Aug. 9, 1966 R. E. ROPER 3,264,730

METHOD AND APPARATUS FOR FORMING SHEET METAL CORNER MEMBERS

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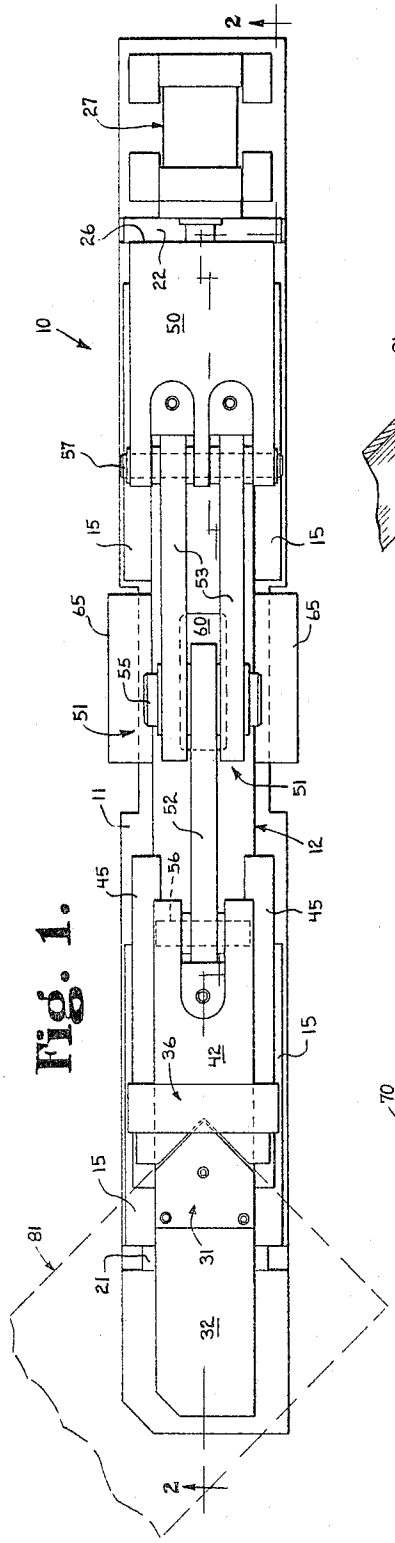


Fig. 1.

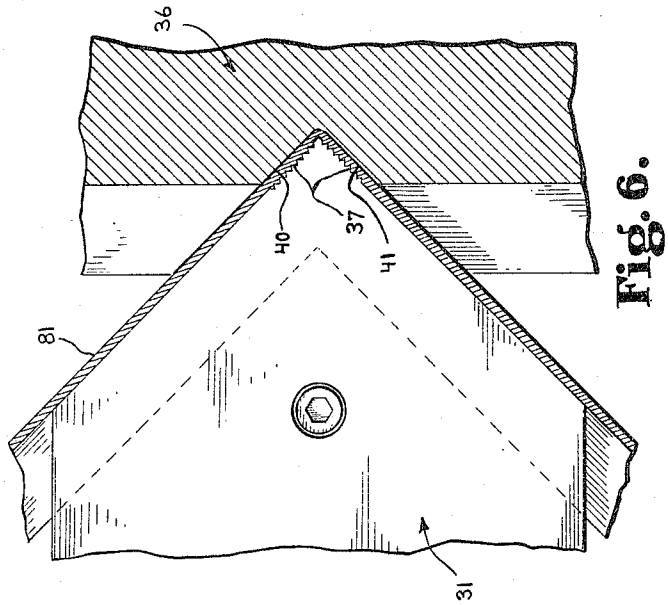


Fig. 6.

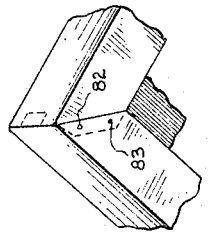


Fig. 8.

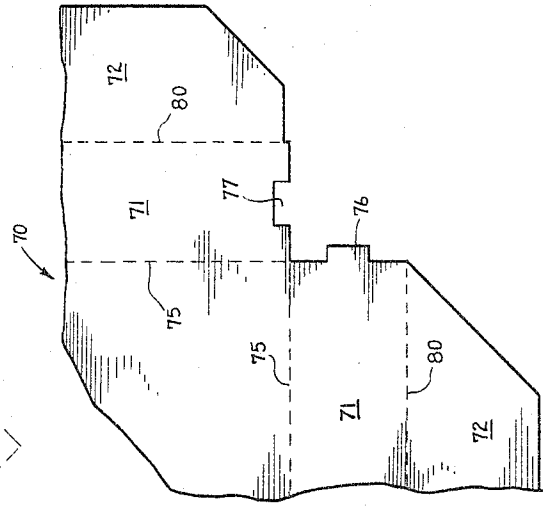


Fig. 7.

INVENTOR.
RALPH E. ROPER

BY
Lockwood, Woodard, Smith & Weikart
Attorneys

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METHOD AND APPARATUS FOR FORMING SHEET METAL CORNER MEMBERS

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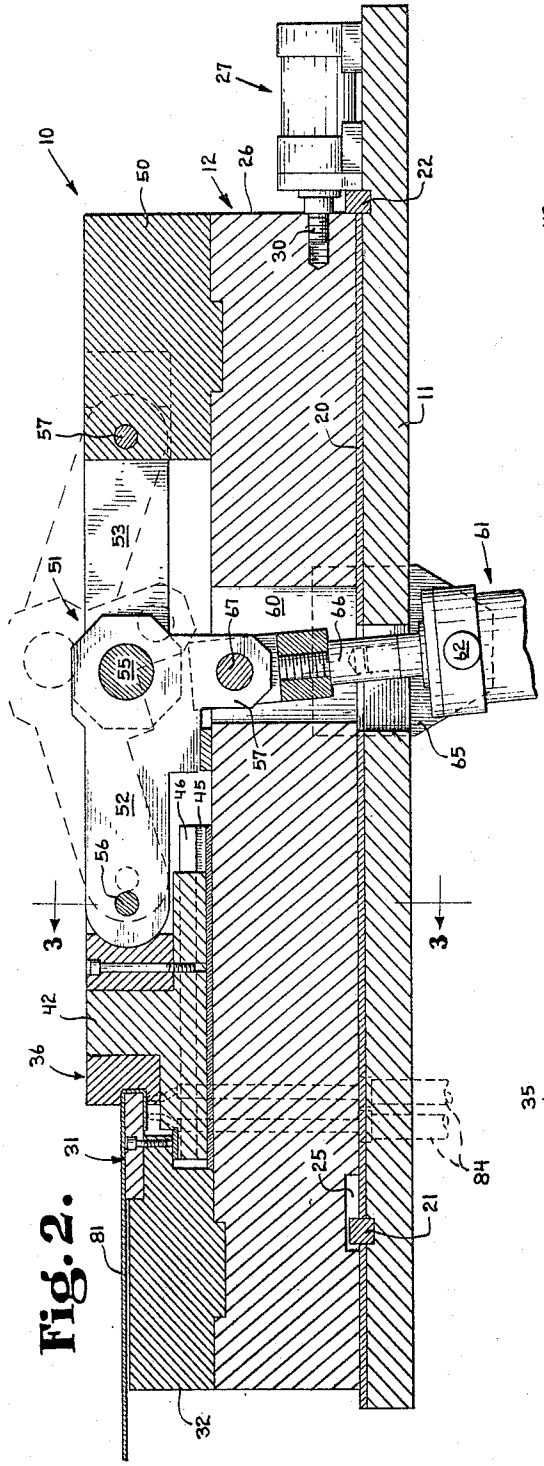


Fig. 2.

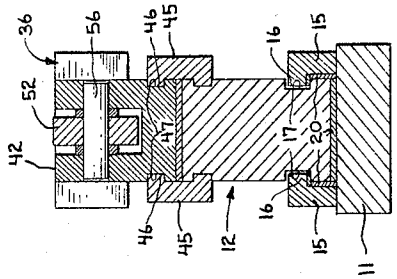


Fig. 3.

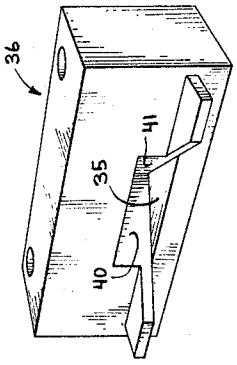


Fig. 5.

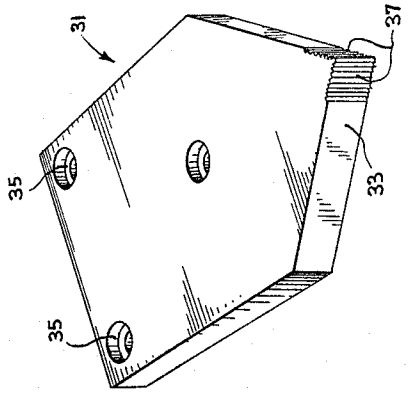


Fig. 4.

INVENTOR.
RALPH E. ROPER
BY
Lockwood, Woodard, Smith & Weikart
Attorneys

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METHOD AND APPARATUS FOR FORMING SHEET METAL CORNER MEMBERS

Ralph E. Roper, Indianapolis, Ind., assignor to Wallace Expanding Machines, Inc., Indianapolis, Ind., a corporation of Indiana

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The present invention relates to a method and apparatus for forming material into corners and more particularly to a method and apparatus for forming sheet metal corner members.

In making refrigerator doors or doors for offices or cabinets or the like, it is known to blank a sheet of metal and to fold two terminal edges of the sheet into perpendicular engaging relation whereby these terminal edges may be welded together. This method involves expensive metal finishing which must be accomplished after the welding operation so that the door corner is of proper configuration and appearance. Such metal finishing is also necessary to insure that the surface of the corner is properly prepared for paint or enamel. Consequently, a primary object of the present invention is to provide an improved method of and apparatus for forming sheet metal corner members whereby the necessity of welding the adjacent terminal edges of the metal is eliminated.

A related object of the present invention is to provide a method and apparatus for forming corner members in such a manner that there is no seam line at the juncture of the terminal edge portions.

Still another object of the present invention is to provide method of and apparatus for forming corner members whereby costly metal finishing is eliminated.

Still another object of the present invention is to provide a method of and apparatus for forming corner members including sharper and more uniform corners.

Related objects and advantages will become apparent as the description proceeds.

The process of the present invention might include the steps of placing a pair of corner members in engagement within a recess, moving a male die into the recess and forcing the male die against the corner defining members and the engaging portions thereof and retaining the metal of the members against flow out of the recess by serrations on the forming face of the male die.

One embodiment of the apparatus of the present invention might include a female die provided with a forming indentation of V-shaped cross section, a male die with a forming face having a V shaped cross section complementary to said forming indentation, means for forcing the dies toward one another, said male die having an irregular forming face for resisting movement of metal out of the female die during forming.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims.

FIG. 1 is a top plan view of forming apparatus constructed according to the present invention.

FIG. 2 is a longitudinal vertical section taken along the line 2—2 of FIG. 1 in the direction of the arrows.

FIG. 3 is a vertical transverse section taken along the line 3—3 of FIG. 2 in the direction of the arrows.

FIG. 4 is an enlarged perspective view of a male forming die forming a part of the structure of FIGS. 1–3.

FIG. 5 is an enlarged perspective view of a female forming die forming a part of the structure of FIGS. 1–3.

FIG. 6 is an enlarged horizontal section showing the above male and female dies in operation with a corner member being formed therebetween.

FIG. 7 is a fragmentary plan view of a blank of sheet metal used in the present invention.

FIG. 8 is a perspective view of a completed corner member formed according to the present invention.

Referring now more particularly to the drawings, there is illustrated forming apparatus 10 which includes a base 11 and a carriage 12 mounted upon the base for longitudinal reciprocation with respect thereto. A plurality of guide members 15 having an inverted L-shape is fixed to the base 11 and project inwardly at 16 into elongated recesses 17 in the sides of the carriage 12. The base 11 and the guides 15 have secured to their upper and inner surfaces, respectively, bearing members 20.

A pair of stops 21 and 22 are fixed within suitable recesses in the base 11. The stop 21 extends into a recess 25 in the lower surface of the carriage 12 and limits the carriage against too great a movement in a leftward direction as viewed in FIG. 2. The stop 22 limits the carriage against movement in a rightward direction as viewed in FIG. 2 by engaging the rightward surface 26 of the carriage.

A fluid piston motor 27 is fixed to the base 11 and has its piston 30 connected to the carriage 12. The carriage may be moved to engage the stop 21 by projection of the cylinder piston 30 or may be moved to engage the stop 22 by retraction of the piston 30.

A male die 31 is fixed to a die mounting block 32 by means of suitable screws passing through apertures 35 in the male die. The die mounting block 32 is, in turn, fixed to and forms a part of the carriage 12. The male die 31 has a forming face 33 which is complementary in shape to an indentation 35 in a female die 36. It should be mentioned that the forming face 33 is not exactly complementary to the indentation 35 because the forming face 33 has a plurality of vertical serrations 37 while the indentation 35 is smooth at its V-defining surfaces 40 and 41.

The female die 36 is removably mounted upon a die mounting block 42 which is, in turn, mounted for reciprocation upon the carriage 12. A pair of guides 45 are fixed to the opposite sides of the carriage and have inwardly projecting portions 46 which are received within suitable elongated recesses 47 in the sidewalls of the die mounting block 42. The guides 45, of course, limit the movement of the die mounting block to reciprocation with respect to the carriage.

Fixed to and forming a part of the carriage 12 is a toggle mounting block 50. A toggle mechanism 51 incorporates a pair of links 52 and 53 which are pivoted at one end to one another by means of a pin 55 and are pivoted at their other ends to the die carrying block 42 and the toggle mounting member 50, respectively. This mounting is accomplished by means of pins 56 and 57 extending through suitable apertures in the members 42 and 50 and the links 52 and 53.

The link 52 has a depending portion 57 which extends into a vertically extending aperture 60 in the carriage 12. A fluid cylinder motor 61 is pivoted at 62 to a pair of downwardly projecting members 65 which are fixed to the base 11. The piston rod 66 of the motor 61 is pivoted to the depending portion 57 of the link 52 by means of a pin 67. It can be appreciated that movement of the piston to retract the rod 66 will cause the toggle mechanism 51 to move from the dotted line position of FIG. 2 causing the die-carrying block 42 to move and be locked leftwardly with regard to the carriage 12.

The process of the present invention is practiced in the following manner. A sheet of metal 70 is blanked out into the configuration shown in FIG. 7 so as to have inner terminal portions 71 and outer terminal portions 72. The sheet is then folded or bent perpendicularly along the lines 75 until the projecting portion 76 extends through the indentation 77. If desired, there may be a plurality

of such projecting portions and indentations and they may have other complementary shapes in addition to the illustrated rectangular shapes. The outer terminal portions 72 are then folded along the lines 80 until they overlap as shown in FIG. 8.

The fluid motor 61 is positioned with the piston rod 66 projected so that the toggle mechanism is in the dotted line position and the fluid motor 27 is positioned with the carriage 10 in the far leftward position. The door blank (which in the present embodiment is movable only vertically) is then placed over and between the male die 31 and the female die 36. The fluid motor 27 is caused to retract its piston rod and to move the male die 31 into the corner defined by the outer and inner terminal portions. The piston motor 61 is caused to retract its piston 66 whereby the toggle mechanism 51 moves the die carrying block and female die 42 and 36, respectively, in a leftward direction causing forming of the corner member 81. This final forming position is shown in solid lines in FIG. 2. After forming has been accomplished, the female die is removed from the formed part by projection of the piston 66 of piston motor 61. The male die is removed from the formed part by projection of the piston of the piston motor 27. The formed part is then moved vertically upwardly away from the apparatus of FIG. 2.

The serrations 37 on the forming face 33 of the male die prevent the metal from flowing outwardly during the forming operation and cause the final corner to have no seam line on the external surface thereof. The external surface of the corner has been so completely finished that it is prepared for painting without further metal finishing operations, said painting thus being the next step of the present process. If desired prior to such painting and while the apparatus is in the position of FIG. 2, a pair of spot welding devices 84 are projected through suitable aligned apertures in the base 11, carriage 12 and die carrying block 42 and are operated to produce spot welds at points 82 and 83 (FIG. 8) between the outer terminal portions 72 of the corner forming member.

It should be understood that the forming operation of the present invention is a cold forming one in which the metal is migrated from the inner walls of the flanges or terminal portions 71 into the slit or opening on the exterior of the metal in such a way as to close the opening, causing the metal to flow to reduce the seam line until it is not visible or barely noticeable.

From the above description, it will be obvious that the present invention provides a corner forming member and apparatus whereby a corner may be formed with no external seam line. It will also be obvious that the present invention provides a method and apparatus for forming corner members whereby costly metal finishing subsequent to welding is eliminated. Furthermore, the present invention provides a method and apparatus for forming sharper and more uniform corners.

While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that only the preferred embodiment has been shown and described and that all changes and modifications that come within the spirit of the invention and the scope of the claims are also desired to be protected.

The invention claimed is:

1. A process for forming sheet metal corner members comprising forming a sheet metal blank to have adjacent edge portions each including an inner terminal portion and a parallel outer terminal portion, folding up the edge portions of the metal to a position wherein they are perpendicular to said blank and said inner terminal portions engage one another, folding in said outer terminal portions into overlapping relation and so that they are parallel to said blank whereby said blank and edge portions define a corner, placing a male die having a serrated forming face within said corner and a female die externally of said corner, causing relative movement of said dies toward one another to form said corner therebetween, spot welding said overlapping outer terminal portions to one another, and painting the external surface of said corner without further finishing operations.

2. Apparatus for forming sheet metal corner members comprising a horizontal base, a carriage mounted for horizontal slidable movement on said base, a first fluid piston cylinder fixed to said base and having its piston connected to said carriage for movement thereof in a direction, a female die provided with a vertical face and a horizontally extending forming indentation opening on said face, a die carrying block removably mounting said female die and slidable upon said carriage, guides fixed to said carriage and limiting said die carrying block to horizontal reciprocation in said direction, a male die removably fixed to said carriage and having a vertical forming face projecting toward and complementary in shape to said indentation, said carriage having a vertically extending passage therethrough, a toggle mechanism including a pair of links pivoted together and pivoted at their distal ends to said carriage and said die-carrying block, a second fluid piston cylinder pivoted to said base and having its piston connected to the pivotal connection of said links, said indentation and male die having a rectangular cross-section of constant vertical width and having a V-shaped horizontal section which tapers in said direction, said male die having vertically extending serrations on the vertical forming face thereof for resisting movement of said metal out of said indentation during forming, a pair of spot welding devices projecting from said carriage and adjacent said male die when fully seated in said indentation for welding a corner member formed by said dies.

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JOHN F. CAMPBELL, *Primary Examiner.*

NEDWIN BERGER, WHITMORE A. WILTZ, *Examiners.*

J. D. HOBART, *Assistant Examiner.*