

Dec. 15, 1936.

E. HOCHREITER ET AL

2,064,160

APPARATUS FOR DIE DRAWING LARGE IRREGULARLY SHAPED SHEET METAL ARTICLES

Filed Dec. 19, 1931

5 Sheets-Sheet 1

FIG. 1

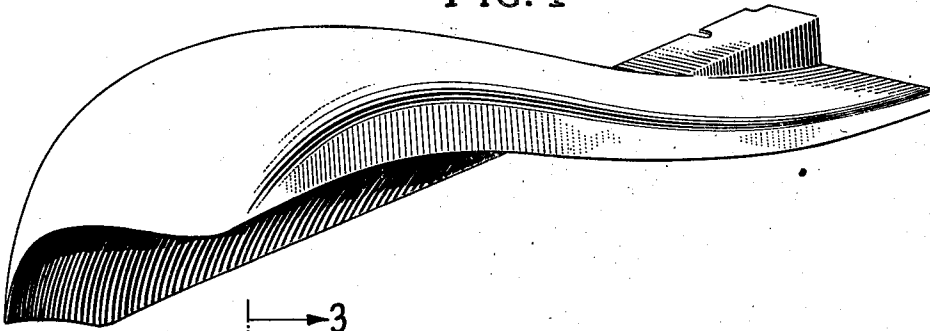


FIG. 2

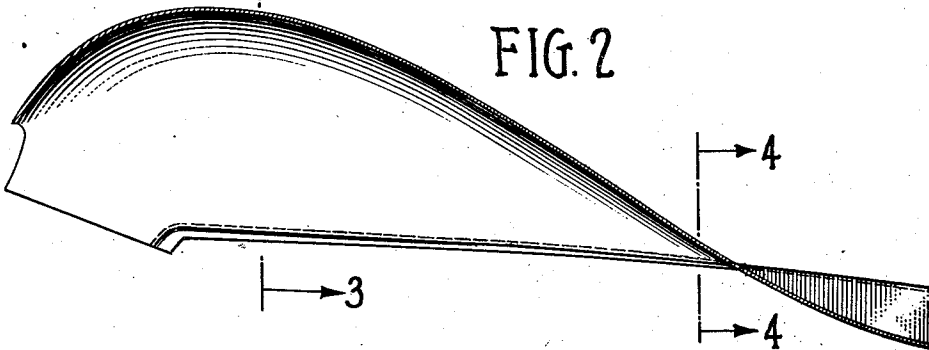


FIG. 4a

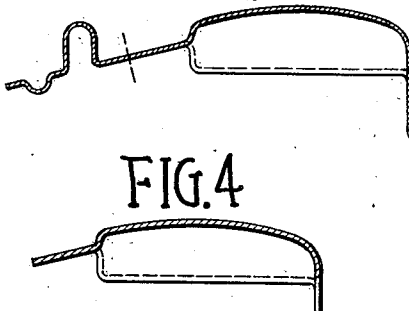


FIG. 4

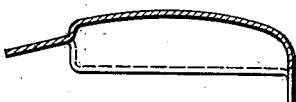


FIG. 3

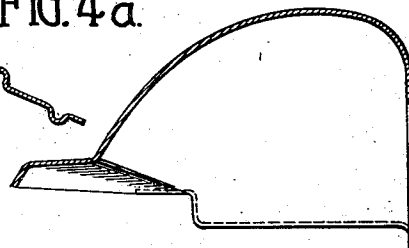
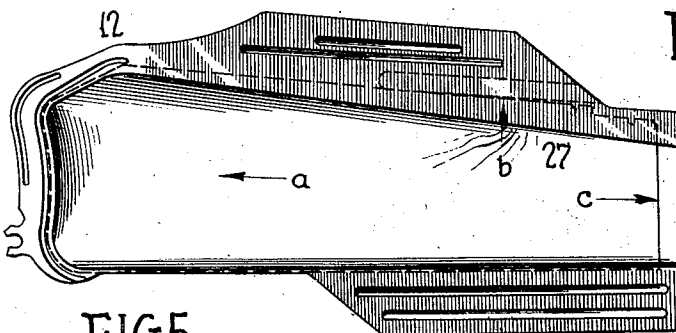


FIG. 5

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5 Sheets-Sheet 2

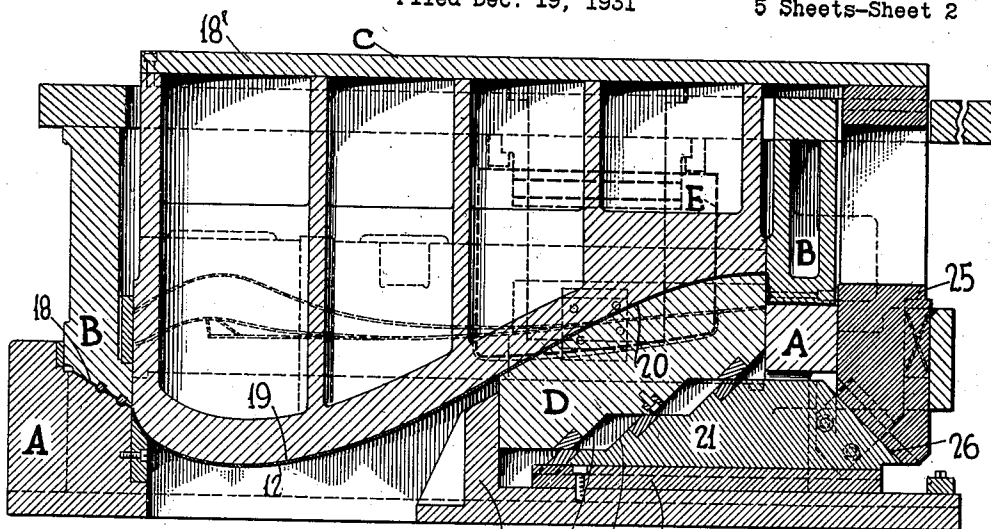


FIG. 7

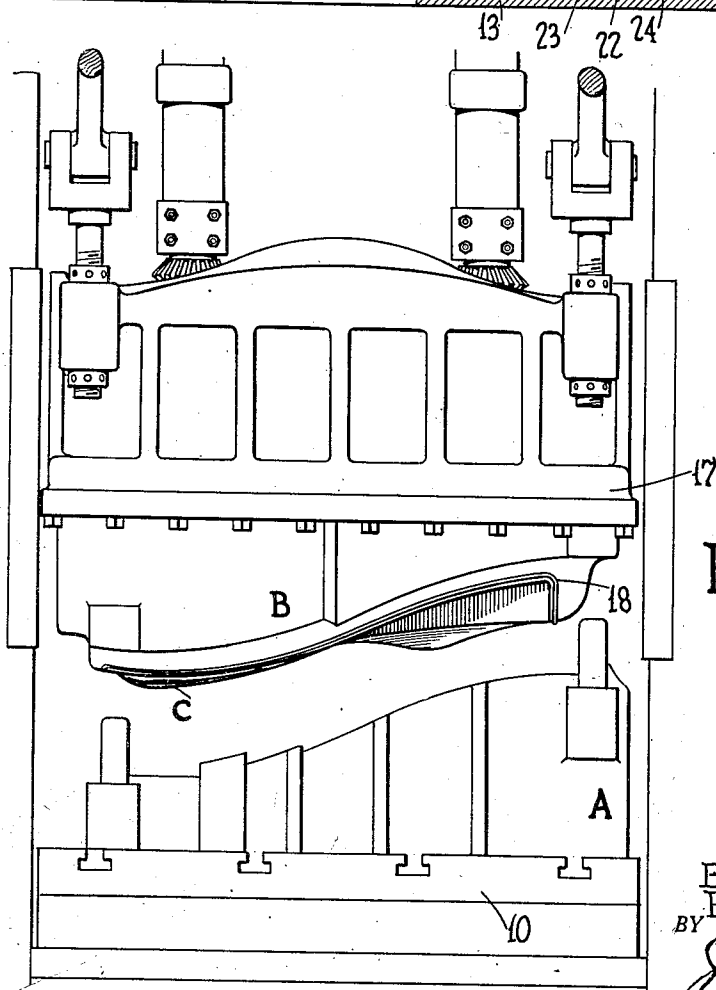


FIG. 6

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FIG. 8

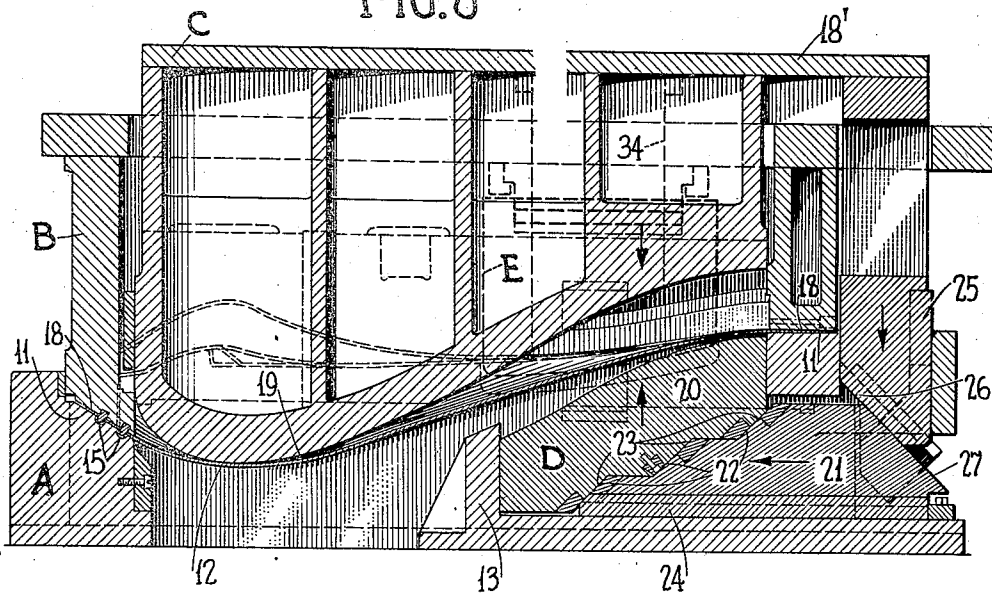
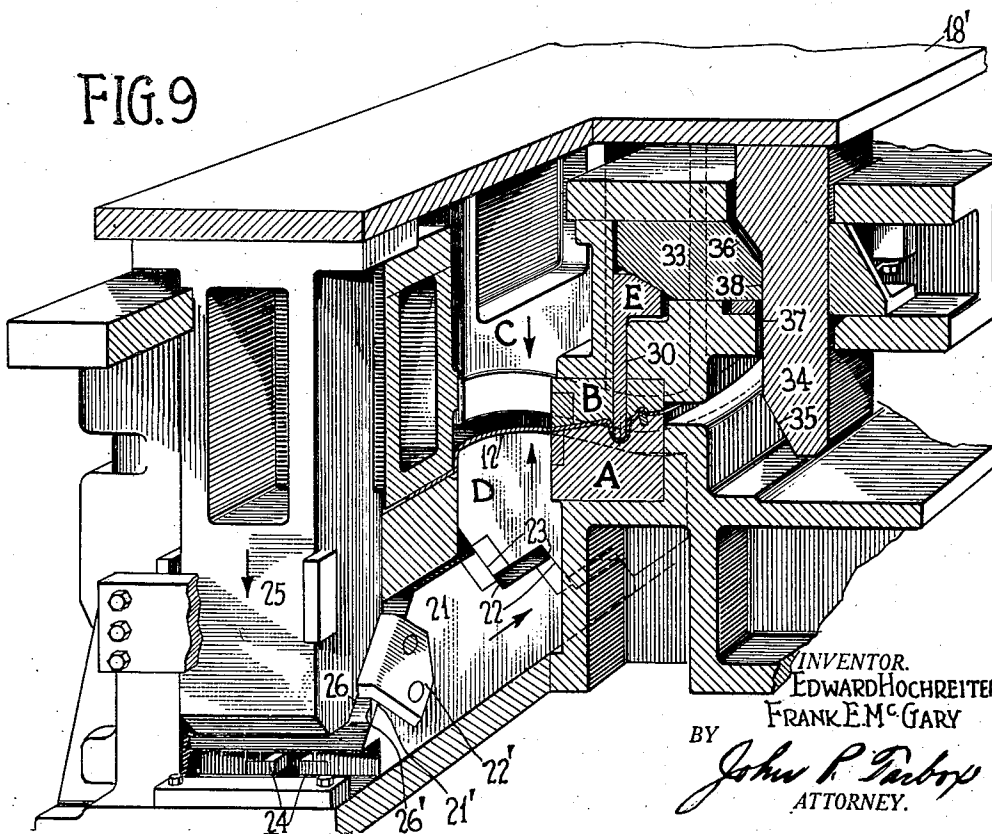


FIG. 9



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FIG. 15

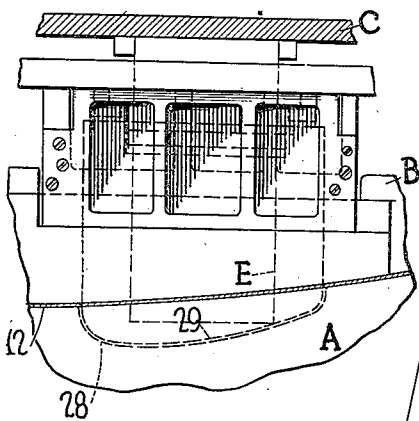
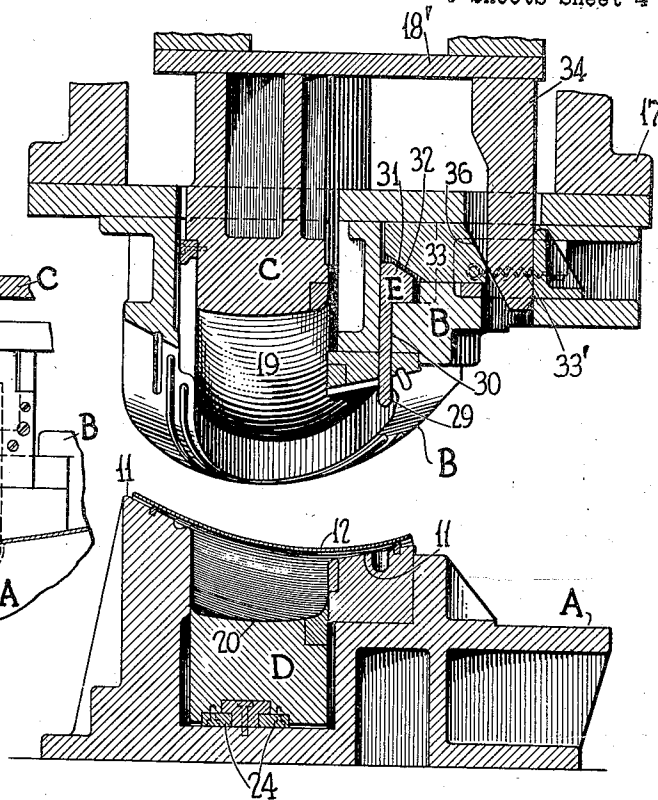


FIG. 10

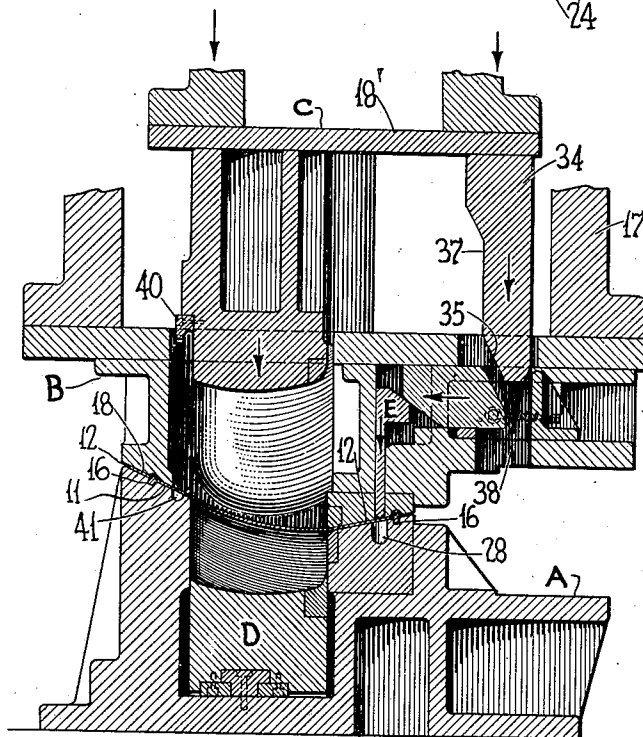


FIG. 11

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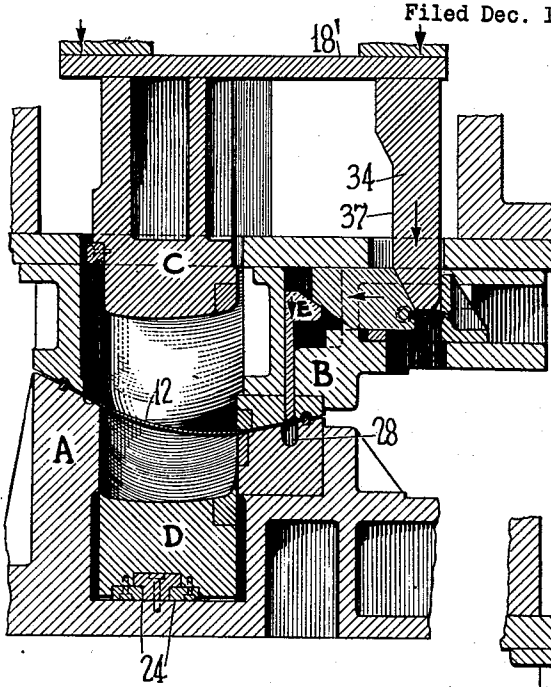


FIG. 12

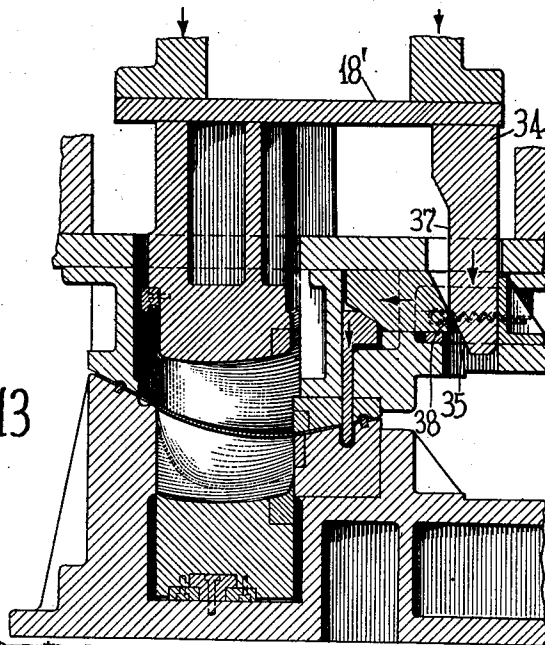


FIG. 13

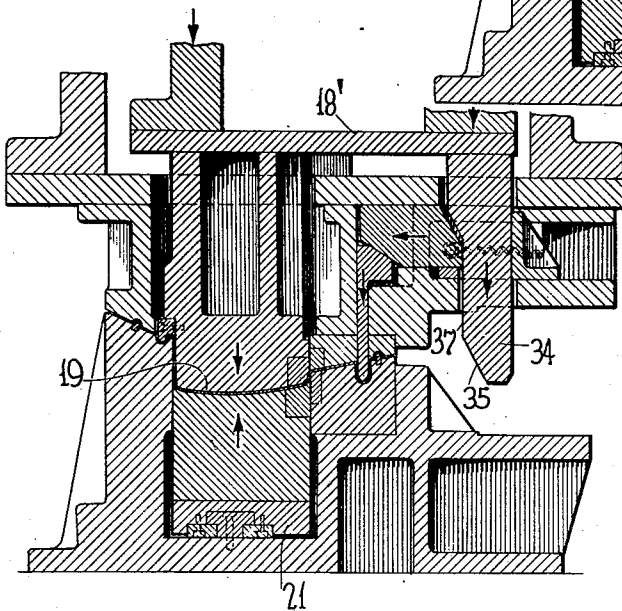


FIG. 14

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UNITED STATES PATENT OFFICE

2,064,160

APPARATUS FOR DIE DRAWING LARGE
IRREGULARLY SHAPED SHEET METAL
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Application December 19, 1931, Serial No. 582,032

7 Claims. (Cl. 113-46)

The invention relates to an apparatus for forming large sheet metal stampings of irregular form.

It is a main object of the invention to reduce the cost of forming such stampings to improve their surface and generally to provide an article of this class which is superior to the articles heretofore produced. In the present application the invention is shown applied to the formation of an entire front fender including the inclined apron joining the crown of the fender to the body or chassis and the horizontal ledge bridging the space between this inclined portion and the body. The crown of the fender is of a double curvature, its rear portion dipping below the horizontal ledge. In the region where the curved crown intersects the horizontal ledge, less metal is required to form the fender than in its forward and rearward portion, and in previous attempts to draw the entire fender, ridges and wrinkles have resulted in this region which were impossible of complete removal, even with expensive operations of hammering and grinding, and thus marred the entire stamping. Such a condition has manifested itself in other relations, where the draw was directed in different directions in different parts of a large irregular stamping in regions between such parts, or where the conditions of draw left too much metal in certain regions to be removed without wrinkles by the draw in other regions.

The present invention has remedied this condition, and by the use of it a large irregularly formed stamping of this class can be produced with a smooth surface throughout and with a minimum number of operations. The main feature of the invention by which these improved results are attained is the use of the step of stretching the metal of the blank in a direction which will tend to remove the excess metal from the region likely to produce wrinkles prior to the final forming operation.

The invention also resides in the means whereby this step can be carried out in proper sequence to the final forming and with a single die press operation.

Other and further objects and advantages will become apparent from the following detailed description of a form of apparatus well adapted to carry out the method and as used in the formation of complete fenders.

In the accompanying drawings showing the invention applied to the formation of the difficult complete fender stampings,

Fig. 1 is a perspective view of a fender stamp-

ing made in accordance with the invention, with the excess metal necessary for the drawing trimmed off.

Fig. 2 is a central vertical longitudinal sectional view of the fender shown in Fig. 1.

Figs. 3 and 4 are transverse sectional views taken respectively on the correspondingly numbered lines of Fig. 2.

Fig. 4a is a transverse section of the fender stamping corresponding to the section shown in Fig. 4 showing the stamping before trimming and indicating in dotted lines the trim lines.

Fig. 5 is a plan view of an untrimmed fender stamping indicating the region in which the wrinkles have heretofore formed, and showing in dotted lines the location of the auxiliary die for removing the excess metal in this region laterally in the drawing operation of the complete stamping.

Fig. 6 is a fragmentary elevational view of a double-action press to which the invention is shown applied, the dies being shown in separated position.

Fig. 7 is a longitudinal vertical sectional view showing the dies and work in the position they occupy at the end of the draw.

Fig. 8 is a corresponding view of the parts at the beginning of the draw.

Fig. 9 is an end perspective view, parts being broken away and shown in section, showing the same just prior to the final draw.

Figs. 10, 11, 12, 13 and 14 are corresponding vertical transverse sectional views showing successive different positions of the parts, respectively, in the approach movement of the dies.

Fig. 15 is a fragmentary sectional view, looking at the inside face of the well or depression in the lower die showing the parts in the position indicated in Figs. 7 and 14.

In the drawings, the apparatus for carrying out the improved method comprises a double acting press in which A designates generally the lower holding die block, B the upper movable holding die block, C the plunger or ram, D an auxiliary upwardly moving die mounted in the lower holding die block A and E, a floating stretching die mounted in the upper holding die.

The lower holding die block A is supported in a usual manner upon the bed 10 of a press and has a central well or recess within which the movable ram C and die D may be accommodated. Surrounding this well it is provided with a continuous seat 11 adapted to receive the peripheral portion of the blank 12, the seat being generally inclined inwardly toward the well, as clearly ap-

pears in Figs. 7 to 13. Centrally of the well is a transverse wall 13 on one side of which is mounted the vertically movable auxiliary die D.

The face 11 of the lower holding die is provided with recesses 15 and projecting ribs 16 extending longitudinally of the seat, and adapted to cooperate with corresponding recesses on the upper holding die to firmly grip the blank. The depth of these ribs and recesses may vary in various locations in accordance with the firmness which it is necessary for the blank to be held in those locations.

The upper holding die B is supported in a usual manner from the vertically reciprocating head 17 of the press and is provided with a working face 18 corresponding to the face 11 of the lower holding die, and between these faces the peripheral portion of the blank is gripped in the final approach movement of the holding die B, as indicated in Figs. 10 to 13.

The holding die faces conform to the peripheral portion of the blank and are adapted to receive a substantially flat blank located as by pins (not shown) on the lower die, and slots on the edges of the blank adapted to engage the pins.

The plunger C is designed to effect the major draw upon the blank and is mounted on a vertically reciprocating head 18' movable independently of the head 17 carrying the upper holding die. In longitudinal section lower working face 19 of the plunger C is of a double curvature, conforming to the shape of the work to be formed, and the face is also transversely curved as indicated in Figs. 9 to 13.

The lowest point of the plunger face 19 is also the region of the greatest draw, and the plunger is free to reciprocate vertically through a central opening in the upper holding die block B and into the well of the lower holding die block A.

In conformity with the shape of the article, a portion of the draw is made in the reverse direction from the movement of the plunger C in making the main draw, and the means for making this reverse draw is the die D having an upper face 20 corresponding to the shape of the article in the region remote from the end engaged by the lowest portion of the plunger.

The actuating means for this die, as clearly shown in Figs. 7 and 8, is a horizontally sliding cam block 21 mounted in the base of the die block A and having on its upper face stepped cam faces 22 adapted to coact with corresponding cam faces 23 on the lower side of the die D. It is guided in its longitudinal movement by gibs 24, and is actuated in the vertical movement of the plunger C by a vertical actuator block 25 secured to the head 18' carrying the ram or plunger C, and having an inclined cam face 26 acting on an inclined face of the cam block 21 to actuate it. To withdraw the block 21 to the inoperative position, the inclined upper faces of lateral ribs 26' on actuator block 25 engage the correspondingly inclined under side of the inwardly extending edge plungers 21' of the brackets 22' secured to the block 21.

Between the front and rear portions of maximum draw, there is a region of minimum draw and in this region, as indicated at 27 in Fig. 5, the metal of the blank has, heretofore, been pushed up into wrinkles. To avoid this objectionable condition, the apparatus of the invention is provided with means for transversely stretching the metal as indicated by the arrow *b* in said figure and to this end, opposite said region of minimum draw the lower holding die face 11 is formed with a longitudinally extending recess 28 lateral-

ly located between the blank gripping ribs and depressions on the lower and upper holding die faces 11 and 18, respectively, and the central well into which the ram C descends. The edges of this recess are rounded and the floating die E mounted for vertical movement in the upper die block is adapted to have its lower longitudinally and transversely rounded face 29 descend into this recess after the blank has been firmly gripped by the opposed holding die faces 11 and 18, and transversely stretch the blank to remove the excess metal in this longitudinal region of the blank prior to the final die drawing operation, and thus avoid the wrinkling of the metal in this region.

The die E is guided in a vertical slot 30 in the upper holding die block B and has at its upper end an inclined cam face 31 which is adapted to be engaged by a corresponding cam face 32 on an actuator block 33 guided for transverse movement in the block B, and itself adapted to be actuated by a vertically movable actuator block 34 secured to the vertically reciprocating ram carrying head 18'. This actuation is by the engagement of a cam face 35 on the lower end of the actuator 34 with a correspondingly inclined cam face 36 on the actuator block 33. After the block 33 has been moved transversely by the engagement of said cam faces, a vertical face 37 on the actuator 34 slides in engagement with a corresponding face 38 on the actuator block 33 and maintains it in operative position during the further descent of the head 18'. Suitable springs 33' act upon the block 33 to move it to inoperative position after it is released by the upward movement of the actuator 34.

From the foregoing description of the construction of the improved apparatus its operation will be readily understood from the following description of its operation when read in connection with the various figures of the drawings showing different successive stages of the operation.

A flat metal sheet roughly of the peripheral contour shown in the plan view of Fig. 5 is first placed over the lower holding die A with its peripheral portion resting on the face 11 of the lower holding die while the parts of the press are in the position shown in Figs. 6 and 10.

The press is then operated to cause the upper holding die B to descend and grip the margin of the blank between the mating faces 11 and 18, respectively, of the lower and upper holding dies, as shown in Fig. 11.

After the sheet is grasped by the holding dies, the lowest portion of the ram C strikes the sheet and starts the drawing operation in the region of the deepest draw at the front of the fender blank 12. This tends to draw the metal longitudinally of the blank as indicated by the arrow *a* in Fig. 5.

The successive movements of the dies take place substantially as indicated in Figs. 12, 13, 14, 15. The ram C continues to descend and the die D at the rear end of the fender is eventually actuated through actuator blocks 25, 21 to draw the rear end of the blank upwardly, and the auxiliary transverse stretching die E is actuated to stretch the metal of the blank transversely of the blank in the region of the minimum vertical draw intermediate the front and rear deeply drawn portions of the blank, all as clearly shown in the figures of the drawings above referred to.

The metal of the blank will thus be simultaneously subjected to drawing strains in the three directions indicated by the arrows *a*, *b* and *c* of Fig. 5.

In the final drawing movement of the dies C

and D, a longitudinally extending raised projection 40 at the side of the ram in the longitudinal region of the minimum draw opposite the stretching die E engages the blank and depresses it into a corresponding recess 41 in the lower holding die face and thus further transversely stretches the blank in this region and at the same time the entire blank is given the final drawing, which is completed when the parts reach the position shown in Fig. 7, when the blank is finally formed.

By so transversely stretching the metal of the blank transversely through die E and projection 40 in the intermediate region of minimum draw, while subjecting the opposite ends thereof to relatively deep drawing operations in the opposite directions, namely, down and up respectively, the portion of the blank which is retained in the final article, as shown in Figs. 1 and 2, emerges smooth and finished in contour and line. The objectionable wrinkles which heretofore have appeared in the region 27, Fig. 5, are by this method and apparatus entirely eliminated, and the entire fender stamping shown in Figs. 1 and 2 produced from a flat blank at one operation of the press.

After the stamping has been formed the movable dies recede to the positions shown in Figs. 6 and 10, and the stamping is removed from the press and subsequently trimmed along the dotted lines indicated in Figs. 4a and 5 to produce the finished complete fender shown in Figs. 1 and 2.

The operation of forming the stampings can proceed as rapidly as the press operation permits, a complete fender being formed at each operation. While the invention has been shown and described in connection with the manufacture of complete fenders, it will be understood that the outstanding feature thereof, namely, the stretching of the metal of the blank to remove excess metal from a region of minimum draw may be practiced in connection with the formation of irregularly shaped stampings of other forms and the particular structure of the apparatus by which this is achieved may be varied to suit the conditions of the particular form of stamping being made, without departing from the generic spirit of the invention as expressed in the claims appended hereto.

What we claim is:

1. Apparatus for die stamping large irregularly shaped sheet metal articles comprising means for rigidly clamping the side and end edges of an elongated blank, means independent of said clamping means for substantially stretching the blank transversely of its length in the plane of the blank when so clamped and means for die drawing the blank, when so stretched and rigidly held, movable generally transversely to the plane of the blank.
2. Apparatus for die drawing sheet metal articles of irregular form which consists of a bed having surfaces upon which the peripheral margins of the blank are adapted to rest, means co-acting with said surfaces to clamp the margins in place, a die movable generally transversely to the sheet for drawing and shaping it, and a stretching die independent of the clamping means and movable with respect thereto to substantially stretch the metal of the blank transversely in certain areas thereof to remove excess metal prior

to the final drawing of the blank to the required form.

3. Apparatus for die drawing sheet metal fenders comprising clamping means for holding the side and end peripheral portions of an elongated blank, a punch movable within said clamping means generally transversely to the plane of the blank to form the same, and a die actuated independently of the clamping means in the movement of said punch for engaging a peripheral portion of the blank and thereby substantially stretching the metal of the blank transversely in a region of minimum draw prior to the final drawing movement of the punch.

4. Apparatus for die drawing sheet metal fenders comprising a bed having a peripheral surface adapted to receive the margins of the blank, and a well within said surface, a die mounted in said bed for upward movement, a punch adapted for downward movement into said well, means associated with said punch for moving the said die upwardly while the punch moves downwardly to draw the metal of the blank in opposite directions at opposite ends thereof.

5. Apparatus for die drawing sheet metal fenders comprising a lower die having a peripheral surface for receiving the marginal portion of the blank, and a central hollow well, a vertically movable die adjacent one end of the well and a vertically movable ram, a clamping die surrounding the ram and movable to clamp the marginal portion of the blank between it and the peripheral surface of said first-named die, a vertically movable stretching die for stretching the blank in a region of minimum draw mounted in said clamping die, and means associated with said ram for actuating said stretching die and the vertically movable die in the approach movement of the ram for forming the blank.

6. Apparatus for die drawing sheet metal articles of irregular form which consists of lateral and end hold down surfaces, a hold down die gripping the metal of a blank between it and said surfaces and leaving a central portion free to be drawn, a movable drawing die movable into engagement with the sheet to form it, and a stretching die movable independently of the hold-down die to substantially stretch the blank in a region of minimum draw engaged by means associated with the drawing die prior to the final drawing movement of the drawing die.

7. Apparatus for die drawing large irregularly formed articles from a flat sheet at one stroke of the apparatus including holding dies for clamping the side and end peripheral portions of an elongated blank, a main plunger for drawing the metal of the blank in one direction to the maximum depth of draw, an auxiliary plunger cooperating with the main plunger for drawing the metal independently of the holding dies from a region of minimum draw simultaneously with the drawing operation of the main plunger to remove excess metal from said region of minimum draw and prevent the formation of wrinkles in the final stroke of the apparatus, and means for operating said parts in properly synchronized relation.

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