T. M. HARRISON.

SHAPING OF SHEET METAL.

APPLICATION FILED SEPT. 2, 1919.

1,329,969.

Patented Feb. 3, 1920.

2 SHEETS—SHEET 1.

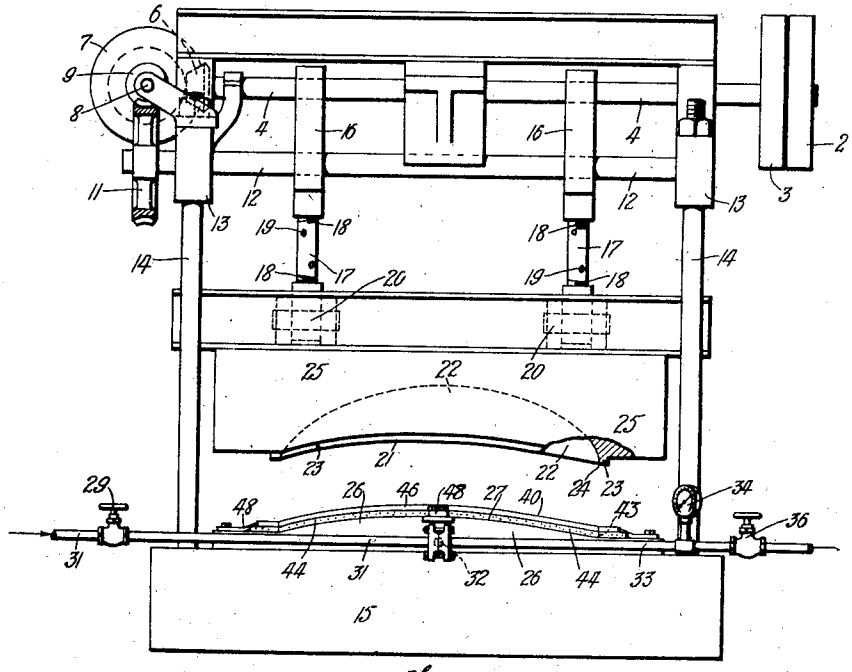


Fig. 1.

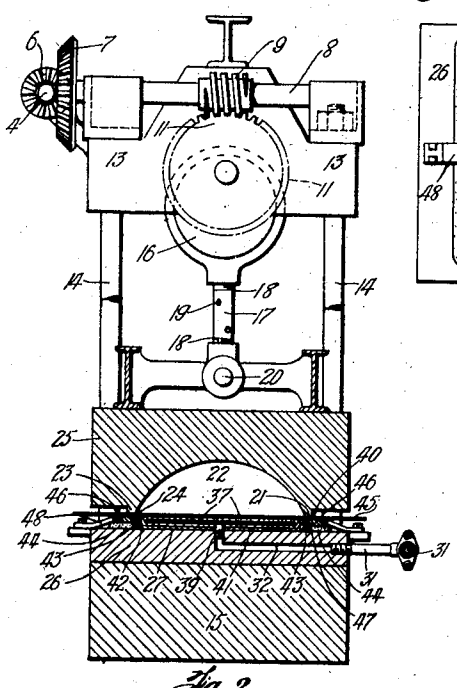


Fig. 2

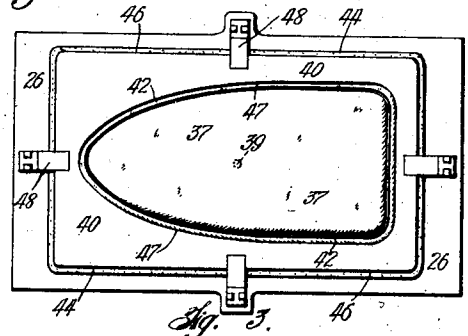


Fig. 3.

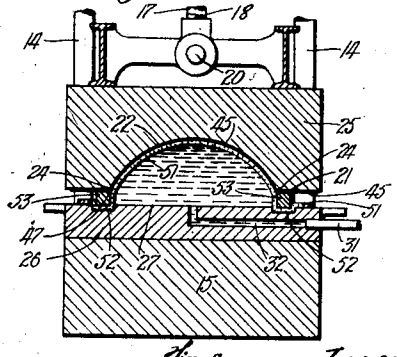


Fig. 4.

Inventor:
Theodore Marfleet Harrison
By Louis Bonnell & Co
Attorney.

T. M. HARRISON.

SHAPING OF SHEET METAL.

APPLICATION FILED SEPT. 2, 1919.

1,329,969.

Patented Feb. 3, 1920.

2 SHEETS—SHEET 2.

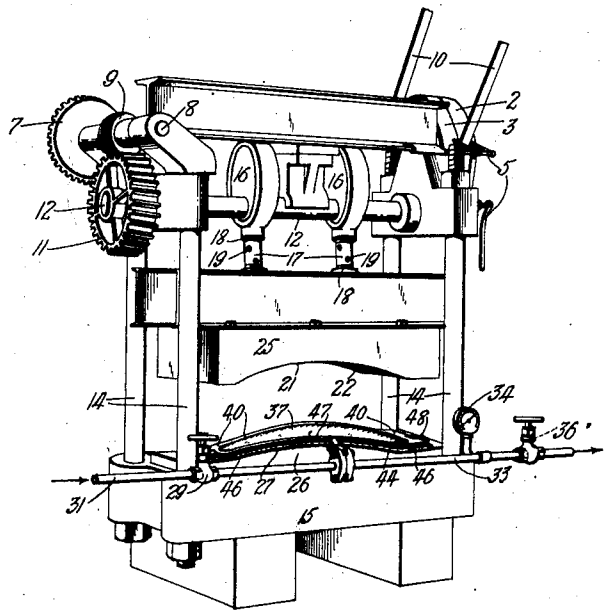


Fig. 5.

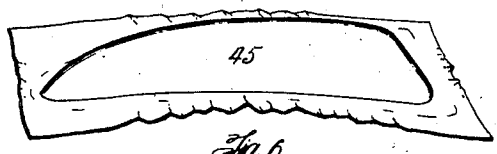


Fig. 6.

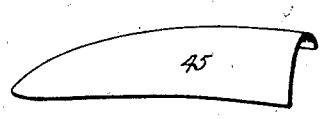


Fig. 7.

Inventor:

Theodore Marfleet Harrison

By Louis Painwelz he

Attorney.

UNITED STATES PATENT OFFICE.

THEODORE M. HARRISON, OF HAWTHORN, MELBOURNE, VICTORIA, AUSTRALIA.

SHAPING OF SHEET METAL.

1,329,969. Specification of Letters Patent. Patented Feb. 3, 1920.

Application filed September 2, 1919. Serial No. 321,116.

To all whom it may concern:

Be it known that I, THEODORE MARFLEET HARRISON, a subject of the King of Great Britain and Ireland, residing in the city of Hawthorn, a suburb of the city of Melbourne, in the county of Bourke, State of Victoria, Commonwealth of Australia, and whose post-office address is 2 Hill street, in the said city of Hawthorn, have invented certain new and useful Improvements in and Connected with the Shaping of Sheet Metal, of which the following is a specification.

This invention relates to the bending and shaping of sheet metal by hydraulic power.

Sheet metal has previously been shaped in various ways, a method in common practice being to place the metal to be shaped between a positive and a negative die and then press the two dies together. The objection to such a method has been the expense associated with the construction of the dies and the powerful and costly machinery necessary to operate them. A further objection has been the requirement of different dies according to the thickness of the material under treatment.

The object of the present invention is to provide a comparatively cheap, simple and effective apparatus in which sheet metal may be transformed to a desired shape in a speedy and economical manner. According to the invention the sheet of metal to be shaped is gripped around its marginal portion between two relatively movable blocks and acquires the required shape by the aid of pressure water admitted to a flexible container which forces the metal into a shaping recess or cavity in one of the blocks. The sides or edges of the sheet are gripped in such a manner that although tightly held, the metal is permitted to creep or slip inwardly to a certain extent to take the shape of said recess when the hydraulic pressure is admitted. By this means the metal may be converted to both regular and irregular forms without distortion or rupture. Any wrinkles forming at the marginal portion of the sheet are ironed or smoothed out as the metal is drawn inwardly. The invention is especially useful in its application to the manufacture of panels, mudguards, or other portions of motor vehicles, but may be applied for various other purposes.

Referring to the drawings which form part of this specification:—

Figure 1 is a part sectional side elevation of the invention applied to the shaping of a sheet metal corner panel for motor car bodies. The upper block is in its raised position.

Fig. 2 is a part sectional end view of Fig. 1, the upper block being lowered and a sheet of metal shown in position to be shaped. The flexible pressure water container is in a collapsed state.

Fig. 3 is a plan of the lower block and the parts resting thereon.

Fig. 4 is a cross sectional view of a modification, the flexible pressure water container being expanded and the sheet of metal forced into the shaping chamber by the hydraulic pressure.

Fig. 5 is a perspective view of the invention.

Fig. 6 shows a sheet of metal as it emerges from the machine after the shaping operation. The article being shaped is in this instance a corner panel for motor car bodies, but it will be obvious that the invention is equally applicable to the shaping of various other sheet metal articles.

Fig. 7 shows a finished corner panel after the out-turned border flange and the superfluous end portion seen in Fig. 6 have been removed.

On reference to the drawings it will be seen that the numerals 2 and 3 indicate fast and loose pulleys on a pulley shaft 4, while 5 is a belt shifting device for moving the driving belt 10 onto either of said pulleys. The shaft 4 carries a bevel pinion 6 which drives a bevel wheel 7 on a worm shaft 8. A worm 9 on said worm shaft engages a worm wheel 11 fixed on a main shaft 12 which is thus provided with a slow and powerful drive. The shaft 12 turns in bearings in head pieces 13 which are supported by guides 14 upstanding from a base or foundation 15. Keyed to the shaft 12 are eccentrics 16 or cranks to each of which is attached the upper end of a connecting rod 17 which is capable of easy adjustment by right and left hand screw threads 18 and turning holes 19 or other suitable means in order that it may be extended or shortened as desired. The lower end of each connect-

ing rod is pivoted to and supports a pin 20 carried by an upper or shaping block 25 which moves along the guides 14.

The underneath or gripping surface 21 of the shaping block or of the depending lip thereof hereinafter described, is, if necessary, longitudinally curved as in Fig. 1 to conform to the shape that the border of the sheet metal is to acquire. Inside the border of the shaping block is formed a shaping recess or chamber 22. The area, height and conformation of this recess or chamber determine the shape to be imparted to the sheet metal. Into said chamber the metal is upwardly forced and shaped by hydraulic pressure as hereinafter described.

Preferably there is formed on the underneath surface of the upper block and surrounding said chamber a depending lip 23. This lip conforms to the marginal shape of said chamber and its inner edge or corner 24 which forms the marginal edge or corner of the chamber is formed square as shown. This square corner of the shaping chamber in contradistinction to a rounded corner forms a material feature of the invention as it causes the marginal portion of the sheet metal to be thoroughly ironed or smoothed out as it is drawn inwardly by the hydraulic pressure.

Beneath the shaping block is a lower block 26. This block rests upon the base or foundation 12 and may, if desired, be capable of being moved to a slight degree either laterally or longitudinally in order that it may be readily alined with the upper block. The upper surface 27 of the lower block may also be longitudinally curved to conform to the border surface 21 of the shaping block as shown.

Outside the lower block and situated in any suitable position is a valve 29 controlling a water inlet pipe 31 which communicates with a water passageway 32 leading to the center of the upper surface of the lower block.

A drain pipe 33 also communicates with said water passageway and is fitted with a pressure gage 34 and a discharge valve 36 for the purpose of draining the apparatus when the sheet metal has been shaped.

In combination with the foregoing a flexible pressure water container of stout rubber, canvas or like elastic or flexible material is employed. This container is preferably in the form of a bag 37 which is closed on all sides and is provided at its bottom with an orifice having a nipple 39 which is screwed or otherwise connected to the water passageway 32 of the lower block as seen in Fig. 2. The marginal edges of the bag lie within the border of the chamber 22 in the upper block.

The elastic or flexible bag preferably rests on a protecting sheet 41 of rubber, fabric or like material which lies on the upper surface of the lower block and has its edges turned up over the sides of the bag as at 42 to protect the latter from injury. A hole is formed through the center of this sheet to pass the nipple 39 of the bag.

Resting on the upper surface of the lower block is a rubber or like flexible pad or cushion 44. The inner edge 43 of this cushion conforms to the marginal shape of the chamber in the upper block and surrounds the elastic bag above mentioned.

Resting upon said cushion is a metal ironing frame 46 upon which the metal sheet 45 to be treated is placed. The upper or gripping surface 40 of this frame conforms to the shape or curvature of the surface 21. The inner edge of said frame is provided with a square corner 47 and conforms precisely to the square marginal edge 24 of the chamber in the upper block beneath which edge it is disposed. The ironing frame 46 is held in position by tongues 48 or other suitable means attached to the lower block.

Instead of the bag 37, the flexible pressure water container may be in the form of a rubber or other suitable flexible sheet 51 as shown in Fig. 4. In this embodiment a jointing groove 52 is formed in the upper surface of the lower block. This groove follows the marginal contour of the edge of the shaping chamber 22 and above it is situated a combined jointing and crowning frame 53. The frame 53 which is preferably made of metal extends completely around the shaping chamber and upon it the metal sheet 45 to be treated is placed. When the upper block is lowered as in Fig. 4, it presses the marginal portion of the flexible sheet into the jointing groove and thus forms a watertight joint between said sheet and the lower block. If the bag 37 or sheet 51 are made of comparatively inextensible material such as canvas, sufficient slackness must be left inside the gripped border to enable the container to fill out to the shape of the chamber 22.

It will be seen that the cushion 44 in the one case and the flexible sheet 51 in the other form a resilient bed for the ironing frames 46 and 53 respectively, thereby allowing said frames to yield slightly in a downward direction and allow the metal sheet 45 to creep inwardly between the ironing frame and the upper block when the hydraulic pressure is applied.

This invention operates as follows:—The driving belt is moved onto the fast pulley by the belt shifting device which may, if desired, be arranged to automatically return the belt to the loose pulley when the eccentrics or cranks have been moved to their lower dead center position, as hereinafter described. The worm gear rotates the main shaft and operates the eccentrics to raise

the upper block sufficiently to allow the sheet of metal under treatment to be placed in position. Said sheet is placed on top of the ironing frame with its marginal edges overlapping the same to a sufficient extent on all sides to provide a firm grip and allow of the inward creepage of the metal which occurs when the pressure water is admitted. The upper block is now lowered until the eccentrics or cranks have reached their lower dead center, the connecting rods thus holding the upper block down in operative position without any possibility of upward movement when the hydraulic pressure is applied. The marginal portion of the sheet of metal is now gripped between the lower surface 21 of the upper block and the upper surface 40 of the metal ironing frame. Pressure water is now admitted to the flexible container causing the latter to expand or fill out and force the sheet of metal upwardly into the shaping chamber until the sheet has assumed the precise shape of said chamber, which will occur in a few moments after the admission of the pressure water. The pressure may now be cut off by closing the valve 29 and the water released from the container by opening the valve 36. The upper block is then raised and the shaped metal sheet removed.

Although the border of the sheet is held tightly between the upper block and the ironing frame the hydraulic pressure causes the edges to gradually creep or slip inwardly as the metal takes its new shape, this being permitted by the yielding of the flexible cushion or sheet beneath the ironing frame. The wrinkles or creases which form around the border of the metal sheet are thus effectively ironed or smoothed out as the metal passes between the corners or edges 24 and 47 into the shaping chamber, the shaped article emerging with perfectly smooth sides and a border flange out-turned squarely from the shaped portion of the sheet as in Fig. 6. This flange is afterward removed by suitable cutters leaving a smooth and uncrinkled edge on the finished article as in Fig. 7.

By adjusting the length of the connecting rods 17 with the means provided, the grip on the sheet may be regulated and different thicknesses of metal accommodated.

The invention provides a simple and effective means of rapidly imparting various shapes either regular or irregular to sheet metal without distortion, rupture or undue straining thereof. The corner panel for motor car bodies with its varying contour from end to end illustrates a good example of the work performed by the invention.

Having now described my invention what I claim as new and desire to secure by Letters Patent is:—

1. Apparatus for shaping and drawing sheet metal, comprising in combination a pair of opposed blocks, one of which has its working face provided with a shaping cavity conforming in size and shape to the article to be obtained, said cavity having a marginal gripping edge; a rigid, metal shaping frame on which the work sheet is adapted to rest, yieldingly supported upon the other block and having a gripping edge for direct co-action with the first-named marginal gripping edge and which exactly conforms thereto in size and shape; means for producing a relative movement between said blocks in a direction to grip the work sheet between said co-acting edges; an expansible element between which and the shaping cavity the work sheet is interposed; and means for applying fluid pressure immediately against said expansible element to force it and the work sheet into said cavity and thereby shape the sheet against the walls thereof; the yielding mounting of said shaping frame enabling it to yield slightly during the shaping operation so as to permit creeping of the sheet between the coacting gripping edges.

2. Apparatus for shaping and drawing metal, comprising in combination a pair of opposed blocks, one of which has its working face provided with a shaping cavity conforming in size and shape to the article to be obtained, said cavity having an abrupt marginal gripping edge; a rigid metal shaping frame on which the work sheet is adapted to rest, yieldingly supported upon the other block and having an abrupt marginal gripping edge for direct co-action with the first-named gripping edge and which exactly conforms thereto in size and shape; means for producing a relative movement between said blocks in a direction to grip the work sheet between said co-acting edges; an expansible element between which and the shaping cavity the work sheet is interposed; and means for applying fluid pressure immediately against said expansible element to force it and the work sheet into said cavity and thereby shape the sheet against the walls thereof; the yielding mounting of said shaping frame enabling it to yield slightly during the shaping operation so as to permit creeping of the sheet between the coacting gripping edges; the square corners produced by the abrupt formation of said edges acting to iron out and smooth the metal as the latter passes between them into the shaping cavity.

3. Apparatus for shaping and drawing sheet metal, comprising in combination a pair of opposed blocks, one of which has its working face provided with a shaping cavity conforming in size and shape to the article to be obtained, said cavity having a marginal gripping edge; a rigid, metal shaping frame on which the work sheet is adapted

to rest, having a marginal gripping edge for direct co-action with the first-named gripping edge and which exactly conforms thereto in size and shape; a yielding cushion arranged upon the other block and upon which the shaping frame is immediately mounted; means for producing a relative movement between said blocks in a direction to grip the work sheet between said co-acting edges; an expansible element between which and the shaping cavity the work sheet is interposed; and means for applying fluid pressure immediately against said expansible element to force it and the work sheet into said cavity and thereby shape the sheet against the walls thereof; the yielding mounting of said shaping frame enabling it to yield slightly during the shaping operation so as to permit creeping of the sheet between the co-acting gripping edges.

4. Apparatus for shaping and drawing sheet metal, comprising in combination a pair of opposed blocks, one of which has its working face provided with a shaping cavity conforming in size and shape to the article to be obtained, said cavity having a marginal gripping edge; a rigid, metal shaping frame on which the work sheet is adapted to rest, yieldingly supported upon the other block and having an open central portion, the marginal edge of which exactly conforms in size and shape to the first-named edge and is designed for direct co-action therewith; means for producing a relative movement between said blocks in a direction to grip the work sheet between said co-acting edges; an expansible element between which and the shaping cavity the work sheet is interposed; and means for applying fluid pressure immediately against said expansible element to force it and the work sheet into said cavity and thereby shape the sheet against the walls thereof; the yielding mounting of said shaping frame enabling it to yield slightly during the shaping operation so as to permit creeping of the sheet between the co-acting gripping edges.

5. Apparatus for shaping and drawing sheet metal, comprising in combination a pair of opposed blocks, one of which has its working face provided with a shaping cavity conforming in size and shape to the article to be obtained, said cavity having a marginal gripping edge; the other block being formed with a fluid supply passage which opens through its working face; a rigid metal shaping frame on which the work sheet is adapted to rest, yieldingly supported on the second-named block and having a marginal gripping edge for direct co-action with the first-named edge and which exactly conforms thereto in size and shape; means for producing relative movement between said blocks in a direction to grip the work sheet between said co-acting edges; a flexible bag mounted on the working face of the second-named block and connected with said fluid supply passage, the work sheet being interposed between said bag and the shaping cavity; and means for supplying pressure fluid through said passage to said bag to expand the latter and thereby force the work sheet into said cavity and against the walls thereof; the yielding mounting of said shaping frame enabling it to yield slightly during the shaping operation so as to permit creeping of the sheet between the co-acting gripping edges.

6. Apparatus for shaping and drawing sheet metal, comprising in combination a pair of opposed blocks, one of which has its working face provided with a shaping cavity conforming in size and shape to the article to be obtained, said cavity having a marginal gripping edge; a rigid, metal shaping frame on which the work sheet is adapted to rest, having an open central portion the marginal edge of which exactly conforms in size and shape to the first-named edge and is designed for direct co-action therewith; a yielding cushion arranged upon the other block and upon which the shaping frame is immediately mounted; means for producing a relative movement between said blocks in a direction to grip the work sheet between said co-acting edges; an expansible element between which and the shaping cavity the work sheet is interposed; and means for applying fluid pressure immediately against said expansible element to force it and the work sheet into said cavity and thereby shape the sheet against the walls thereof; the yielding mounting of said shaping frame enabling it to yield slightly during the shaping operation so as to permit creeping of the sheet between the co-acting gripping edges.

7. Apparatus for shaping and drawing sheet metal, comprising in combination a pair of opposed blocks, one of which has its working face provided with a shaping cavity conforming in size and shape to the article to be obtained, said cavity having a marginal gripping edge; the other block being formed with a fluid supply passage which opens through its working face; a rigid metal shaping frame on which the work sheet is adapted to rest, having an open central portion the marginal edge of which exactly conforms in size and shape to the first-named edge and is designed for direct co-action therewith; a yielding cushion arranged upon the second-named block and upon which the shaping frame is immediately mounted, said cushion having an open central portion the marginal edge of which forms a continuation of that of the frame opening; means for producing relative movement between said blocks in a direction to grip the work sheet between said co-acting edges; an expansible bag connected with the

fluid supply passage and arranged upon the second-named block within the confines of the openings in the frame and cushion, the work sheet being interposed between said bag and the shaping cavity; and means for supplying pressure fluid through said passage to said bag to expand the latter and thereby force the work sheet into said cavity and against the walls thereof, the yielding mounting of said shaping frame enabling it to yield slightly during the shaping operation so as to permit creeping of the sheet between the co-acting gripping edges.

In testimony whereof I affix my signature.

THEO. M. HARRISON.

Witness:
JACK NANCE.