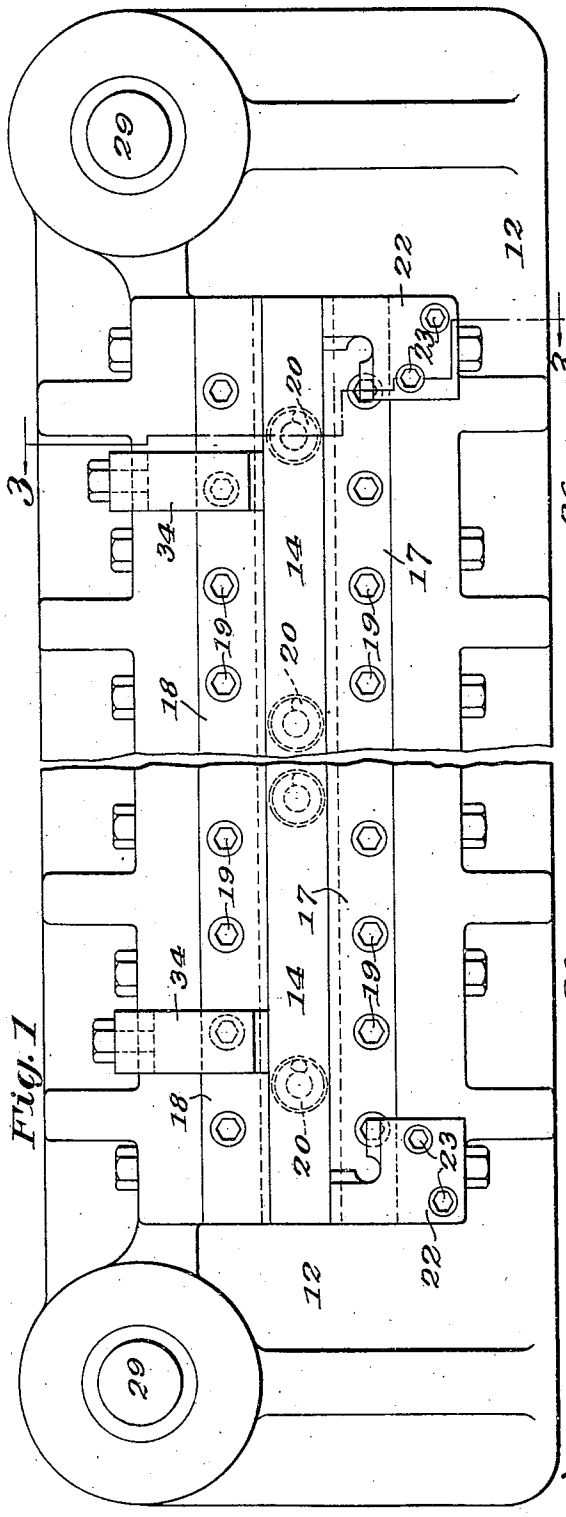
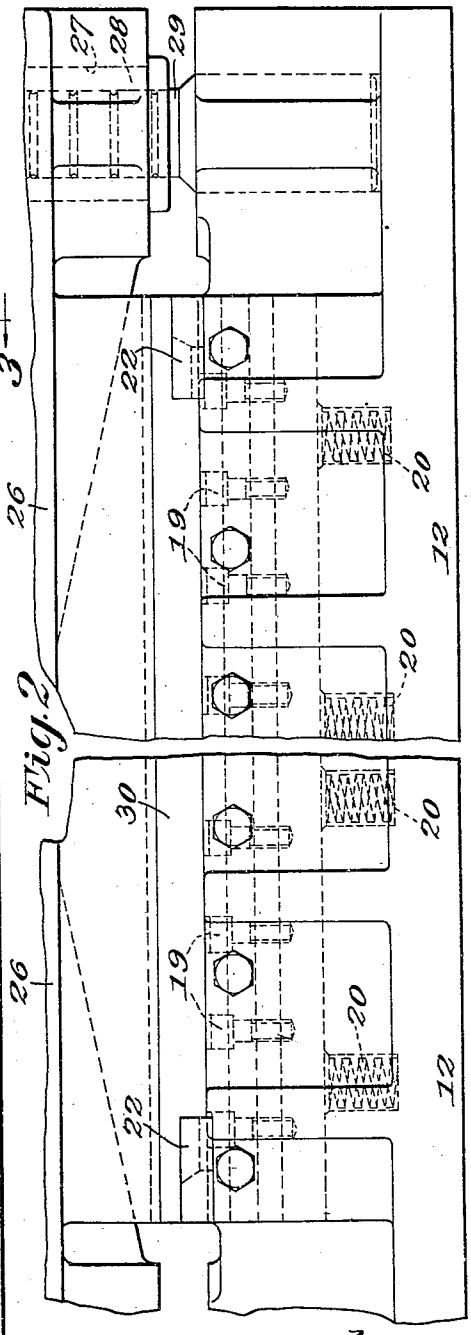
April 9, 1929. O. J. GROEHN ET AL 1,708,615

METHOD OF SHAPING SHEET METAL

Filed Dec. 28, 1927 10 Sheets-Sheet 1





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METHOD OF SHAPING SHEET METAL

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Fig. 3

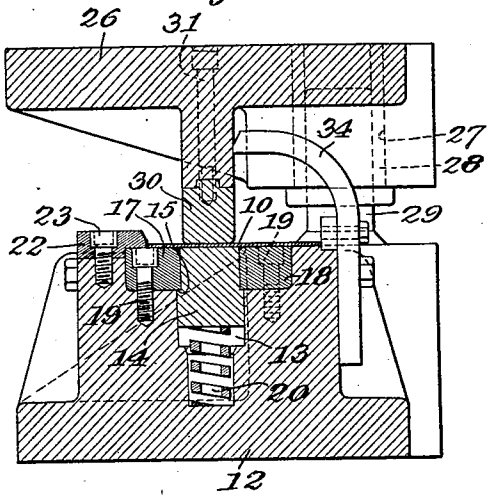


Fig. 4

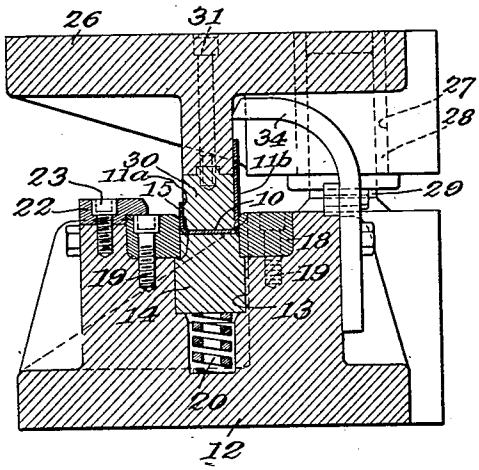


Fig. 6

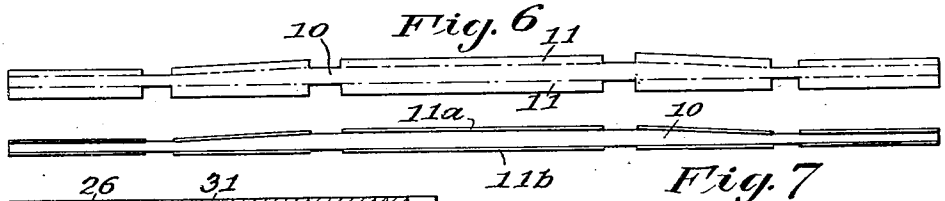


Fig. 7

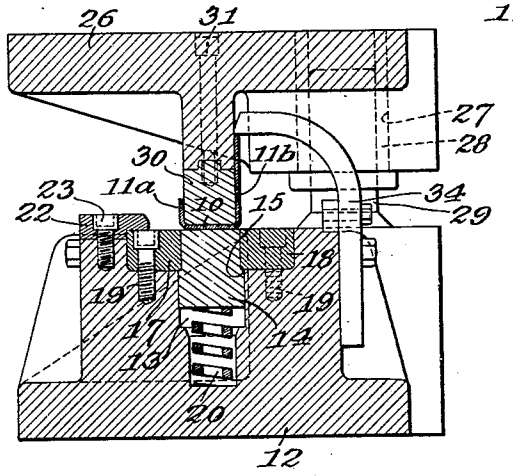


Fig. 5

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April 9, 1929. O. J. GROEHN ET AL 1,708,615

METHOD OF SHAPING SHEET METAL

Filed Dec. 28, 1927 10 Sheets-Sheet 3

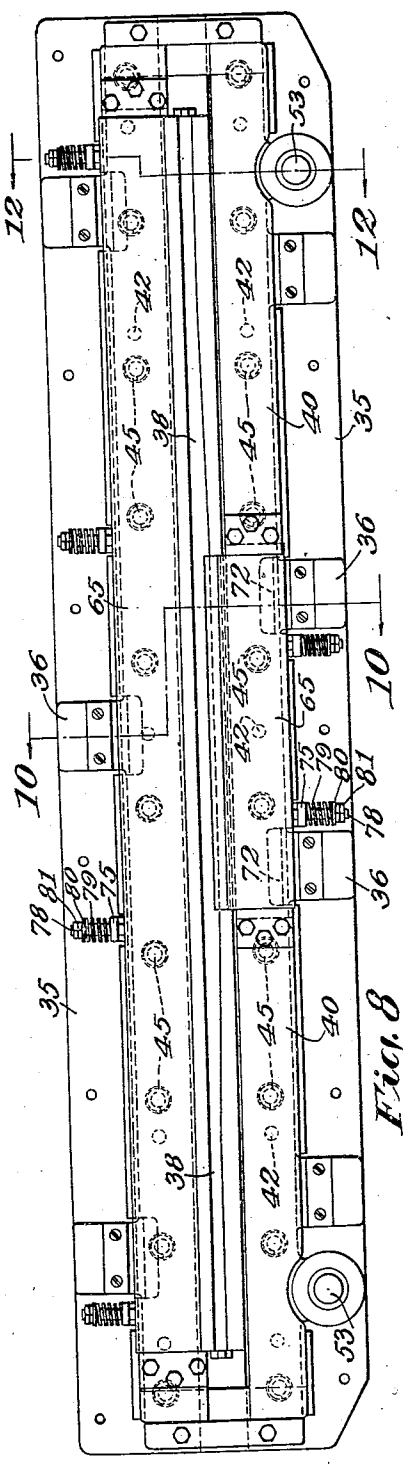


Fig. 8

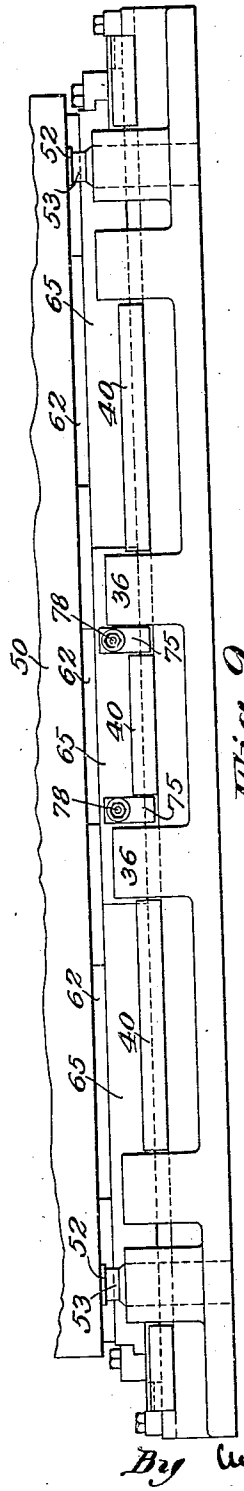


Fig. 9

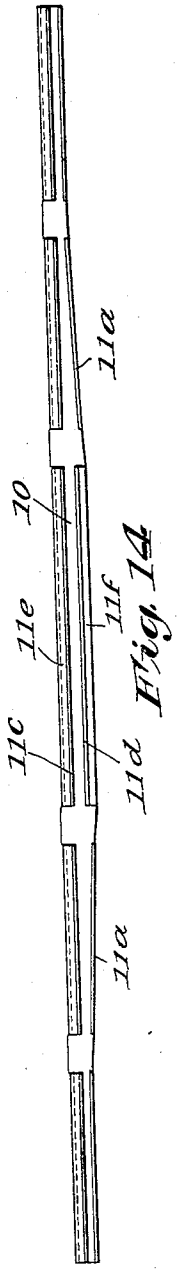


Fig. 14

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April 9, 1929. O. J. GROEHN ET AL 1,708,615

METHOD OF SHAPING SHEET METAL

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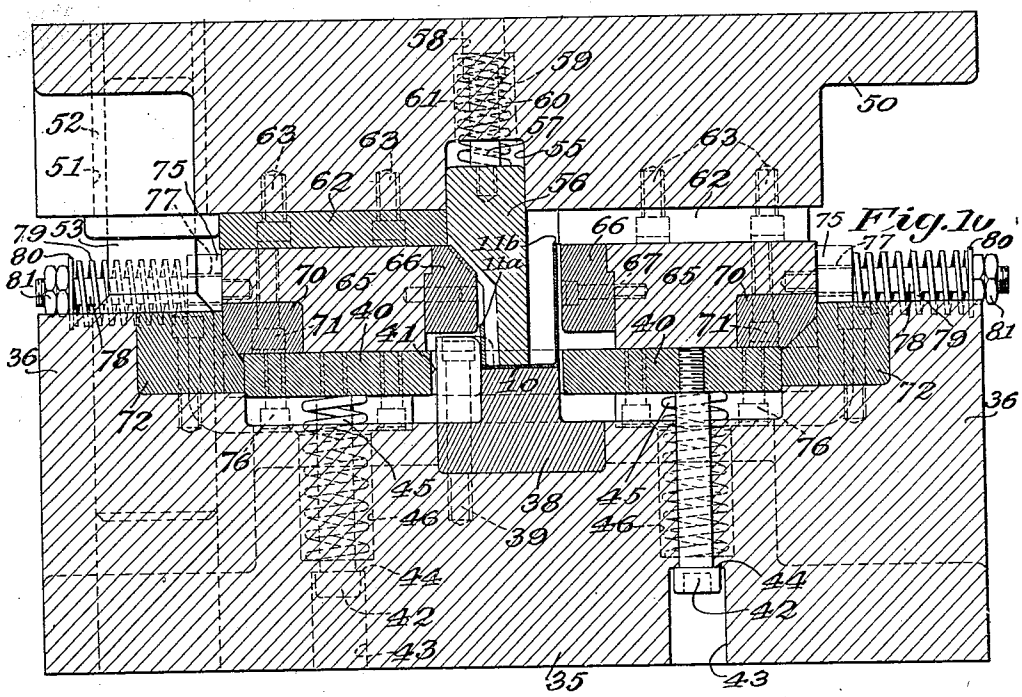


Fig. 10

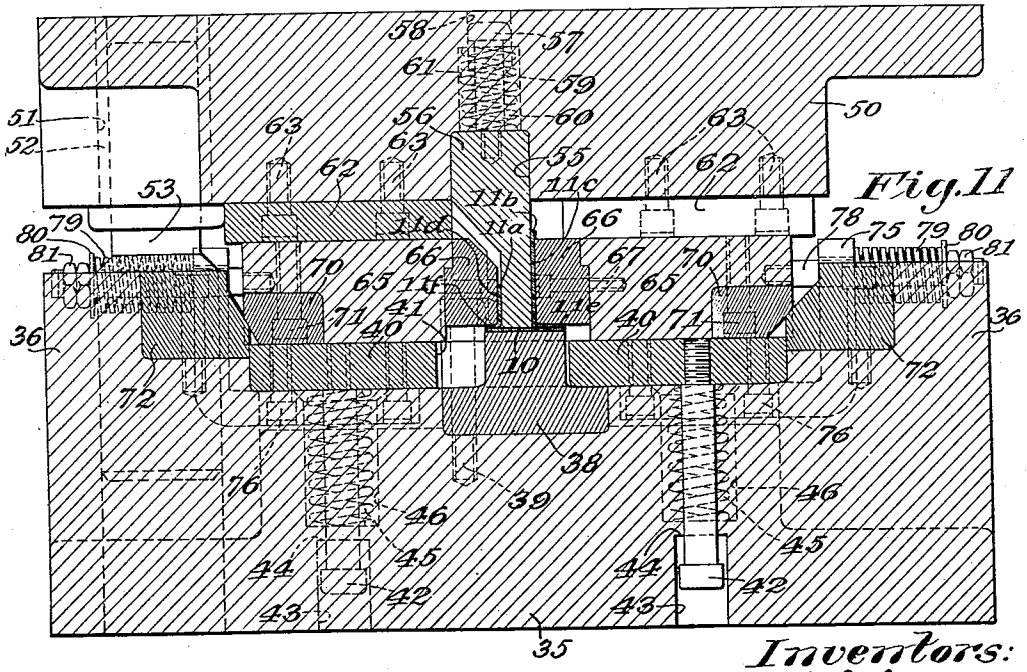


Fig. 11

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April 9, 1929. O. J. GROEHN ET AL 1,708,615

METHOD OF SHAPING SHEET METAL

Filed Dec. 28, 1927 10 Sheets-Sheet 5

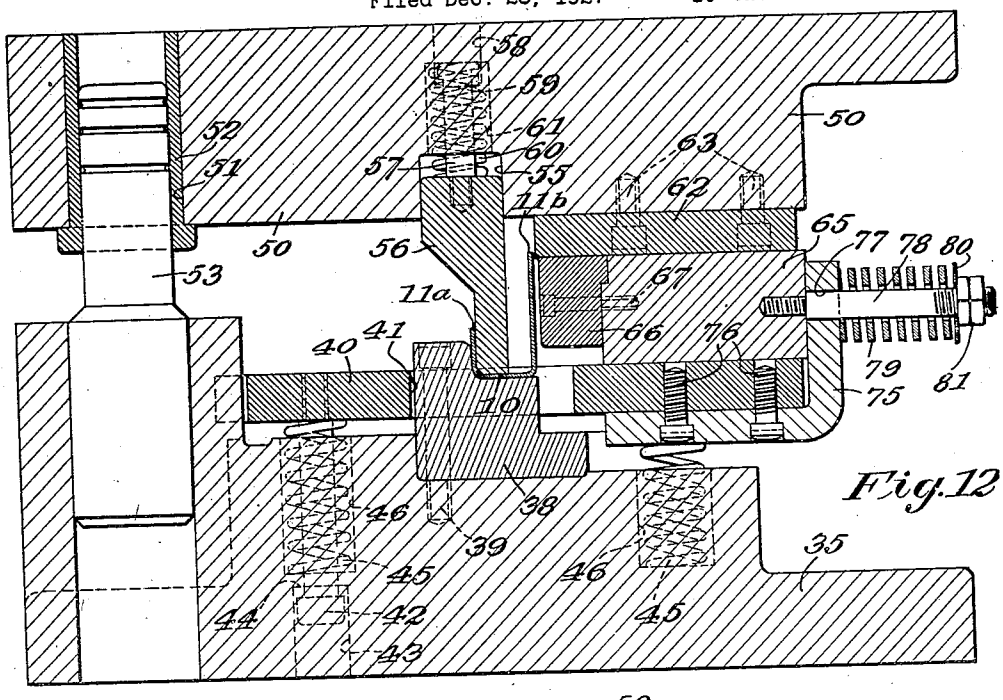


Fig. 12

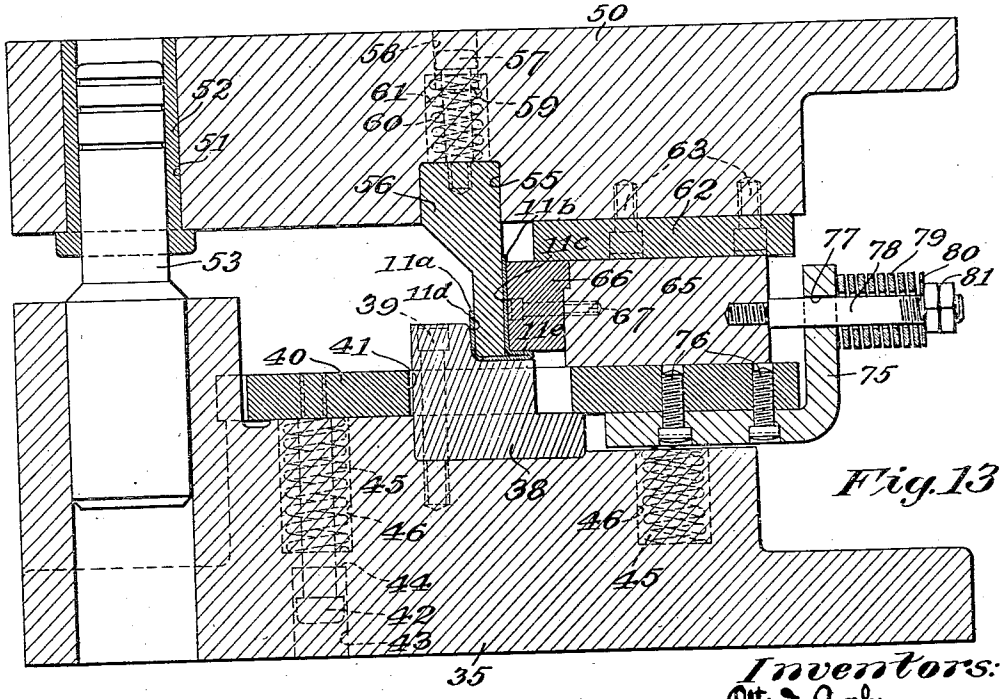


Fig. 13

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April 9, 1929. O. J. GROEHN ET AL 1,708,615

METHOD OF SHAPING SHEET METAL

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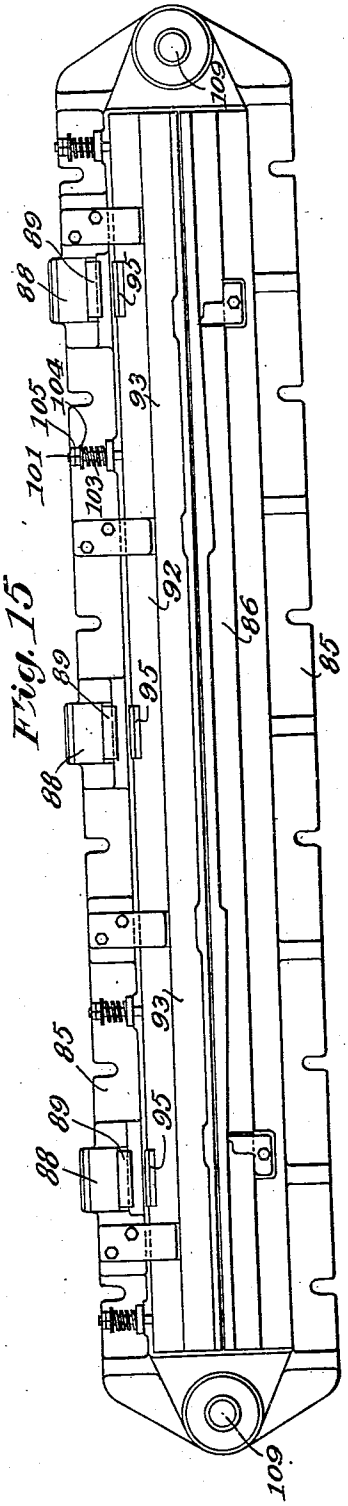


Fig. 15

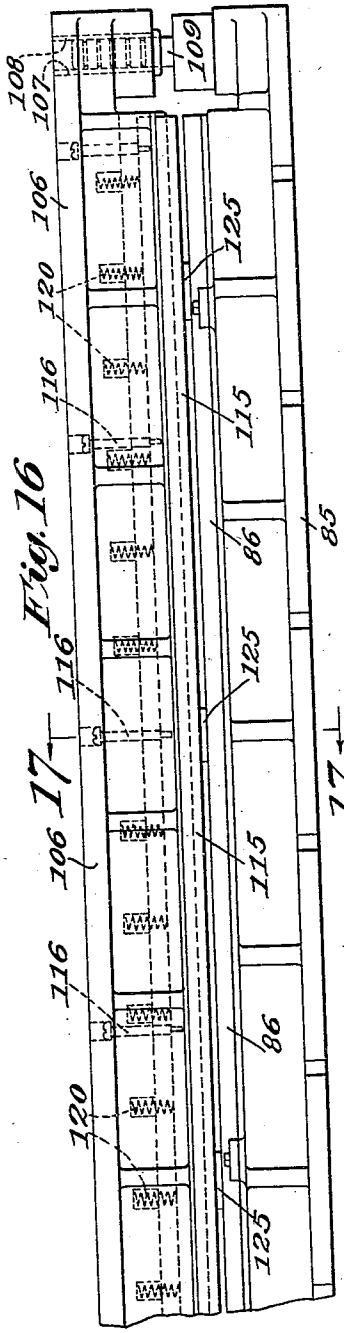


Fig. 16

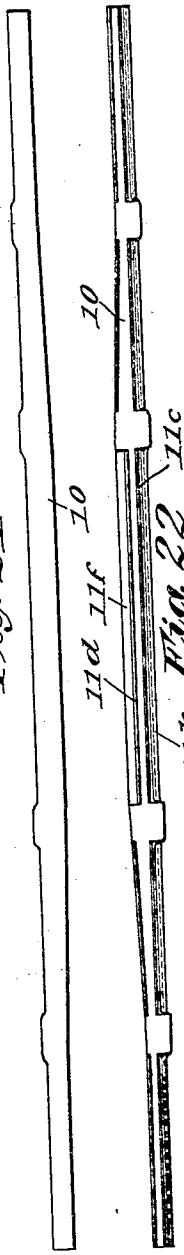


Fig. 21

Fig. 22

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April 9, 1929. O. J. GROEHN ET AL 1,708,615

METHOD OF SHAPING SHEET METAL

Filed Dec. 28, 1927 10 Sheets-Sheet 7

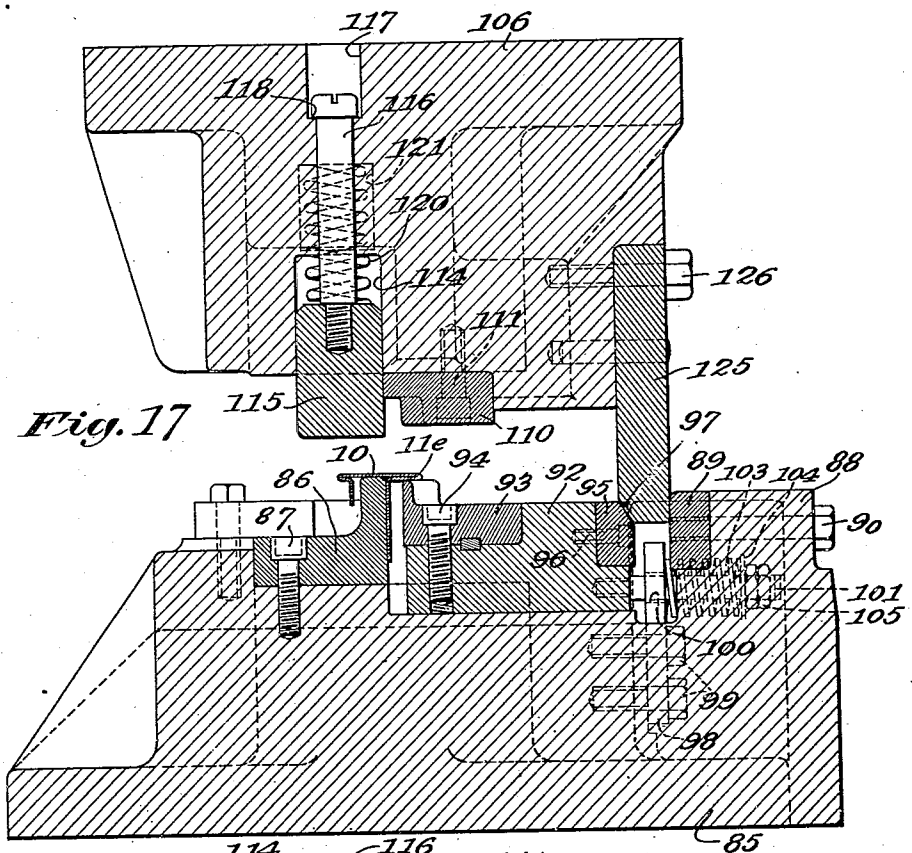


Fig. 17

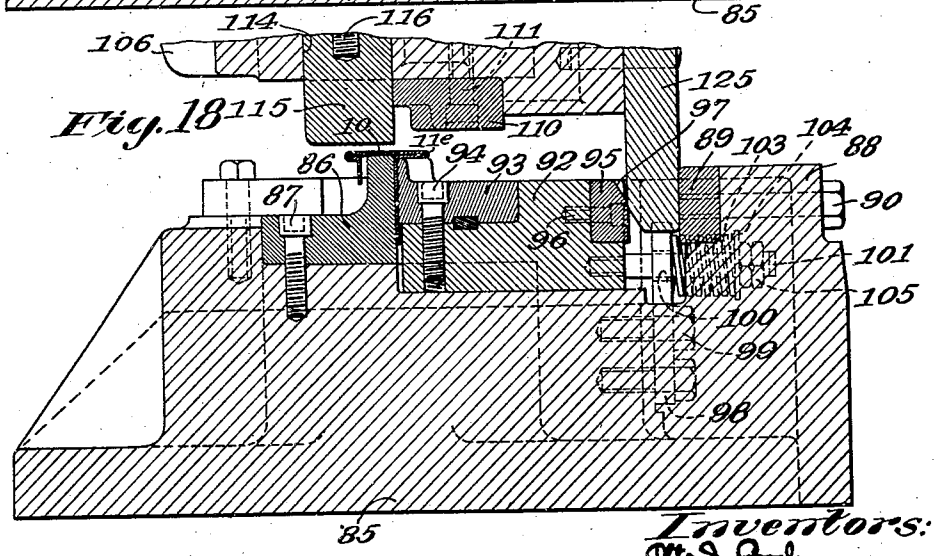


Fig. 18

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April 9, 1929. O. J. GROEHN ET AL 1,708,615

METHOD OF SHAPING SHEET METAL

Filed Dec. 28, 1927 10 Sheets-Sheet 8

Fig. 19

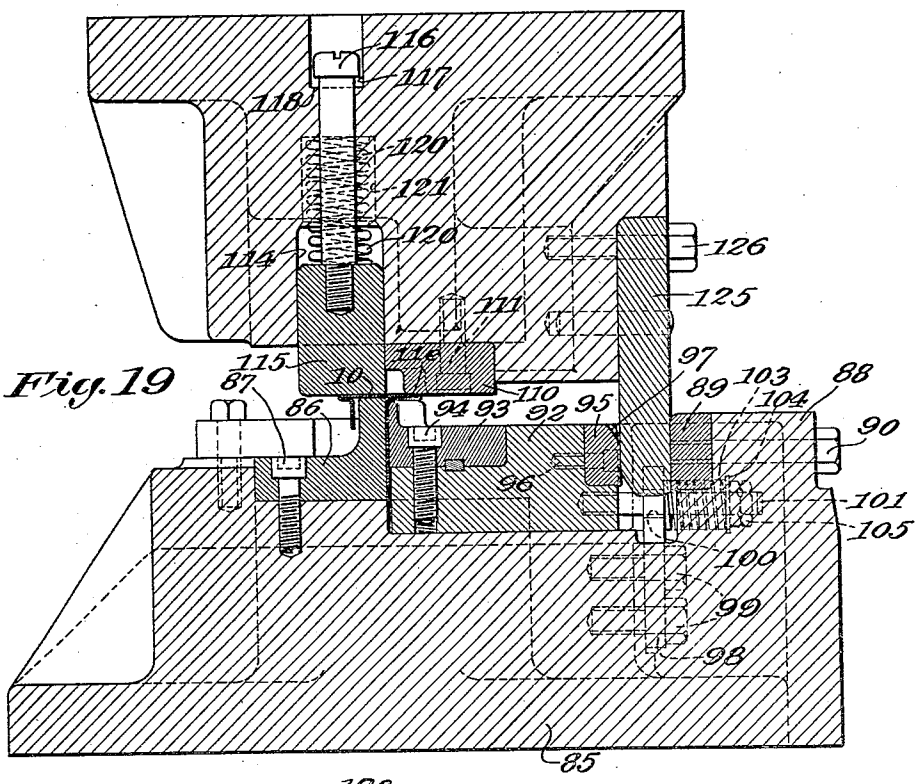
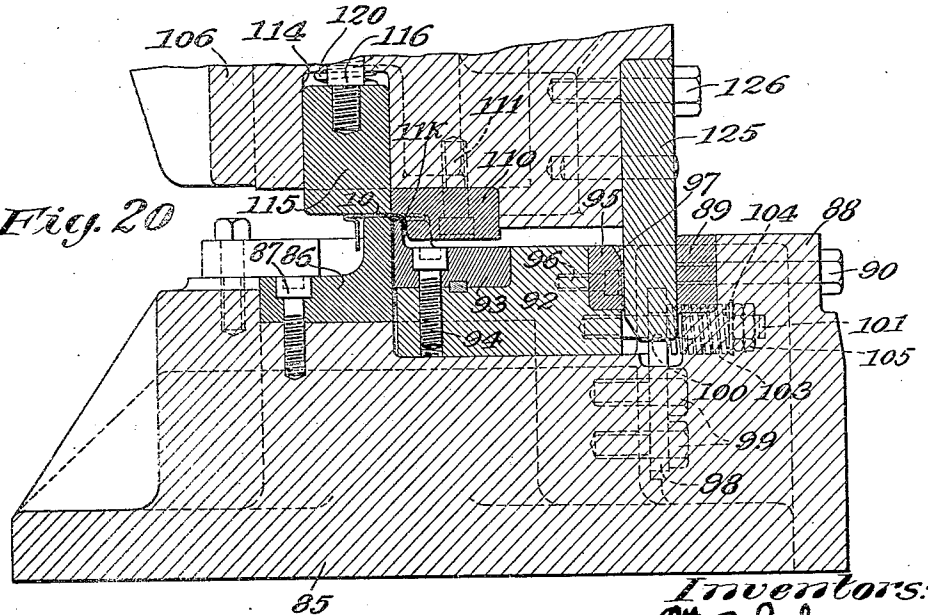


Fig. 20



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April 9, 1929. O. J. GROEHN ET AL 1,708,615

METHOD OF SHAPING SHEET METAL

Filed Dec. 28, 1927 10 Sheets-Sheet 9

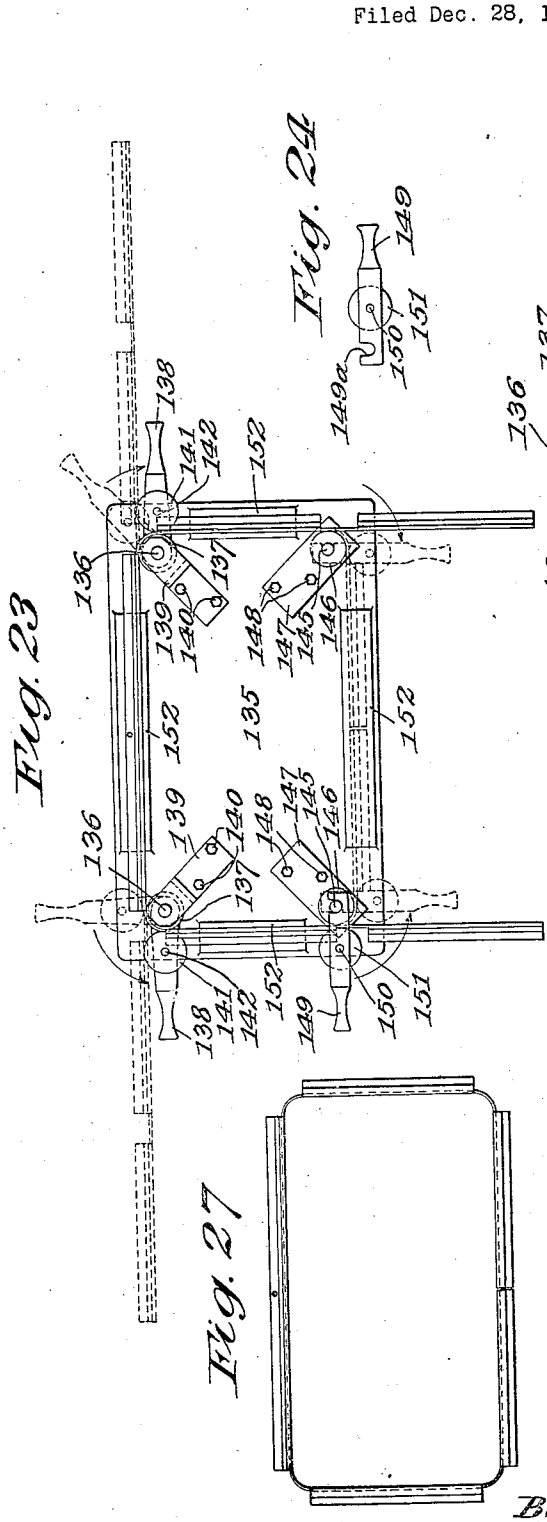


Fig. 23

Fig. 24

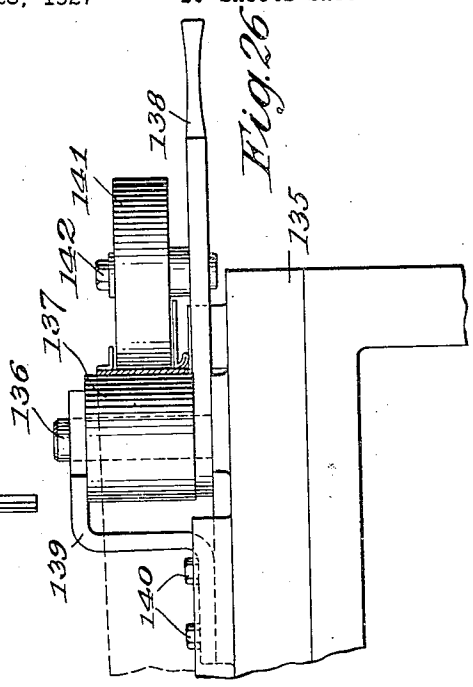


Fig. 26

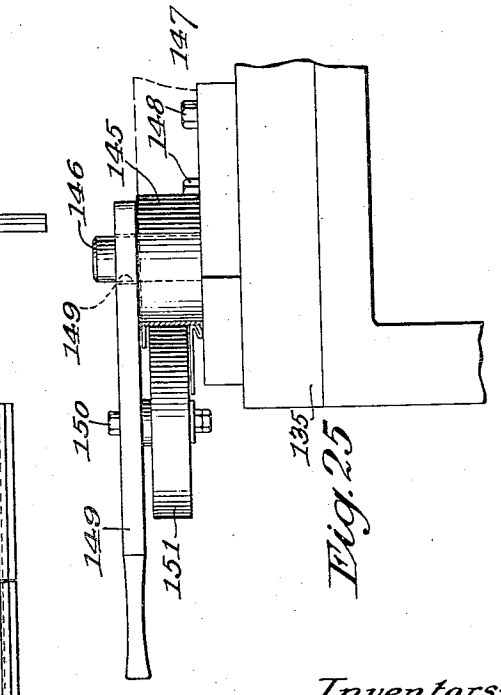


Fig. 25

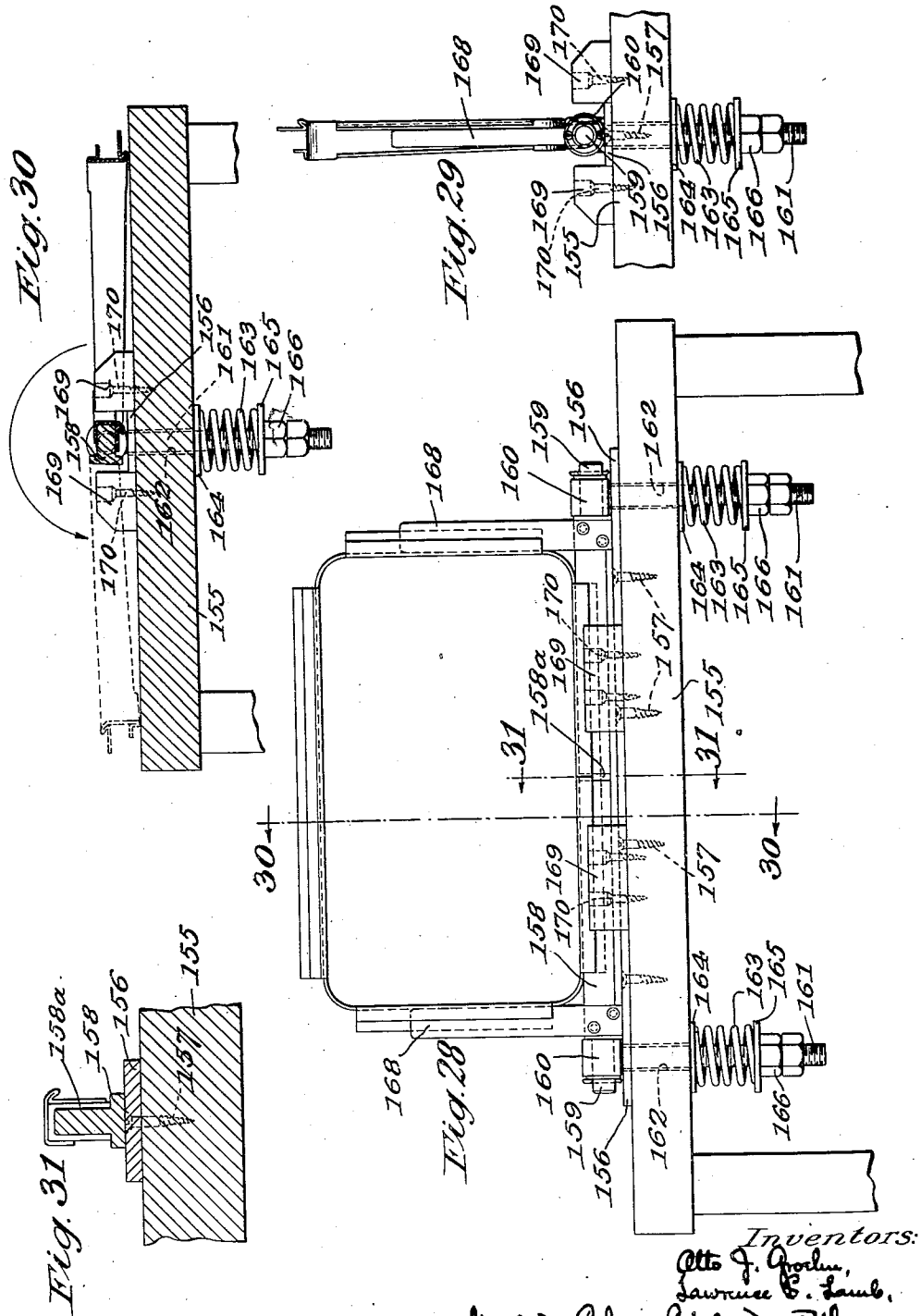
Fig. 27

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METHOD OF SHAPING SHEET METAL

Filed Dec. 28, 1927 10 Sheets-Sheet 10



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UNITED STATES PATENT OFFICE.

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METHOD OF SHAPING SHEET METAL.

Application filed December 28, 1927. Serial No. 243,030.

This invention relates to a method of shaping sheet metal and more particularly to the production of a quarter window finish molding for an automobile body.

It is an object of the invention to provide an improved method whereby articles of this type may be produced rapidly and efficiently upon a modern production basis.

Before explaining in detail the present invention, and the method or mode of operation embodied therein, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation, and it is not intended to limit the invention beyond the terms of the several claims hereto appended or the requirements of the prior art.

The invention will be more clearly understood from the following description, in conjunction with the accompanying drawings; in which,

Fig. 1 is a plan view of the lower half of an apparatus for performing one of the operations;

Fig. 2 is a fragmentary side elevational view of the same;

Figs. 3, 4 and 5 are sectional views taken upon the line 3—3 of Fig. 1 showing respectively the relation of the parts at the beginning of the operation, at the time the work is completed, and as the work is about to be ejected;

Fig. 6 is a plan view of a suitable blank after it has been cut;

Fig. 7 is a plan view of the blank as shaped by the first folding operation;

Fig. 8 is a plan view of the lower half of an apparatus for performing the second folding operation;

Fig. 9 is a side elevational view of the same;

Figs. 10 and 11 are sectional views taken upon the line 10—10 of Fig. 8, showing the relation of the parts at the beginning and completion of operation respectively;

Figs. 12 and 13 are sectional views taken upon line 12—12 of Fig. 8;

Fig. 14 is a plan view of the blank as shaped during the second folding operation;

Fig. 15 is a plan view of the lower half of an apparatus for performing the third folding operation;

Fig. 16 is a side elevational view of the same;

Figs. 17, 18, 19 and 20 are sectional views taken upon line 17—17 of Fig. 16, showing the relation of the various parts at different stages from the beginning to the completion of the operation.

Figs. 21 and 22 are plan views of the opposite sides of the body of the blank respectively, after the completion of this operation;

Fig. 23 is a plan view of an apparatus for performing the fourth folding operation;

Fig. 24 is a detail view of a detachable portion of the same;

Figs. 25 and 26 are fragmentary elevational views of portions of the apparatus showing the permanently and detachably mounted devices respectively for shaping the blank around the supports for defining the vertices of the polygon;

Fig. 27 is a plan view of the blank as shaped by this operation;

Fig. 28 is a front elevational view of an apparatus for performing the welding operation;

Fig. 29 is an end elevational view of the same;

Fig. 30 is a sectional view taken upon line 30—30 of Fig. 28, showing the frame in a horizontal position.

Fig. 31 is a sectional view taken upon line 31—31 of Fig. 28, showing the frame in vertical position.

In practice of the invention a blank of sheet material is cut to suitable size and shape so that it may be subsequently folded to form the desired article. In the production of an article, such as a quarter window finish molding for an automobile, the sheet material is cut to provide a body 10 from which extends a plurality of spaced projections 11 (as shown in Fig. 6). The projections 11 are then turned inwardly, preferably at their line of connection with the body of the blank, to provide flanges 11^a and 11^b. A suitable apparatus for performing this operation comprises a base 12 (see Figs. 1–5) having a central opening 13 to receive for sliding engagement therewith a block 14 provided with shoulders 15. Suitable wearing blocks 17 and 18 are secured in any suitable manner, as by screws 19, upon the top surface of the base so as to extend slightly into the opening

13. The block 14 normally is held upwardly with the shoulders 15 engaging the bottom inner edge of the blocks 17 and 18 by springs 20, the block 14 being shaped so that when it is thus positioned its top surface will be substantially flush with the top surfaces of the blocks 17 and 18. Positioning blocks 22 are secured in any suitable manner, as by screws 23, to the top surface of the base and serve to position accurately the blank to bring the body 10 above the opening 13 in the base. A ram 26 is provided to move toward and away from the base, and with this in view is provided with openings 27 for collars 28 adapted to receive for sliding engagement therewith guides 29 fixed in the base. An upper die 30 is suitably secured upon the ram 26, as by screws 31, and is positioned thereon to move downwardly to carry the body 10 of the blank into the opening 13 of the base and fold the projections 11 inwardly by engagement thereof with the blocks 17 and 18. Stripping bars 34 are secured upon the base and are positioned to engage the blank and remove the same from the upper die 30 as the ram is raised.

In performing this operation, the blank is placed upon the blocks 17 and 18 and against the blocks 22 so as to bring the body 10 above the opening 13 and with the projections 11 extending over the blocks 17 and 18. The ram 26 is then lowered to engage the body of the blank and hold the same against the block 14. On further downward movement of the ram the projections 11 of the blank are drawn into the opening 13 and folded between the blocks 17 and 18 and the upper die 30 to form flanges 11^a and 11^b (as shown in Fig. 7).

One or more of the flanges 11^a or 11^b are then offset. A suitable apparatus for this purpose may comprise a base 35 (see Figs. 8–13) having spaced projections 36 extending upwardly therefrom. A suitable member 38 is positioned between the projections 36 and secured upon the top surface of the base in any suitable manner, as by screws 39, and serves to support the body of the blank. A plate 40 is provided with an opening 41 to provide clearance for the member 38 and is movably secured to the base by bolts 42 having threaded engagement with the plate 40 and passing through openings 43 in the base. The openings 43 are provided with shoulders 44 adapted to engage the head of the bolts and serve as a stop therefor. The plate 40 normally is held in an extended position by springs 45 supported in recesses 46 in the base and engaging the lower surface of the plate.

A ram 50 is arranged for movement toward and from the base, and with this in view is provided with openings 51 for collars 52 adapted to receive for sliding engagement therewith guides 53 fixed in the base. A recess 55 is provided in the lower surface of the ram directly above the member 38 to receive for movement therein a mandrel 56. The mandrel 56 is held upon the ram 50 by bolts 57 threaded to the mandrel and passing through openings 58 provided with shoulders 59 to engage the head of the bolt and serve as a stop therefor. The mandrel normally is held in extended position by springs 60 within recesses 61 and extending to engage the top surface of the mandrel. Bearing blocks 62 are secured to the lower surface of the ram upon opposite sides of the mandrel 56 in any suitable manner, as by screws 63.

Dies 65 are movably mounted upon the plate 40 on opposite sides of the member 38 and are provided on their inner surface with wearing blocks 66 secured thereto in any suitable manner, as by screws 67. A wearing block 70 is secured, as by screws 71, to the outer lower edge of each die and each is adapted for engagement with a wearing block or cam 72 upon the inner surface of one of the projections 36.

Suitable means are provided for holding the dies away from the mandrel 56 and member 38. For this purpose brackets 75 are secured to the plate 40 in any suitable manner, as by screws 76, and are provided near their upper free ends with openings 77 to permit the free passage of bolts 78 secured at one end to the dies 65. A spring 79 surrounds each bolt 78 and extends between the brackets 75 and washers 80 positioned and held near the free ends of the bolts by nuts 81.

In performing this operation the blank is placed in the apparatus with the body of the blank resting upon the support 38 and with the flanges 11^a and 11^b extending upwardly. The ram 50 is then lowered to bring the mandrel 56 between the flanges and into engagement with the body of the blank to hold the same against the member 38. Upon further downward movement of the ram 50, the bearing plates 62 engage the top surface of the dies 65 to move the same downwardly together with the plate 40. In the course of the downward movement of the dies, the wearing blocks 70 are brought into engagement with the cams 72 whereby the dies are moved inwardly in a direction perpendicular to the direction in which they are moved solely by the ram, thereby imparting a resultant movement to the dies inclined to the member 38 and mandrel 56 to cause the blocks 66 to engage the flanges to fold them along the lines of previous fold the portions 11^c and 11^d of flanges 11^b and 11^a respectively against the mandrel 56 and the portions 11^e and 11^f of the flanges 11^b and 11^a respectively against the body of the blank upon the member 38.

When the blank has been shaped in this manner, the ram 50 is raised to remove the mandrel 56 from the blank and the plates 62 from the dies 65. At the same time the springs 45 raise the plate 40 together with

the dies 65, and the springs 79 act upon the dies to move them outwardly along the cams 72. During this operation each flange on one side of the body 10 of the blank is offset while only the central flange upon the other side of the body is offset.

A portion of the body is then turned inward. A suitable apparatus for this purpose may comprise a base 85 (Figs. 15–20) having a block 86 secured in any suitable manner, as by screws 87, to the top surface of the base near one side thereof for supporting the body of the blank with a flange overhanging and engaging the side of the block. A plurality of projections 88 extend upwardly at one side of the base and have wearing blocks 89 secured to their inner upper edges in any suitable manner, as by bolts 90. A lower die member 92 is mounted for movement along the top surface of the base between the projections 88 and the block 86. A hardened die block 93 having a cam surface 97 is secured upon the inner upper edge of the die 92, as by screws 94, and a hardened wearing block 95 is secured to the upper outer edge of the die, as by screws 96.

The die 92 normally is held away from the block 86 in any suitable manner. As illustrated, a bracket 98 is secured to the base, as by bolts 99, and is provided near its upper end with an opening 100 adapted to permit the free passage of a bolt 101 secured to the die 92. A spring 103 surrounds the bolt 101 and extends between the outer surface of the bracket 98 and a washer 104 positioned and held near the outer end of the bolt, as by nuts 105.

A ram 106 is adapted for movement towards and from the base and for this purpose is provided with openings 107 for collars 108 adapted to receive for sliding engagement therewith suitable guides 109 fixed in the base. A hardened upper die block 110 is secured to the lower surface of the ram 106, as by screws 111, and is positioned to engage and shape a portion of the body of the blank around the lower die block 93.

A recess 114 is provided in the lower surface of the ram to receive for movement therein a work gripping member 115 which is secured to the ram by bolts 116 secured to the member 115 and passing through openings 117 in the ram provided with shoulders 118 adapted to engage the head of the bolt and serve as a stop. The member 115 normally is held in extended position by springs 120 positioned in recesses 121 in the ram and engaging the top surface of the member 115. A cam 125 is secured near one edge of the ram 106 as by bolts 126 and depends therefrom so as to enter the space between the blocks 89 and 95 upon the projections 88 and lower die 92 respectively.

To turn the projecting portion 11^e of the body of the blank inward the blank is supported in inverted position upon the block 86 with the flanges 11^b overhanging and engaging the side of the block. The ram 106 is then lowered to bring the work gripping member 115 into engagement with the body of the blank and hold the same yieldingly against the member 86. At the same time the cam 125 engages the cam surface 97 upon the lower die and moves the latter into engagement with the flanges 11^a of the blank and holds the same against the side of the block 86 thereby positioning the lower die block 93 beneath the portion 11^e of the body of the blank. Upon further downward movement of the ram, the upper die block 110 is brought into engagement with the portion 11^e of the body of the blank and shapes the same against the lower die block 93 to turn the portion 11^k inwardly.

The thus shaped strip of sheet metal is then folded to the polygonal shape of the window opening so as to bring the free ends of the strip together. A suitable apparatus for this purpose may comprise a table 135 (Figs. 23–27) having pins 136 mounted therein upon which suitable supports 137, such as rolls, are pivotally mounted, and which are positioned to define two adjacent vertices of the polygon. In the form illustrated the rolls 137 are mounted upon the pins 136 between a lever 138, pivotally mounted upon the pins 136 adjacent the top surface of the table, and brackets 139 extending from near the top of the pins 136 to the table and secured to the latter in any suitable manner, as by bolts 140. A roll 141 is pivotally mounted upon a stud 142 on each lever 138 and is positioned to engage the body of the strip of sheet metal and shape the same against the corresponding support or roll 137.

The supports defining the other vertices of the polygon may conveniently be in the form of rolls 145 pivotally mounted upon pins 146 mounted in plates 147 which are secured to the top surface of the table in any suitable manner, as by bolts 148. A detachable manually operated device, such as a lever 149, is provided with a notch 149^a for detachably and pivotally connecting the lever to the pins 146. The levers 149 are provided with studs 150 carrying rolls 151 positioned to engage the body of the strip of sheet metal and shape the same about the rolls 146. In order that the strip of sheet metal may be elevated to a suitable position relative to the rolls 137 and 145, the table is provided with suitable upwardly extending projections 152 which engage and support the strip of sheet metal between the supports or rolls defining the vertices of the polygon.

In shaping the strip of sheet metal the outer surface of the body of the sheet metal adjacent the central flanges is positioned to extend between and against the rolls 137 and with rolls 141 against the inner surface of the

body of the sheet metal. The strip of sheet metal is then bent manually at right angles around each of the rolls 137 and thereafter the levers 138 are manually operated in the direction of the arrows (Fig. 23) to bring the rolls 141 against the body of the strip of sheet metal and shape the same around the rolls 137. The strip of sheet metal is then bent at right angles around each of the rolls 145 to bring the free ends together. The levers 149 are then mounted upon the pins 146 so as to bring the rolls 151 into engagement with the body of the strip of sheet metal which then is shaped around the rolls 145 by turning the levers 147 in the direction of the arrows (Fig. 23).

The free ends of the strip of sheet metal are then welded together. A convenient apparatus for use in this connection may comprise a table 155 (Figs. 28–31) having a plate 156 secured to the top surface thereof in any suitable manner as by screws 157. A frame comprising a T-shaped base 158 having a slot 158ª is provided with cylindrical projections 159 mounted in bearings 160. The bearings 160 are secured to the table 155 by bolts 161 passing freely through openings 162 in the table and extending beyond the lower surface of the table. The extension of each of the bolts 161 is surrounded by a spring 163 extending between a washer 164 abutting the bottom surface of the table and a washer 165 held and secured near the outer ends of the bolts, by nuts 166. The T-shaped frame is provided with upright members 168 secured to the frame adjacent the projections 159. Blocks 169 are secured to the table, as by screws 170.

The strip of sheet metal folded to the shape of a polygon with the free ends together is placed in the frame with opposite sides engaging the upright members 168 and with the portions adjacent the free ends of the strip of sheet metal engaging the T-shaped frame member 158 directly above the slot 158ª. With the frame in a vertical position the free ends of the body of the strip of sheet metal are welded together and the frame is turned to bring the frame members 168 to a horizontal position. The free ends of one set of flanges are then welded together and the frame turned to bring the members 168 in a horizontal position on the opposite side of the original vertical position and the free ends of the other set of flanges are welded together. The springs 163 permit yielding of the bearings 160 to provide clearance for the bottom of the T-shaped frame 158 when being turned and yet hold the frame rigidly in the position to which it has been turned.

What we claim is:

1. The method of shaping sheet metal which comprises cutting a blank to provide a body and a plurality of spaced projections extending therefrom, folding the projections at their line of connection with the body to provide inwardly extending flanges, offsetting one of said flanges, and turning a portion of the body inward, bending the blank between the flanges to bring the ends of the blank together, and welding the ends to form a continuous article.

2. The method of shaping sheet metal which comprises cutting a blank to provide a body and a plurality of spaced projections extending therefrom, folding the projections at their line of connection with the body to provide inwardly extending flanges, offsetting one of said flanges, turning an adjacent portion of the body inward, bending the blank between the flanges to bring the ends of the blank together, and welding the ends to form a continuous article.

3. The method of shaping sheet metal which comprises cutting a blank to provide a body and a plurality of spaced projections extending from each side thereof, folding the projections at their line of connection with the body to provide inwardly extending flanges, offsetting all the flanges on one side and one of the flanges on the other side of the body, turning inward a portion of the body on one side thereof, bending the blank between the flanges to bring the ends of the blank together, and welding the ends to form a continuous article.

In testimony whereof we affix our signatures.

LAWRENCE S. LAMB.
OTTO J. GROEHN.