

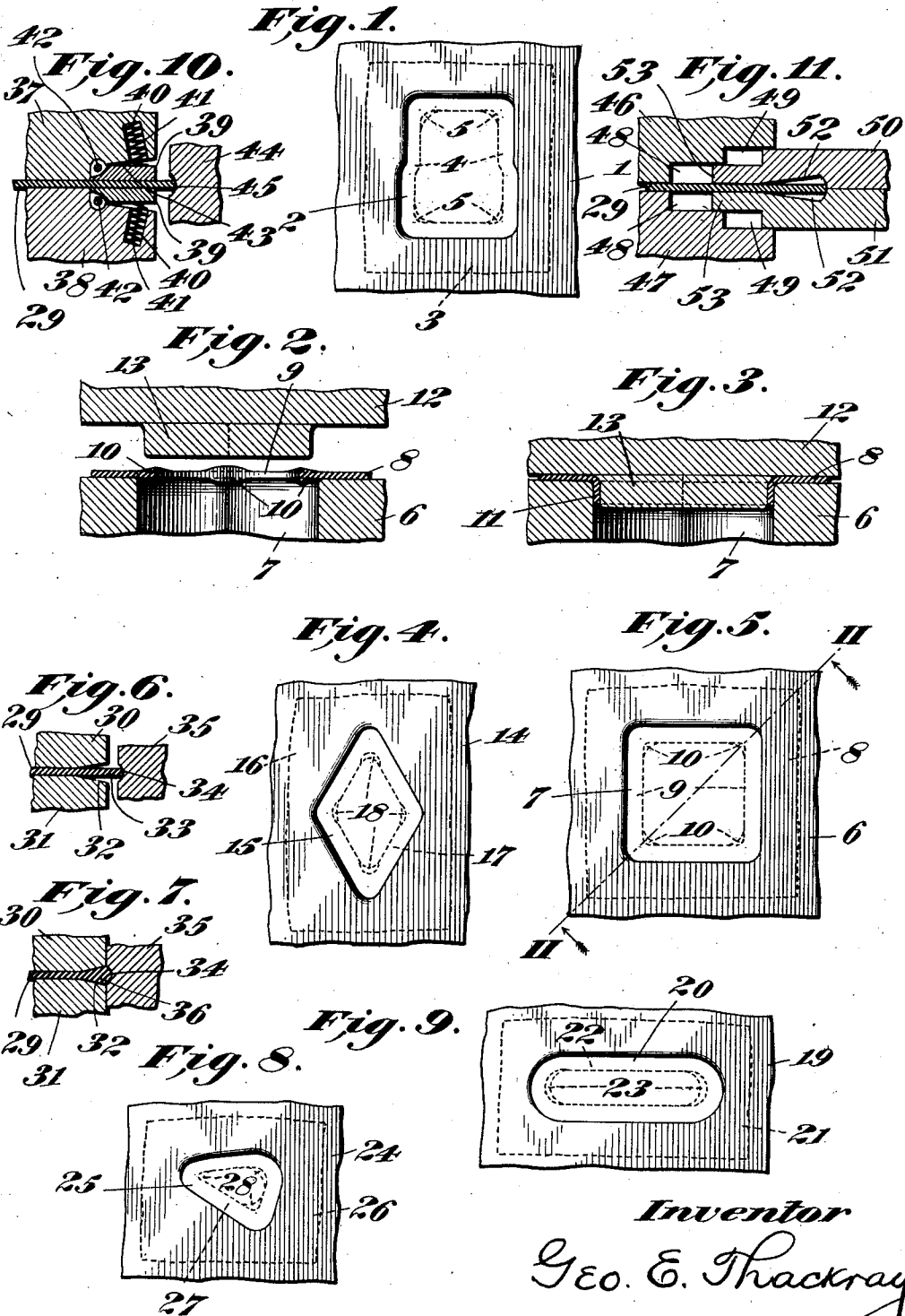
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FLANGING METAL

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FLANGING METAL.

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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 Metal; 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 or 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.

In cutting the notch or opening in a plate I leave an extra amount of metal in the corners or re-entrant angles, which metal extends outwardly and integrally from the other portions, preferably with the outline of a curve to a distance somewhat greater than the projection of the other portions of the plate beyond the line which is ultimately to form the bend line between the flange and the body of the plate. By bend line I mean the line of integral junction between the body of the metal and the integral flange thereof, the location of this line, however, on a curved or rounded junction being somewhat indeterminate, but nevertheless it is known as the bend line to those skilled in the art to which this invention appertains.

After the plate has been cut as desired, as before stated, the portions in the re-entrant angles or corners of the plate are upset by hammering or pressing the material thereof inwardly toward the body of the plate so that their edges are of considerably greater thickness than the body of the plate and taper thence into the body of the plate at or about the ultimate bend line. The flange is then formed on the plate by hammering or pressing down the marginal portions, and this is preferably done with a pair of dies, one of which is provided with an opening having rounded edges and the other has a projection adapted to force the metal of the flange downwardly into said opening as illustrated in Figure 3, the projection being of dimensions or widths less than that of the opening in the bottom die by an amount substantially equal to twice the thickness of the flange so formed.

As the metal has a tendency to be drawn or made thinner in the re-entrant angles or corners, this upsetting of the same to greater thicknesses will counteract this effect, so that when the flange is formed it will be of substantially uniform thickness in the corner portions and in the other portions, such as the sides, ends, etc., which are adjacent and joined thereto. As part of the plate in the extreme corners is apt to be thinned most, I prefer to make it thickest in this place and it may also taper laterally thence to the other parts of the plate. This is done by adding a greater width of extra metal at the corners and less metal as their edge lines merge into the other portions, the added metal thus being somewhat of the shape of a crescent or curved surface of greatest width at its center and with their edges tapering thence toward their integral junctions with the edges of the other portions.

This upsetting may be accomplished by clamping the plate between a pair of clamping dies, and then projecting an upsetting tool against its edge, although this may be accomplished by hammering or in any other way desired. After the flange is formed by bending the marginal portions of the plate it is of substantially uniform thickness throughout, and the proportion of the parts is preferably such that the edge of the flange may be in a plane or substantially so, or will finish to any other edge conformation desired, and this can also be prearranged by making the original outline of the marginal edges of the metal to be flanged of suitable conformation before flanging.

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 part of this specification and in which like characters refer to like parts:

Figure 1 is a top plan view of a portion of a bottom die having a hole of the shape shown therein, which in this case is composed of two rectangles joined by a reverse curve and intended to correspond to the bolster opening in a truck side frame, a portion of the plate to be flanged thereon being indicated in dotted lines; Figure 2 is a cross section through a plate having a substantially square opening therein with rounded upset corners and through the top and bottom dies therefor, showing the plate in position before flanging, this section being taken on the diagonal line II—II of Figure 5; Figure 3 is a section corresponding to Figure 2, but showing the dies after they have been pressed toward each other and the plate with the integral flange formed thereby; Figure 4 is a top plan view similar to Figure 1, but showing an open-

ing in the die of diamond shape with rounded corners, and a plate indicated by dotted lines thereon; Figure 5 is a plan view similar to Figure 1, but showing the die in full lines with substantially square openings therein with rounded corners; Figure 6 is a cross section through a pair of clamping dies and the upsetting die showing the plate, the corners of which are to be upset; Figure 7 is a section which corresponds to Figure 6, showing the plate after its corner portions have been upset; Figure 8 is a plan view similar to Figure 1, showing a die with a triangular opening with rounded corners and in dotted lines the plate thereon, and Figure 9 is a similar plan view showing a die having an opening with two sides parallel and its ends of semi-circular outline with the plate thereon in dotted lines.

In each of Figures 1, 4, 5, 8 and 9, part of the bottom die is shown in full lines and part of the plate to be flanged in dotted lines superimposed thereon.

Figure 10 is a cross section of another form of clamping dies and upsetting mechanism showing means for holding a hot plate and so clamping its edge portion as to prevent buckling to insure that it will be upset to the form illustrated in Figure 7, and Figure 11 is a cross section of another arrangement of clamping dies and the upsetting die to accomplish the same purpose.

Referring now to the characters of reference on the drawings:—As illustrated in Figure 1, 1 is a portion of a bottom die, 2 is the opening therein, the upper edges of the metal surrounding which have rounded corners as indicated, this opening being formed of two rectangles joined by reverse curves of the shape required to form a bolster opening in a truck side frame, as my invention is particularly well adapted to forming integral flanges in such frames around the bolster and other openings thereof. 3 is a portion of the plate superimposed upon the die 1, and 4 are the marginal portions from which the flange is to be bent and which at first project over the rounded edges of the dies as illustrated. The corner portions 5 of the plate are thickened or upset prior to flanging, so that when they are flanged they will be of substantially the same thickness as the rest of the integral flange of which they form a part.

As illustrated in Figure 2, 6 is the bottom die, 7 is a square opening therein with rounded corners, 8 is a portion of the plate to be flanged, 9 is the material which forms the flanges thereof, and 10 are the thickened or upset corner portions of the flange 11 as formed by the dies and as illustrated in Figure 3, and in Figures 2, 3 and 5, 6 is the

bottom die, 7 the square opening therein, 12 is the upper portion of the upper die and 13 is the projecting portion thereof which forms the flange 11.

5 Referring now to Figure 4, 14 is a portion of the bottom die having a diamond shaped opening 15 therein with rounded corners, 16 is a portion of the plate superimposed thereon, its marginal portions 17 project-
10 ing over said opening and having thickened or upset portion 18.

Referring now to Figure 9, 19 is a part of the bottom die having an opening 20 therein with parallel sides and semi-circular
15 ends as illustrated; 21 is a part of the plate superimposed thereon having marginal portions 22 projecting over said opening with thickened or upset end portions 23 as illustrated.

20 Referring now to Figure 8, 24 is a portion of the bottom die, 25 is the triangular opening therein with rounded corners, 26 is a part of the plate superimposed thereon having marginal portions 27 projecting over
25 the opening, and 28 are the thickened or upset corner portions of the plate.

Referring now to Figure 6, 29 is a part of the plate which is clamped between the
30 clamping dies 30 and 31, the outer edges of which are flared adjacent the edge 33 of the plate before it is upset. The clamping dies 30 and 31 are adapted to approach each other or to be withdrawn from each other by any suitable means (not shown). An
35 upsetting die 35 is also provided, preferably having a groove 34 in its end portion adapted to contact with the edge portion 33 of the plate. Means may also be provided (not shown) for projecting the upsetting
40 die 35 into the position indicated in Figure 7, whereby the plate is upset between the clamping dies 30 and 31 and into the shape indicated at 36 in Figure 7, after which the
45 upsetting die is withdrawn by a reversal of its movement. In upsetting this plate I prefer to make the edge somewhat rounded as illustrated in order to prevent tearing or distortion by the after-flanging operation, although I may make it flat and substantially at right angles to the side of the plate
50 if desired.

The shape or conformation of the upsetting and clamping dies in a plane or section taken at right angles to that of Figures
55 6 and 7, may be of any conformation desired, dependent upon the shape of the flange to be produced from this part of the plate, as will be readily understood, so I have not shown all the various forms of
60 these in the drawings; for example:—The form or plan view of the die for upsetting the corners of the plates illustrated in Figures 1, 2, 4, 5, 8 and 9 would be rounded or convexly curved to produce the shapes
65 illustrated in the corners of these plates

and those for other shapes shown would be correspondingly shaped.

Referring now to Figure 10, the clamping dies are 37 and 38, and these are provided with hinged portions 39 which are set in
70 recesses in the edge portions of the clamping dies and hinged at 42. These clamping dies are also provided with recesses 40, in which spiral springs 41 are inserted and adapted to contact with the hinged portions
75 39 with pressure sufficient to prevent the plate from buckling when upset, but the springs are of such strength as to allow the portions 39 to spread apart as the plate is upset to the form 36 illustrated in Figure
80 7. 43 is the space or opening in which the hinged portions 39 are mounted, 44 is the upsetting plunger and 45 is a groove in the end thereof, the boundaries of which are adapted to contact with the edge of the
85 plate 29.

Referring now to Figure 11, the clamping dies are 46 and 47 and are adapted to be moved toward or from each other, and these are provided with recesses or openings ad-
90 jacent their end portions, namely, 48 and 49, adapted to receive the end portions 53 of the upsetting plungers 50 and 51 and guide the same in its movement. The upsetting plunger is made in two parts, 50 and
95 51, and are provided with a somewhat triangular shaped recess 52 therein. When the upsetting plunger formed of two sections 50 and 51 is pushed toward the left the edge of the plate 29 will be upset to
100 the form illustrated at 36 in Figure 7. After this is done the clamping dies are separated and the two parts of the upsetting plunger separated and the plate withdrawn.

The clamping dies and upsetting plungers illustrated in Figures 6, 7, 10 and 11 may be projected, retracted and operated hydraulically, mechanically or otherwise, but the details of these are not illustrated,
110 as they will be readily understood by one skilled in the art.

Having thus described my invention I will now explain its operation:—A metal plate is provided with a notch or hole there-
115 in of any shape desired, and this may be made by punching, shearing, or in any other way, and after this is done the plate is preferably heated to a good red heat or to whatever heat may be best for the subse-
120 quent operation. The plate is then placed in position between the clamping dies, and the material thereof and immediately adjacent the re-entrant corners or angles is upset by any of the forms of clamping and
125 upsetting dies, which latter are projected against the plate in directions substantially coincident with the axis of the central plane of the plate, and the inner corner portions are thus formed of metal which is thickest
130

at the edge and then merges into the body of the plate, as illustrated at 36.

The plate is then taken and superimposed upon a bottom die as indicated in Figures 1, 2, 4, 5, 8 or 9 with the margins of the plate projecting over the opening in the die. The flange forming die or plunger is then projected against the plate and presses the flange downwardly as particularly illustrated in Figures 2 and 3.

By reason of the fact that the corner portions of the plate are thicker, the thickness of the plate at the inner or re-entrant angles within the opening will be maintained, and as the flanging operation progresses the plate will gradually draw thinner in the corners, and the die plunger will also assist in drawing this as required, so that the flange will be of substantial uniform thickness throughout and finally equal or approximately equal to that of the original plate. By reason of this thickening of the corners the material thereof will not be made thinner than the body of the plate, and the side portions or straight portions of the flanges will merely be bent down as they are flanged and will not be unduly drawn or thinned. After this is done the dies are retracted and the plate removed therefrom and the apparatus is ready for another operation.

My invention is also applicable to forming an internal flange around the margin of a circular hole in a plate or one which is of substantially uniform curvature, and in this case I would first upset the entire inner marginal portion of the plate surrounding and adjacent the hole and then afterwards flange it preferably by means of dies in the manner described, thus preventing thinning of the flange material.

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 forming an integral flange from a plate around an opening therein, which consists in upsetting the corner portions thereof to thicknesses greater than the body of the plate and then forming or pressing the flange therefrom, whereby the corner portions are not unduly thinned.

2. The method of forming an integral flange around an opening in a metal plate, which consists in firmly holding the corner portions thereof, then upsetting the edge portions thereof to thicknesses greater than the body of the plate, and then bending the flanges therefrom to extend at an angle with the plate, whereby the corner portions are not unduly thinned.

3. The method of forming a flange around an opening with rounded corners in a metal plate, which consists in providing the marginal portions of said plate adjacent the opening with extra material in the corner portions, then upsetting the material to thicknesses greater than that of the body of the plate, the upset portions being thickest at their edges and tapering thence into the body portion, and then bending the marginal portions around the opening at an angle to said plate, whereby an integral flange is formed without unduly thinning the corner portions thereof.

4. The method of flanging a metal plate, which consists in providing an opening therein with extra material in the rounded corner portions thereof, then upsetting the material in and adjacent said corners to a thickness greatest at the edge and greater than that of the body portion, said greatest thickness tapering both laterally and longitudinally into the body portion, whereby an integral flange is formed around said opening without unduly thinning the corner portions thereof.

5. The method of providing an integral flange on a plate, which consists in cutting an opening therein, leaving extra material around the corner portions thereof, then upsetting said corner portions to thicknesses greater than that of the body portion, then bending the plate on the bend line at a distance from the edge surrounding said opening until the integral portions thereof project at an angle from the plate body, thereby forming a flange of approximately uniform edge thickness.

6. The method of forming an integral flange around a circular or substantially uniformly curved opening in a metal plate, which consists in first upsetting the marginal portions thereof to a thickness greater than that of the plate and then bending the flange portions therefrom, whereby said flange is not unduly thinned.

In witness whereof I hereunto affix my signature.

GEORGE E. THACKRAY.