

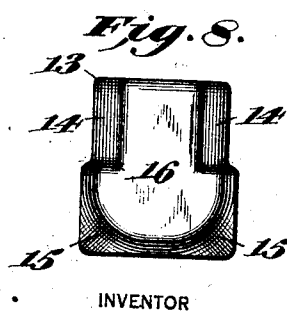
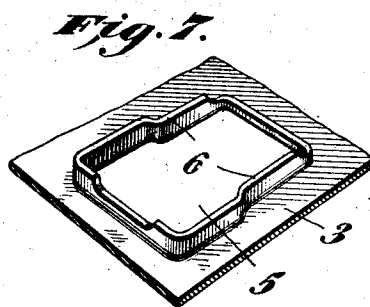
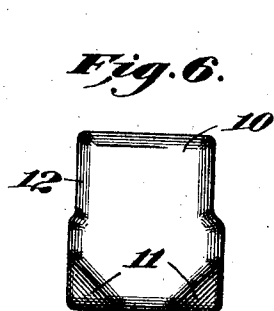
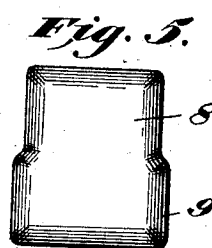
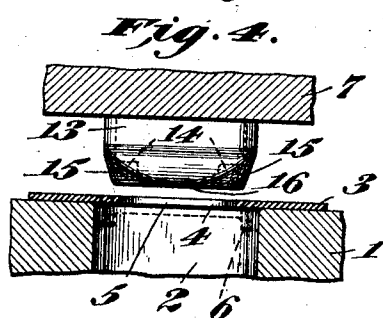
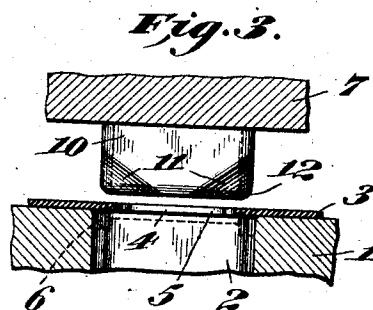
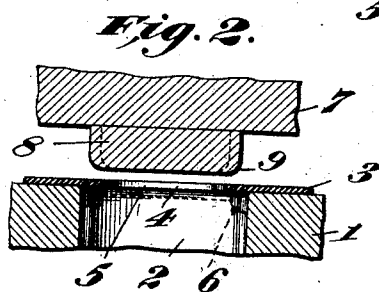
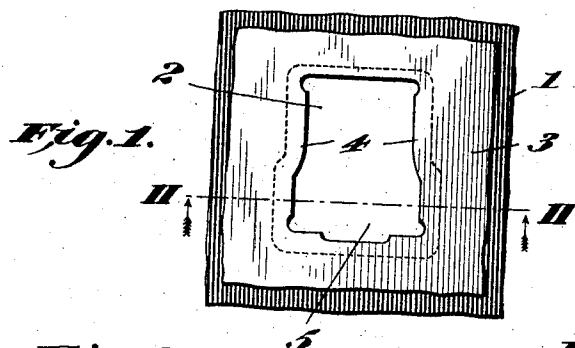
April 13, 1926.

G. E. THACKRAY

1,580,930

FLANGING

Filed Dec. 6, 1922



INVENTOR

Geo. E. Thackray

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UNITED STATES PATENT OFFICE.

GEORGE E. THACKRAY, OF WESTMONT BOROUGH, PENNSYLVANIA.

FLANGING.

Application filed December 6, 1922. Serial No. 605,327.

To all whom it may concern:

Be it known that I, GEORGE E. THACKRAY, a citizen of the United States, and a resident of the borough of Westmont, in the county of Cambria and State of Pennsylvania, have invented certain new and useful Improvements in Flanging; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to flanging metal and particularly to forming what I call internal flanges, namely, those which are shaped or pressed from a metal plate or other metal shape, including re-entrant angles with or without curved corners.

By an internal flange I mean one that is pressed or shaped from the marginal metal which surrounds a notch or opening, or is adjacent to a re-entrant angle in the metal, and in doing this, part of the material of the flange and particularly the edge portion of the completed flange is of greater lineal dimensions than before.

I have found that where attempts have been made to produce flanges of this kind there is a tendency for the metal to stretch in the internal angles and to a lesser extent in the metal adjacent thereto, and when the flange is of substantial width this action has a tendency to reduce its cross section and in some cases to actually sever the material in or near the re-entrant angle. An example of this is as follows:—If I strive to form a flange around the margin of a notch or an opening in a plate, which opening is approximately 12 inches square and preferably provided with rounded corners, and the flange is to be integrally formed of the marginal metal which surrounds said opening and is to be pressed outwardly and ultimately stand at an angle from the other material of the plate, that the lineal edge perimeter before flanging the opening of the flange would be 12 times 4 or 48 inches, while if the flange is formed of uniform width the lineal perimeter of the edge of the flange, if it is 3 inches deep, would be four times 18 inches or 72 inches, thus requiring the edge of the flange to stretch on an average of 50 per cent. The stretch, however, under such conditions, would be more concentrated in the corners with the result of thinning the corner metal to less

than one-half its original thickness, and in some cases the metal in the corners might be torn, thus making a flange which is defective and useless. In forming flanges around openings or notches of various other forms somewhat similar results will occur, as will be readily understood.

It is the object of my invention to obviate this difficulty and to form internal flanges without undue thinning or undue localization of said thinning.

In order to accomplish this, for example, in the case of a metal plate, a notch or opening will be first cut therein and the plate then heated to a good red heat, if the material is of such a nature to be worked more easily at such a temperature.

The hole or notch in the plate is of such size that when superimposed upon the bending die having an opening therein, the upper corner fillets of the metal bounding the opening in the bottom die are at distances from the edges of the hole in the plate about equal to the depths or widths of the various portions of the integral flange to be formed thereon, which flange is preferably bent to shape by the action of a male or top die having a projection which forces the margins of the plate adjacent the hole into the bottom or female die. In order to prevent undue thinning of the corners which are subject to excessive stretching by the enlargement of the lineal dimensions of the edge portion of the plate when flanging, I arrange the surfaces of portions of the male die adjacent the corners in a sloping manner or with larger radii of curvature so that the operation of bending down these marginal portions of the plate is not so abrupt. This arrangement of sloping surfaces on the male die adjacent the corners of the hole in the plate will have the effect of gradually pushing down the material which forms the corner portions of the flanges and the portions adjacent thereto so as to distribute the thinning over a larger distance, with the result that the thinning is not localized in the corners and rupture of the same is prevented. This also permits the corner portions of the flange to gradually draw, by cohesion, metal from the adjacent or straighter portions of the sides or ends of the flange, thus tending toward the results before indicated.

In some cases I prefer to arrange the top die with offset portions so that the corner

portions of the flanges are drawn or bent downwardly first while the adjacent side or end portions are free, thus allowing a plastic flow of more metal into the corners. After this is done, the other portions of die, finish the bending of the side and end portions; or the margins with narrower portions.

Having thus given a general description of my invention, I will now, in order to make the matter more clear, refer to the annexed sheet of drawings, which forms parts of this specification and in which like characters refer to like parts:—

Figure 1 is a plan view of a part of a bottom die having an opening therein of shape corresponding to the bolster opening in a truck side frame with a portion of the plate to be flanged superimposed thereon and having its marginal portions projecting over said opening, the material of the die surrounding the opening preferably having rounded upper corners; Figure 2 is a vertical sectional elevation taken on the line II—II of Figure 7, showing the bottom die, the top die and the plate in position on the bottom die prior to the flanging; Figure 3 is a vertical sectional elevation similar to Figure 2, but showing in elevation another form of top die with sloping corner portions adapted to bend or form the flange in and adjacent to the corners; Figure 4 is a vertical sectional elevation through the top and bottom dies showing the plate superimposed upon the bottom die with its margins projecting over the opening therein, this top die, however, being of slightly different form, as that part which forms the side flanges is offset and does not operate until after the corner portions are pressed downwardly by the sloping corner portions of the die; Figure 5 is a bottom plan view of the top die illustrated in Figure 2; Figure 6 is a bottom plan view of the top die illustrated in Figure 3; Figure 8 is a bottom plan view of the top die illustrated in Figure 4, and Figure 7 is a perspective view of a portion of a plate after the internal flange is formed thereon, as illustrated.

Referring now to the characters of reference on the drawings:—1 are bottom dies each having an opening 2 therein, the material at the upper end of the opening being preferably rounded or formed with a curve so as to more easily bend the plate, this curve preferably being of the minimum size required for this purpose so that almost all of the flange will be at substantially right angles with the body of the plate. The part of the plate immediately contiguous to the margins of the upper die is known as the bend line, as this is the line where the bending of the flange begins from the body of the plate.

As illustrated in the various figures, 3 is a portion of a plate which is superimposed

upon the bottom die, and these plates are each provided with an opening 5 therein, which may be of various forms, all of which, however, have re-entrant angles which are preferably supplemented by rounded junctions or curved fillets, as shown, in order to avoid the square corners which are difficult to make and tend to damage the material to be flanged. The marginal portions of the plates to be flanged are 4 and in the various illustrations 6 is the flange formed around the opening of the plate after the flanging operation. The top plunger or ram of the top die is 7 and the top male die or projection, as illustrated in Figures 2 and 5 is 8, having a lower rounded edge 9, which is formed to a considerable radius so that the action thereof is somewhat progressive when bending the margins of the plate into the bottom die.

As illustrated in Figures 3 and 6, 10 is the top or male die having sloping or beveled surfaces 11 at its corners, and these are adapted to gradually and progressively bend down the corner portions of the flange, the lower edge of this die also having a rounding 12 as illustrated.

As illustrated in Figures 4 and 8, 13 is the top or male die having offset portions 14, formed as shown, which, as the die operates, are adapted to contact with the side portions of the flange after the corner portions have been first gradually pressed down, thus allowing the corners to be shaped while at the same time permitting the material which forms the flange to be maintained in the corners and to be drawn away from the side portions, as this is done in order to prevent undue thinning of the corner portions. The die 13 also has sloping or chamfered corners 15 which gradually bend the corner portions of the plate, and 16 is the bottom or somewhat T-shaped lower face of the die 13.

My invention operates as follows:—A plate 3 has a hole 5 cut therein to any shape desired, which, however, has re-entrant angles or corners provided with rounded fillets for the reasons heretofore stated, and this plate is then placed over the opening in the bottom die 1 when the top die is in its upper position. Suitable gauges (not shown) may be used to hold the plate in position on the bottom die, after which the top die is pushed downwardly and bends the marginal portions of the plate into the opening 2 of the bottom die, whereby the flange 6 is formed thereon as illustrated in Figure 7.

By reason of the construction and conformation of my dies the corner portions which would otherwise be drawn thin or severed are gradually pulled, bent or drawn into shape in such a way that the straighter or side portions of the flange are pressed

downwardly more by pure bending, and while this is done the plastic flow of the material is such that the material flows toward and into the corner portions to maintain their thicknesses. The sloping sides of the dies also have a diagonal wiping or drawing action which has a tendency to pull the material from the side or end portions of the flange into the corners to maintain their thickness as nearly as possible.

Although I have shown and described my invention in considerable detail, I do not wish to be limited to the exact and specific details thereof, as shown and described, but may use such modifications in, substitutions for, or equivalents thereof as are embraced within the scope of my invention or as pointed out in the claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:—

1. The method of flanging a plate around an opening of substantially rectangular shape therein, which consists in bending the corner portions thereof by a progressive bending action while the adjacent side and end portions are substantially free, and then bending said side and end portions.

2. The method of flanging a metal plate around an opening therein, which consists in first cutting said opening to the form desired with re-entrant corners, then gradually and progressively bending the corner portions while bending the side or end portions more abruptly.

3. The method of flanging a metal plate around an opening therein, which consists in first making said opening to the form desired with re-entrant corners, then gradually and progressively bending the corner portions while the adjacent side portions and end portions are substantially free, and then finishing the flange by bending said side and end portions.

4. Apparatus for forming an internal flange on a plate around an opening having re-entrant angles, preferably with rounded corners, comprising a bottom die having an opening therein substantially conforming to the outline of said flange, a male die cooperating therewith having a projecting portion of shape similar to the opening in the bottom die but of lesser size, the corner portions of said male die being sloping.

5. Apparatus for forming an internal flange on a plate around an opening having re-entrant angles, preferably with rounded corners, comprising a bottom die having an opening therein substantially conforming to the outline of said flange, a male die cooperating therewith having a projecting portion of shape similar to the opening in the bottom die but of lesser size, corner portions of said male die being sloping, and its portions adapted to contact with side or end portions of the flanges being off-set therefrom so as to act later in the movement of said male die.

6. Apparatus for forming an internal flange on a metal plate around an opening therein having re-entrant corners, comprising a bottom die having an opening substantially conforming to the outline of the general shape of said flange, and having rounded edge portions, a male die adapted to cooperate therewith having a projecting portion of shape similar to the opening in the bottom die but of lesser size by an amount about equal to twice the thickness of the metal to be flanged, two of the corner portions of said male die which form the corners of the flange being sloping, and other portions adjacent thereto which form the side and end flanges offset therefrom, so as to act later in the movement of said male die.

In witness whereof I hereunto affix my signature.

GEORGE E. THACKRAY.