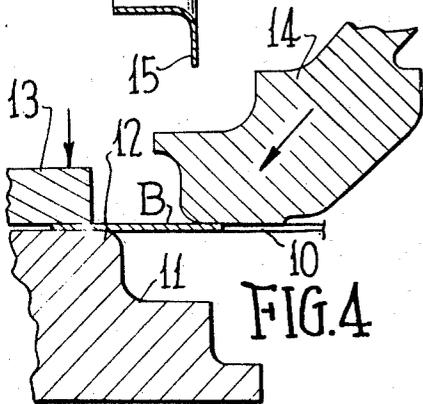


FIG.4

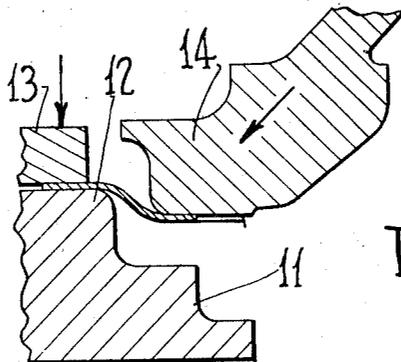


FIG.5

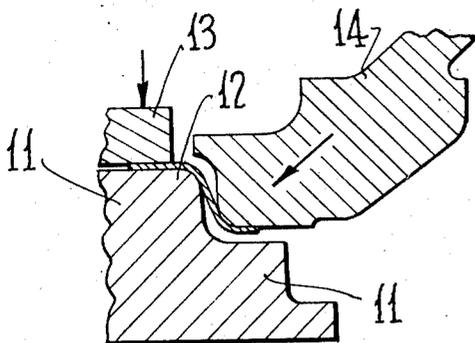


FIG.6

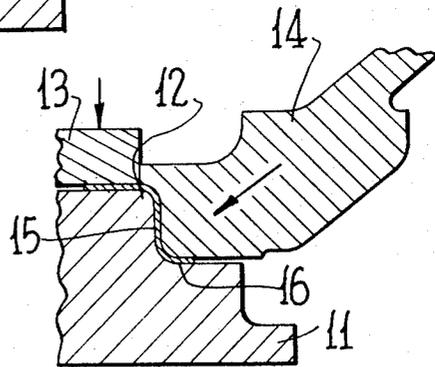


FIG.7

INVENTOR.

GEORGE L. KELLEY

BY

John P. Carbo
ATTORNEY.

UNITED STATES PATENT OFFICE

1,979,472

METHOD OF AND APPARATUS FOR DRAWING SHEET METAL

George L. Kelley, Philadelphia, Pa., assignor to
Edward G. Budd Manufacturing Company,
Philadelphia, Pa., a corporation of Pennsylvania

Application March 18, 1931, Serial No. 523,444

5 Claims. (Cl. 153—25)

My invention relates to a method of drawing continuously flanged corners around an interior opening in a metal sheet and more particularly to the formation of substantially square flanged interior corners in such sheets.

It has heretofore been found possible, where the punch moved normal to the sheet, to draw the interior square corners in a metal sheet to but a very small depth without cracking or tearing the metal in the corners. This was due to the fact that the metal in the corners, when drawn normal to the sheet, is taken from a very small area in the corner and thus requires to be stretched beyond its strength in forming a flange of substantial depth.

It is an object of this invention to overcome these difficulties and to produce square corners of this nature, and this is attained by directing the drawing operation in such direction as to draw the metal from a considerable area in both directions from the sides toward the corner. Furthermore, this is done with a minimum number of drawing operations. In fact, it may be done, in some cases, by a single operation.

It is also an object of my invention to provide apparatus to carry out the method, and as will be apparent from the understanding of my invention, the apparatus and the method are ultimately intertwined in concept and function.

In the drawing, I have illustrated more or less diagrammatically one form of apparatus by which my method may be practiced.

In them,

Fig. 1 is a plan view showing an apparatus for drawing all four corner flanges simultaneously in a blank having a rectangular opening.

Fig. 2 is a detail view of a corner of the blank after the drawing operation.

Fig. 3 is a detail of a corner after the blank is trimmed following the drawing operation.

Figs. 4, 5, 6 and 7 show successive views of the drawing operation, the arrows indicating the movements of the dies.

According to the apparatus for practicing the method of the invention disclosed herein, a flat sheet metal blank B is taken in which a rectangular hole 10, indicated by dot and dash lines in Fig. 1, has been cut, the hole being substantially smaller than the final flanged opening to be formed, thus leaving a generous width of metal from which the flange may be formed.

The blank so formed is then placed upon a suitable female die 11 having its edges shaped to form the flange so that the metal around the

opening projects inwardly beyond the outer raised portion 12 of the die a substantial distance on all sides. Suitable hold down dies 13 hold the metal down upon the outer raised portion 12 of said female die 11 and the male dies or punches 14 with angular working face formations corresponding to the female die working face formations and arranged to be moved downwardly and toward the corners of the female die and blank are then brought to engage the overhanging inner edge of the metal to draw it toward the corners and then down to form the square corner flange. The movement toward the corner and downwardly may take place simultaneously, i. e., the male dies 14 may move diagonally downwardly and outwardly. In this drawing operation the metal is drawn from both side edges adjacent the corners toward the corners so that in the downward drawing movement to form the flange enough metal will be furnished to form the flange of the desired depth.

After this initial corner flanging operation, the blank B may have the appearance of Fig. 2 with a relatively deep continuous flange 15 substantially at right angles to the body of the blank and a narrow laterally extending flange 16 of excess metal formed at the edge of the main flange 15 extending at right angles to the sheet. The blank can be subsequently trimmed to form the finished corner shown in Fig. 3.

It will be understood that the method may be carried out by other apparatus than the specific apparatus disclosed and that the movement of the male die is not necessarily continuous in a diagonal direction, as indicated. It is within the contemplation of the method to move the male die first a short distance downwardly then horizontally outwardly, and then downwardly and so on until the final position shown in Fig. 7 is reached. Also, the flange 15 between the corner portions may be formed simultaneously with the corner formation by a further die operation. To draw the metal from as wide an area as possible, it is, however, desirable to first complete the operation on the corners before finish flanging the rest of the opening. This final finish flanging may be performed in a finish die operation at right angles to the sheet in the usual manner. To provide for a balanced draw, the four corners of the blank are preferably formed simultaneously by moving the four male dies guided, if desired, by suitable guides 17 toward the four corners in unison.

The corners of the working faces of the male and female dies 11 and 14 are suitably formed

with slightly rounded corners so as to avoid cutting the metal of the sheet. This rounding is not sufficient, however, to prevent the formation of substantially square corners in the continuously flanged opening in the blank. The flange of said opening is by the improved process possible of formation to a depth substantially greater than the flanges possible by prior methods, and without the necessity of welding or otherwise providing additional metal on the corners.

What I claim is:

1. The method of forming a continuous flange on an interior substantially square corner of a substantially flat metal sheet which consists in first cutting out the sheet to leave ample metal to form the corner flange, then holding down the sheet outwardly and on both sides of said corner, and engaging the metal of the sheet by a drawing tool having the contour of the corner to be formed inwardly of the final corner to be formed and drawing it from both sides toward the corner and downwardly to the depth of the draw.

2. The method of forming a continuous flange on an interior substantially square corner of a substantially flat metal sheet which consists in first cutting out the sheet to leave ample metal to form the corner flange, then holding down the sheet outwardly and on both sides of said corner and engaging the metal inwardly and on both sides of the corner by a punch having the contour of the corner to be formed and having an initial downward movement and then a further movement outwardly toward the final corner to be formed and downwardly to the depth of the draw.

3. The method of forming a continuous flange around a square cornered opening formed in a metal sheet which consists in taking a substantially flat sheet having an opening therein smaller than the final opening, firmly holding down the

sheet outwardly of the margin of the final opening, and then simultaneously drawing the flanged four corners of the opening by engaging the metal of the sheet inwardly of each corner by a punch having the contour of the corner to be formed, and moving the punches downwardly and outwardly toward the final corner to be formed to the depth of the draw, said outward movement drawing metal from both sides adjacent a corner toward the corner.

4. Apparatus for forming a continuous flange on an interior substantially square corner of a substantially flat metal sheet comprising peripheral hold down dies adapted to clamp a blank, a female die having an opening with a corner contoured to the contour of the flanged corner to be formed, a male die having a corresponding contour, and movable downwardly and outwardly into mating relation with the corner of the female die, whereby it first engages the metal of a blank inwardly of the corner and draws it from regions remote from the corner toward the corner in its subsequent movement.

5. Apparatus for forming a continuous flange around a substantially square cornered opening formed in a substantially flat metal sheet comprising peripheral hold down dies adapted to clamp a blank, a female die having an opening therein with corners contoured to the form of the flange to be formed, and male dies each contoured corresponding to the contour of a corner of the female die, and each mounted for movement with respect to the cooperative corner of the female die downwardly and outwardly into mating relation therewith, whereby in such movement each first engages the metal of a blank inwardly of a corner and draws it from regions remote from the corner toward the corner in its subsequent movement.

GEORGE L. KELLEY.

5 80
 10 85
 15 90
 20 95
 25 100
 30 105
 35 110
 40 115
 45 120
 50 125
 55 130
 60 135
 65 140
 70 145
 75 150