

Jan. 10, 1961

R. H. THOMS

2,967,560

MACHINE AND PROCESS FOR CORNER BENDING CORRUGATED SHEET

Filed June 11, 1956

4 Sheets-Sheet 1

Fig. 1.

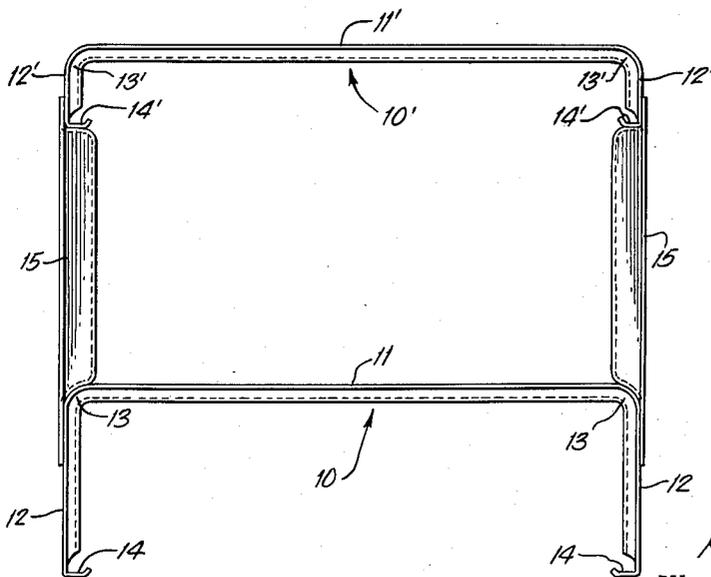
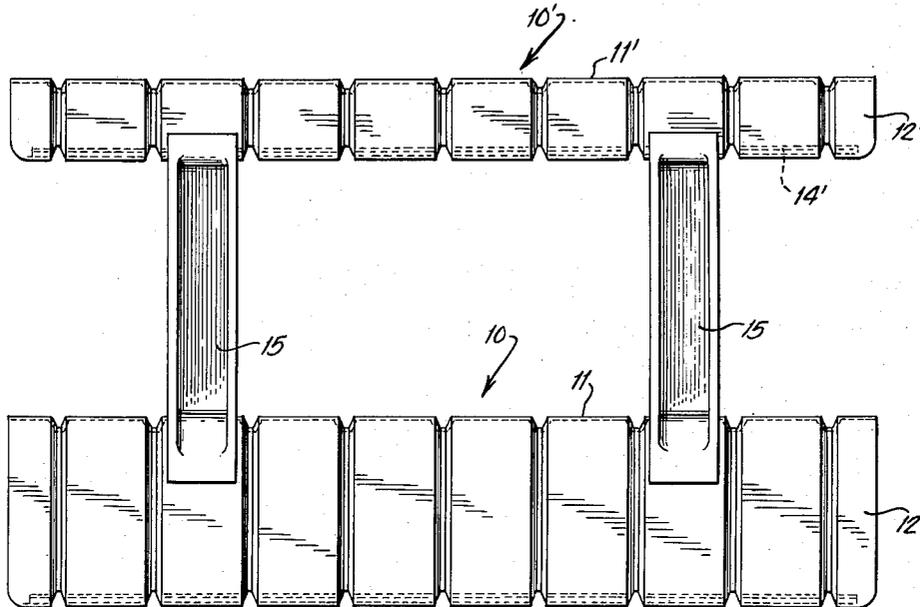


Fig. 2.

INVENTOR.  
RUDOLPH H. THOMS  
BY *H. A. Woodlief*  
ATTORNEY

Jan. 10, 1961

R. H. THOMS

2,967,560

MACHINE AND PROCESS FOR CORNER BENDING CORRUGATED SHEET

Filed June 11, 1956

4 Sheets-Sheet 2

Fig. 4.

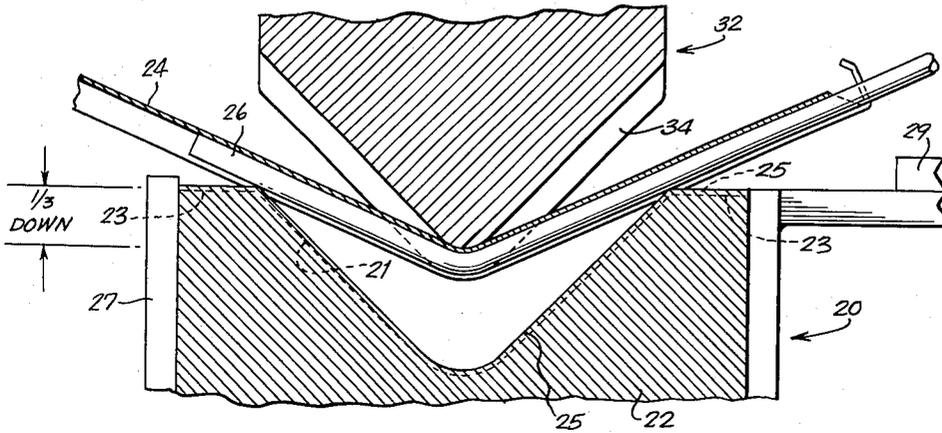


Fig. 5.

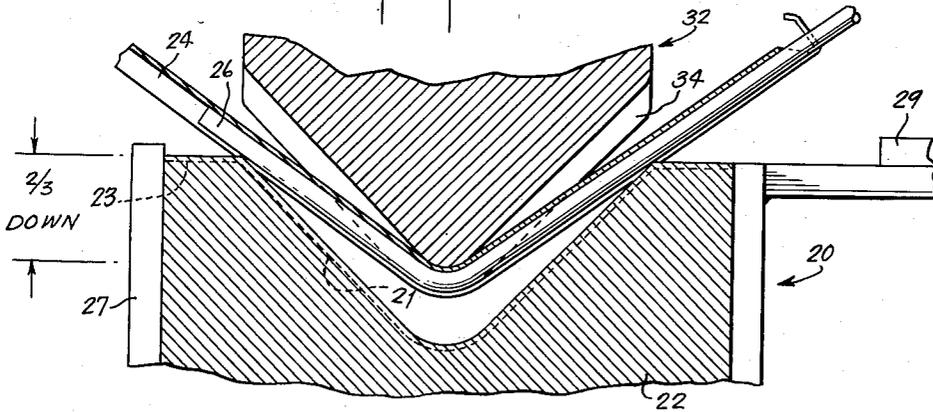
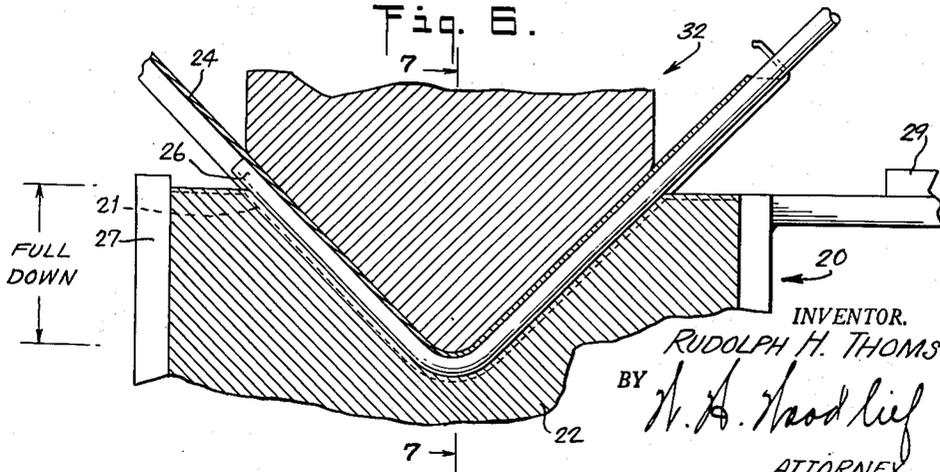


Fig. 6.



INVENTOR.  
RUDOLPH H. THOMS  
BY *H. A. Hood*  
ATTORNEY

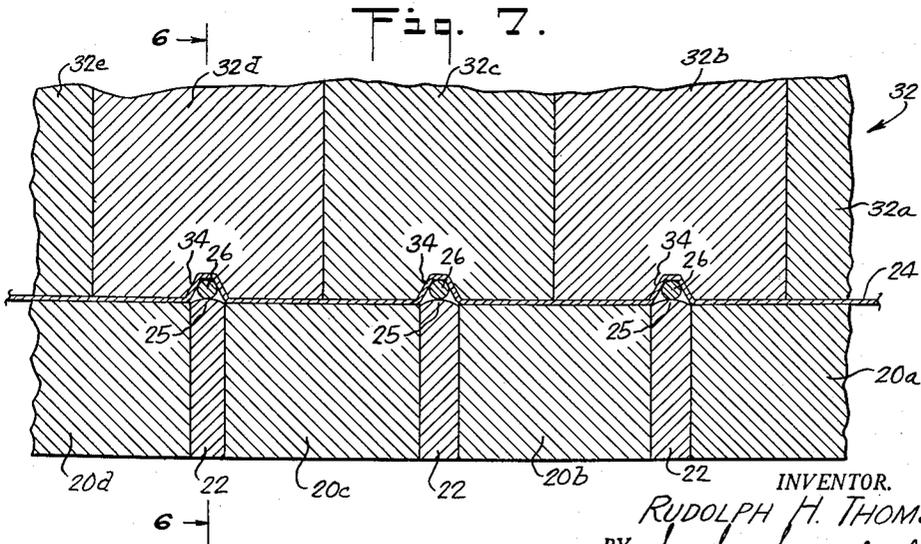
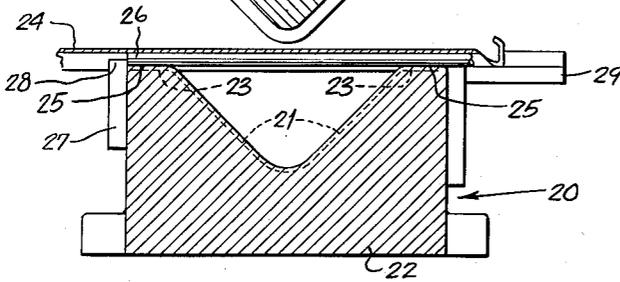
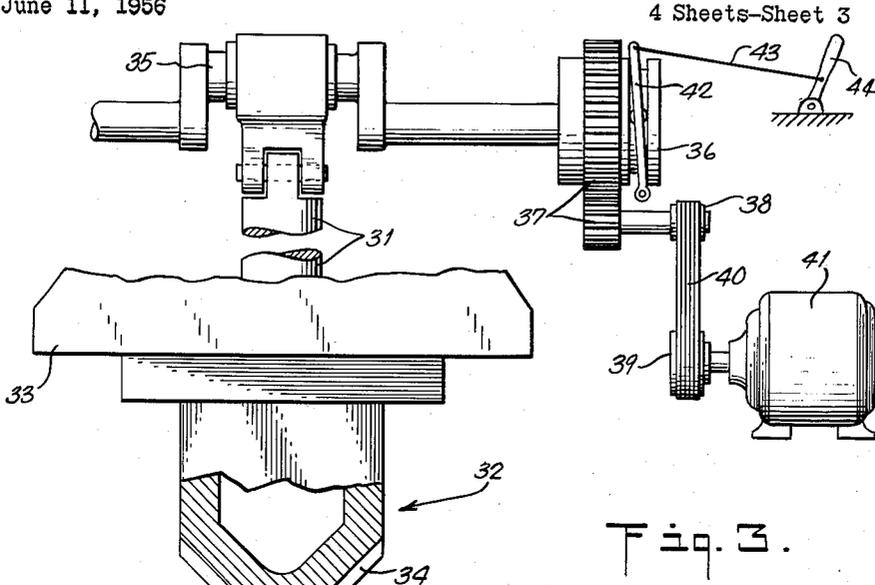
Jan. 10, 1961

R. H. THOMS

2,967,560

MACHINE AND PROCESS FOR CORNER BENDING CORRUGATED SHEET

Filed June 11, 1956



INVENTOR.  
RUDOLPH H. THOMS  
BY *H. A. Hadley*  
ATTORNEY

Jan. 10, 1961

R. H. THOMS

2,967,560

MACHINE AND PROCESS FOR CORNER BENDING CORRUGATED SHEET

Filed June 11, 1956

4 Sheets-Sheet 4

Fig. 8.

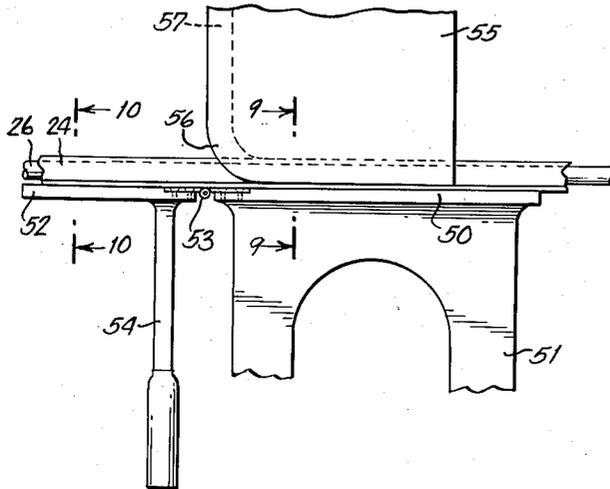


Fig. 9.

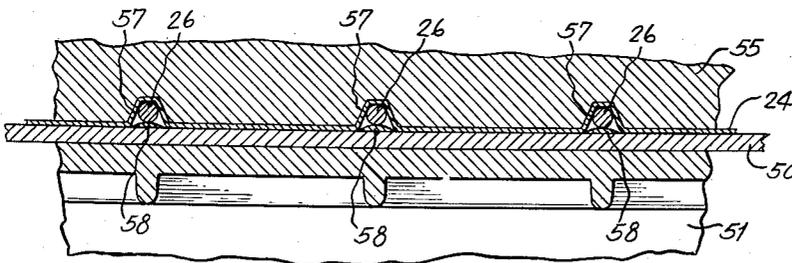
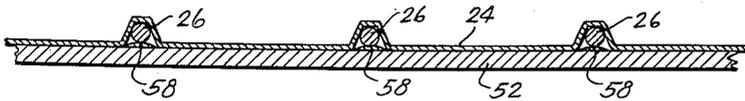


Fig. 10.



INVENTOR.  
RUDOLPH H. THOMS  
BY *H. A. Hood*  
ATTORNEY

1

2,967,560

**MACHINE AND PROCESS FOR CORNER BENDING  
CORRUGATED SHEET****Rudolph H. Thoms, Cleveland, Ohio, assignor to Republic  
Steel Corporation, Cleveland, Ohio, a corporation of  
New Jersey**

Filed June 11, 1956, Ser. No. 590,647

11 Claims. (Cl. 153—21)

The present invention relates to cold-formed sheet metal articles and their forming processes and machines. More particularly, the invention relates to articles which embody formed corners, and to processes and machines for cold-forming of such corners, transverse to corrugations which are provided in the sheet metal from which the article is formed and which contribute to enhanced strength and rigidity of the finished article.

In the interests of economy, lightness, and ease of fabrication, many articles are formed from relatively light weight sheet metal and employ some form of corrugation or ribs by which to increase the strength and rigidity of the article equivalent to that of one formed from noncorrugated sheet or other metal of much heavier weight. Often the corrugations or stiffening ribs are stamped out of the sheet metal after the blanking step and most or all of the forming steps are completed, but there are many instances where economy and ease of fabrication make it highly desirable suitably to corrugate a base sheet metal prior to any forthcoming step. Much difficulty is experienced in those instances where it is desired to provide a cold-formed corner bend in the corrugated metal transverse to its corrugations, and heretofore this has been accomplished largely at a sacrifice of corner strength and rigidity by more or less deformation of each corrugation in the region of the bend. To avoid erratic and more-or-less uncontrolled deformations of this nature, it has been proposed that the bending step be accompanied by deliberate and positionally controlled deformations in the form of positioned creases or indentations symmetrically extending throughout the corner bend region. Nevertheless a corner bend transverse to the corrugations has heretofore often resulted in a structure so weakened as to necessitate the use of one or more strengthening straps bridging the corner and affixed to points spaced some distance to each side thereof.

Where articles formed of sheet metal are used in food handling and processing, it is highly desirable that the article have smooth surfaces throughout not only to facilitate sanitary cleansing but in fact to assure it. Additionally, and perhaps equally important, it is desirable that the article be completely devoid of any sharp closed-in corners, or cracks or crevices in which food may collect and develop bacteria. Thus in a food handling article involving corner bends transverse to corrugations it is highly undesirable to have deformation in the nature of wrinkles or indentations at corner bends of the corrugations or to use corner bracing straps or the like as above described.

It is an object of the present invention to provide a new and improved method and process for forming corner bends in corrugated sheet metal, transverse to the corrugations thereof, while enabling the preservation of substantially uniform corrugation cross-sectional configuration and smooth corrugation wall surfaces throughout the bend.

It is a further object of the invention to provide a novel method and machine for forming corner bends

2

transverse to the corrugations of corrugated sheet metal while minimizing corrugation distortion in the bend, thereby enabling the attainment of substantially optimum corner strength and rigidity obviating the need of corner braces and characterized by smooth and crevice-free corner surfaces.

It is an additional object of the invention to provide a new and improved method and machine particularly suited for forming corner bends transverse to the corrugations of corrugated sheet metal of those types which are difficult to work as typified by stainless steel and titanium, including titanium alloys.

It is another object of the invention to provide a novel article cold-formed of corrugated sheet metal, and particularly one cold-formed of corrugated stainless steel sheet or corrugated titanium sheet, having stiffening and rigidizing skirts or flanges yet one exhibiting smooth surfaces throughout free of sharp corners, cracks and crevices and therefore one particularly suited for use in handling and processing food stuffs.

It is a further object of the invention to provide a new and improved machine for corner bending corrugated sheet metal of the high-melting-point types, typified by stainless steel, transverse to its corrugations while faithfully preserving uniform corrugation cross-sectional configuration to enable the fabrication of articles having corner bends possessing to a high degree the desirable characteristics attributable to this type of construction.

Other objects and advantages of the invention will appear as the detailed description proceeds in the light of the drawings forming a part of this application and in which:

Fig. 1 illustrates in elevational side view, and Fig. 2 in elevational end view, a platform embodying the present invention and particularly suitable for use in handling and processing food stuffs;

Fig. 3 illustrates in cross-section, and partly diagrammatically, the construction of a machine embodying the invention for cold-forming corner bends in corrugated sheet metal, and Figs. 4 through 7 are cross-sectional views illustrating the operation of the machine at various points in its operating cycle, Figs. 4 through 6 being enlarged views of the bending dies shown in Fig. 3 and Fig. 7 an enlarged section on line 7—7 of Fig. 6;

Figs. 8 through 10 illustrate the construction of a corner bending machine embodying the present invention in modified form.

Referring now more particularly to Figs. 1 and 2, there is illustrated a platform embodying the invention and particularly suitable for holding meat during storage and while cooking it. The platform is of double-deck construction and includes two similar platform sections 10 and 10' each having a platform portion 11, 11' and depending skirt or side portions 12, 12' joined to the platform portion by a right angle corner bend portion 13, 13'. The side portions 12, 12' terminate at their bottom edge in inturned feet portions 14, 14' as shown, and differ from each other only in length as between the lower and upper platform. The side portions 12, 12' provide enhanced stiffness and rigidity to the platform portion 11, 11', the side portions 12 having sufficient length for the insertion under the platform of a suitable transportation dolly or the forks of a fork-lift truck while the side portions 12' of the upper platform provide additional head room for the products placed on the lower platform 11.

These platforms are formed in a novel manner presently to be described in detail, and each in integrally cold-formed from a high melting point sheet metal (having a melting point in excess of 2,000° F.) which is usually considered as difficult to work but possesses such desirable properties as high strength and high resistance to

oxidation and corrosion. Typical of such metals are stainless steel sheet or titanium sheet. Each platform is shown as fabricated of sheet metal having regularly spaced corrugations of isosceles trapezoidal cross-section enabling a high degree of stiffness and rigidity with minimum weight of sheet metal, and the two platforms are integrally united by upright spacer members 15 which are arc welded around the entire juncture of the upright and platform and the welded region is thereafter ground to a smooth welded surface free of cracks and crevices in which food may collect and develop bacteria. The uprights 15 have their center portions recessed by a conventional drawing or stamping process for increased strength and rigidity of these members. The corner bends 13 and 13' of the platforms have a radius of curvature approximately twice that of the depth of corrugation, and are so formed in a manner presently to be described as to have uniform cross-sectional configuration and smooth side walls throughout the length of the corner bend. The platform accordingly possesses smooth surfaces throughout without hidden sharp corners, cracks or crevices, a construction which greatly facilitates and readily insures proper cleansing for reasons of sanitation.

By way of example, an article embodying the present invention has been formed of 13 gauge (0.093 inch) stainless steel sheet having corrugations of  $\frac{5}{8}$  inch depth with an isosceles trapezoidal cross-section having walls forming an angle of  $60^\circ$  with the surface of the article. A radius of curvature of  $1\frac{1}{2}$  inches, related to the outer surface of the corner bend, is readily attainable for a material of the type and having corrugations of the shape and size last recited while yet retaining uniform corrugation cross-sectional configuration and smooth corrugation wall surfaces throughout the bend.

The present invention as embodied in one form of machine for forming corner bends in corrugated sheet metal as above described is illustrated in elevational cross-sectional view, partly schematic, in Fig. 3 and certain additional details of construction are illustrated in the fragmentary cross-sectional view of Figs. 4 through 7 which illustrates successive stages in each cycle of operation of the machine. Referring particularly to Figs. 3 and 7, the machine includes a stationary die member 20 suitably secured to the bed (not shown) of a power press of conventional construction. The die member 20 has a V-shaped concave groove 21 defining the desired angle and radius of curvature of the corner bend, here shown by way of illustration as defining a right angled corner bend of  $1\frac{1}{2}$  inch radius. As shown more clearly in Fig. 7, the die member 20 is conveniently constructed in a plurality of sections 20a-20d each having an associated insert 22 with an upper surface 25 of convex curvilinear configuration. The width of each die member section and its associated insert 22 corresponds to the corrugation spacing. These sections of the inserts 22 are relatively positioned by the use of locating pins (not shown), and are suitably bolted or clamped together as a unitary structure by means not shown. As many die member sections and associated inserts are used as the width of the sheet metal to be bent requires, thus providing a rather flexible form of die member construction in which die member sections and associated inserts may be added or subtracted as required for the forming of articles of different widths without necessitating the construction of an individual die member for each such width.

The upper surfaces 23 of the die member sections 20a-20d are planar and provide initial support for the generally planar corrugated sheet metal 24 in which it is desired to form a corner bend. The upper surfaces 25 of the inserts 22 support an individual temporary deformable metal die member 26 initially of generally linear configuration. One die member 26 is positioned, either before or after positioning of the sheet metal 24, within each corrugation of the sheet metal and has a cross-sectional configuration related to that of the corrugation. For ex-

ample, the temporary die members 26 may conveniently have circular cross-section when used with corrugations of isosceles trapezoidal cross-sectional configuration, the diameter of such die member being selected such that it engages the opposing side wall surfaces of the corrugation at the initiation of the corner bending operation and preferably also engages the apex surface of the corrugation at the outset of the bending operation or immediately after the bending step starts. For corrugations having the cross-sectional configuration and dimensions hereinafore mentioned, the temporary die members 26 may have a diameter of  $\frac{1}{2}$  inch and are formed of untempered but suitably stiff metal such as hot-rolled low-carbon-content steel rod with unpolished surfaces. For use with stainless steel or titanium, the temporary die members 26 are used without grease or other lubrication. These temporary die members 26 may have short precut lengths or may each be comprised by the end portion of a much longer length of metal rod.

A front gauge 27 is suitably affixed to the die member 20 and has an upper end 28 extending within each corrugation for use as a positioning stop for locating the forward end of each temporary die member 26. A back gauge 29 is also affixed to the die member 20 in any suitable manner to provide a positioning stop for engagement by an edge portion of the sheet metal 24 positionally to locate the sheet metal with relation to the die member 20 and thereby establish the position of the corner bends in the sheet metal.

The corner bending machine also includes a punch die member 32 which, as shown in Fig. 7, may be constructed in demountable sections 32a-32e relatively positioned in conventional manner by locating pins, not shown, and suitably bolted or clamped together as a unitary structure. The die member 32 is suitably secured to the slide 33 of the power press, the slide 33 being supported by ways (not shown) for reciprocatory motion in conventional manner. The lower end of each punch die member section 32a-32e has a convex contour conforming to the formed surface 21 of the die 20, and each is provided with a centrally positioned groove 34 of the same cross-sectional configuration as the corrugations of the sheet metal to receive the corrugations and preserve their exterior configuration during the corner bending process.

As shown schematically in Fig. 3, the slide 33 of the power press is driven through each cycle of reciprocatory motion by any suitable means. For simplicity of illustration, mechanical means are shown in Fig. 3, for driving the slide, as by a crank arm 31 which connects the slide 33 to a conventional crank shaft 35 mechanically connected through a cycle controllable clutch 36, ring and pinion gears 37, pulleys 38 and 39, and a belt 40 to a source of motivating power 41 such as an electric motor. The clutch 36 includes a yoke 42 mechanically connected through suitable linkage 43 to a manually operable hand lever or foot pedal 44 by which each punch cycle is initiated in conventional manner.

The sheet metal 24 is cut and blanked (and pierced if piercing is desired) while in sheet form, and is thereafter corrugated as by the use of conventional corrugating rolls. Certain initial bending or forming steps may then take place, such as bending the feet 14 of the platform. The sheet metal and temporary die members 26 are then placed in the power press and positioned by use of the respective gauges 27 and 29, and the machine is initiated through a punch cycle of operation by actuation of the hand lever or foot pedal 44. Figs. 4 through 7 illustrate successive stages of the punch cycle of operation starting from the initiation of the cycle as shown in Fig. 3 and continuing through one-third of the punch down-stroke illustrated in Fig. 4, two-thirds of the punch down-stroke illustrated in Fig. 5, and the completion of the down-stroke as illustrated in end cross-sectional view in Fig. 6 and side cross-sectional view in Fig. 7.

It will be noted from these several illustrations that the temporary die members 26 are supported by the die member 20 at regions remote from the region of corner bend of the sheet metal 24, that the temporary die members 26 are conformably bent concurrently with the corner bending of the sheet metal 24 by bending stresses imparted to the temporary die members 26 through the sheet metal 24, and that throughout the corner bending step the temporary die members 26 support the side walls of each corrugation and preferably also bear against the inside apex surface of the corrugation to maintain the corrugation wall spacing throughout the corner bending process.

The precise manner in which the temporary die members 26 maintain substantially uniform corrugation cross-sectional configuration and smooth corrugation wall surfaces throughout the corner bending process is not fully understood, but it is believed that these desirable results are produced by frictional forces set up by engagement of the temporary die members 26 with the inside wall surfaces of the corrugations rather than by the heaviness or stiffness of the material of the temporary die members 26. These frictional forces all along the length of each temporary die member 26 are believed to increase as the bend progresses and appear to be accompanied to more or less extent by a dragging effect, thus holding quite firmly the inside wall surfaces of the corrugation and doubtless causing some actual wall compression. It has been found in practice that the temporary die members 26 may have a somewhat loose fit with the corrugations at the initiation of the corner bending operation, a perfect fit appearing not to be required, and that they snug up with the corrugations as soon as the actual bending operation begins. Since the crest of each corrugation is received within a groove 34 of the punch die member 32, the grooves 34 appear to guide the compressive flow of the sheet metal in the crest during the bending step. At the moment of full closure of the die members 20 and 32, the top surface of each insert 22 engages an associated die member 26 to force the latter fully into its corrugation and thereby force the side walls and apex of the corrugation into conforming engagement with an associated groove 34 of the die members 32 as a final corrugation forming step.

Upon completion of the down stroke of the punch die 32 as illustrated in Figs. 6 and 7, the die 32 is automatically raised again to complete its reciprocatory cycle and the corner formed material 24 is removed from the press. The now-bent temporary die members, i.e. the rods 26, can be discarded as scrap; or alternatively they may either be restraightened to their initial linear configuration for reuse in a subsequent bending operation, several such restraightening operations being deemed practicable before the fatigue of the metal of the temporary die renders the latter unsuitable for further use, or the bent end of each temporary die may be cut off and discarded as scrap where the temporary die is composed of only the end portion of a long length of temporary die material.

Since the cross-sectional configuration remains uniform and without distortion and with smooth corrugation walls throughout the corner bend, an article formed with corner bends in accordance with the present invention is characterized by corner bends of much greater strength and appreciably greater rigidity than heretofore exhibited by prior corner bends of deformed cross-section even though strengthened by bridging bracing corner straps as heretofore described.

A form of corner bending machine embodying the present invention in modified form suitable for hand operation is illustrated in Figs. 8, 9, and 10. This form of machine is in the nature of a sheet metal brake having a bed 50, supported on a stand 51, to receive and position the corrugated sheet metal 24 and temporary deformable die members 26 for the corner bending operation. A bending plate 52 is pivotally movably supported by hinges 53 to the bed 50 or stand 51 as in conventional

metal brake constructions and is movable by manual force exerted on a handle 54 or like actuator affixed to the plate 52. A hold-down member 55 is supported in conventional manner by guides or ways (not shown) for movement toward and away from clamping hold-down engagement with the sheet metal 24 on the bed 50, and has a lower corner 56 rounded to define the radius of curvature of the corner bend which it is desired to form in the sheet metal. The hold-down member 55 is provided with grooves 57 to receive the corrugations of the sheet metal 24 initially and at the completion of the bending operation, as illustrated by the fragmentary cross-sectional view of Fig. 9. As also illustrated in Figs. 9 and 10, a plurality of metal strips 58 are suitably secured to the bed 50 and bending plate 52 in registry with the corrugations of the sheet metal and have convex surfaces engaging the temporary die members 26 to serve the same purpose as the insert members 22 of the machine earlier described.

The operation of a machine embodying the present form of the invention is believed evident from the foregoing description considered in connection with the drawing. Manual actuation of the handle 54 is effective to move the bending plate 52 about its hinge point 53 to bend the corrugated sheet metal 23 and temporary die members 26 by exerting bending stress on the temporary die members 26 at points removed from the region of bend of the sheet metal. The curved corner 56 of the hold-down member 55 engages the sheet metal 24 at the region of the bend to effect concurrent bending of the sheet metal 24 and temporary die members 26 to the desired radius of curvature. The grooves 57 of the hold-down member 55 and the temporary die members 26 cooperate during the bending process in much the same manner and to attain the same result as described in connection with the machine of Figs. 3-7.

From the foregoing description of the invention, it will be apparent that the invention enables the cold-forming of corner bends transverse to the corrugations of corrugated sheet metal (e.g. of iron, steel and the like, and particularly special metals as described above) while preserving maximum stiffness and rigidity of the corner thus formed to obviate the need of any corner bracing. Articles so cold-formed in accordance with the invention accordingly possess high strength and stiffness and exhibit smooth surfaces free of wrinkles, cracks and crevices as is particularly desired in those articles used in handling and processing of food stuffs.

While specific forms of the invention have been described for purposes of illustration, it is contemplated that numerous changes may be made without departing from the spirit of the invention.

What is claimed is:

1. The method of forming corner bends in, and transverse to the corrugations of, corrugated sheet metal while maintaining substantially uniform corrugation cross-sectional configuration and smooth corrugation wall surfaces throughout the bend comprising: positioning the corrugated sheet metal between spaced-apart corner bending dies with the sheet supported on one of said dies at places spaced apart in the direction of said corrugations, including in cooperative relation with each corrugation a temporary deformable metal die member dimensioned to maintain corrugation wall spacing and positioned to receive bending stresses through said sheet metal and having a length corresponding substantially to the ultimate length of engagement of said bending dies with said sheet metal, and closing said dies to exert a bending force on said sheet metal at the region of said bend and counterforces on said temporary die members at regions removed from said region of bend to form said bend while concurrently conformably bending each said temporary die member by bending stresses imparted thereto through said sheet metal.

2. A corrugated stainless steel sheet or plate metal corner bending machine comprising, a pair of corner

bending dies supported for relative movement between open position receiving said sheet or plate metal therebetween and closed position at which a desired corner bend is formed and including a convex die member having grooves of cross-sectional configuration corresponding to that of said corrugations to receive said corrugations as the bend progresses and including a mating concave die member, the corrugations of said sheet metal having isosceles trapezoidal cross-section, said sheet or plate metal being supported by said concave die member with the corrugations thereof spanning said concave die member in the direction of their length, a temporary deformable metal die member of circular cross-section individual to and positionable within and extending substantially throughout the ultimate die-engaged length of each corrugation included in a corner bend, the diameter of said deformable metal die members being selected with relation to the corrugation wall spacing to maintain said wall spacing during corner bending thereof, and means for effecting forced movement of said corner bending dies to said closed position concurrently to bend said sheet metal and each said temporary die member.

3. The method of forming corner bends in, and transverse to the corrugations of, corrugated sheet or plate metal while maintaining substantially uniform corrugation cross-sectional configuration and smooth corrugation wall surfaces throughout the bend comprising: positioning the corrugated sheet or plate metal between opposing and relatively movable corner bending members with the corrugations positioned perpendicular to the region over which the corner bend is desired, one of the said members having corrugation-receiving grooves of cross-section substantially corresponding to that of the corrugations and also extending substantially perpendicular to said region of bend, positioning within each corrugation in engagement with at least opposing side-wall areas thereof an elongated initially linear but deformable metal member extending beyond said region of bend on each side thereof, and applying bending forces to said corner bending members to provide relative movement between said corner bending members to form said bend by said forces being exerted on said sheet or plate metal and each said deformable member at said region of said bend.

4. The method of forming corner bends in, and transverse to the corrugations of, corrugated sheet or plate metal while maintaining substantially uniform corrugation cross-sectional configuration and smooth corrugation wall surfaces throughout the bend comprising: positioning the corrugated sheet or plate metal between spaced-apart mating convex and concave corner bending die members with the corrugations spanning said concave die member, one of said die members having corrugation-receiving grooves of cross-section substantially corresponding to that of the corrugations and extending substantially perpendicular to the region of said one die member over which the corner bend in said sheet or plate is to be formed, including in cooperative relation with each corrugation on the side of said sheet or plate opposite said groove die member and extending over the span of said concave die member a temporary deformable metal die member dimensioned to maintain corrugation wall spacing, each said deformable die member receiving bending forces exerted thereon by the non-grooved one of said die members and said sheet or plate receiving bending forces exerted thereon by said grooved die member, and closing said die members to form said bend while concurrently conformably bending each said temporary die member by bending stresses imparted thereto through said sheet or plate metal.

5. The method of forming corner bends in, and transverse to the corrugations of, corrugated sheet or plate metal while maintaining substantially uniform corrugation cross-sectional configuration and smooth corrugation wall surfaces throughout the bend comprising: positioning the corrugated sheet or plate metal between

spaced-apart corner bending dies including a convex die member grooved to receive said corrugations as the bend progresses and including a mating concave die member, the corrugations of said sheet or plate spanning said concave die member, including within each corrugation a temporary deformable metal die member spanning said concave die member and dimensioned to maintain corrugation wall spacing and to receive bending stresses through said sheet or plate metal, and closing said dies to exert a bending force by said convex die member on said sheet or plate metal at the region of said bend and to support the ends of said temporary die members by said concave die member to form said bend while concurrently conformably bending each said temporary die member by bending stresses imparted thereto through said sheet or plate metal.

6. The method of forming corner bends in, and transverse to the corrugations of, corrugated sheet or plate metal having a melting point in excess of 2,000° F. while maintaining substantially uniform corrugation cross-sectional configuration and smooth corrugation wall surfaces throughout the bend comprising: positioning the corrugated sheet or plate metal between spaced-apart mating convex and concave corner bending die members with the corrugations spanning said concave die member, one of said die members having corrugation-receiving grooves of cross-section substantially corresponding to that of the corrugations, including in cooperative relation with each corrugation on the side of said sheet or plate opposite said grooved die member and extending over the span of said concave die member a temporary deformable low-carbon-content steel die member dimensioned to maintain corrugation wall spacing, and closing said die members to form said bend while concurrently conformably bending each said temporary die member by bending stresses imparted thereto through said sheet or plate metal.

7. The method of forming corner bends in, and transverse to the corrugations of, corrugated stainless steel sheet or plate metal while maintaining substantially uniform corrugation cross-sectional configuration and smooth corrugation wall surfaces throughout the bend comprising: positioning the corrugated stainless steel sheet or plate metal between spaced-apart mating convex and concave corner bending die members with the corrugations spanning said concave die member, one of the said die members having corrugation-receiving grooves of cross-section substantially corresponding to that of the corrugations, including in cooperative relation with each corrugation on the side of said sheet or plate opposite said grooved die member and extending over the span of said concave die member a temporary deformable low-carbon-content steel rod dimensioned to maintain corrugation wall spacing, and closing said die members to form said bend by the use of bending forces exerted by said convex die member on said sheet or plate metal and on each said deformable rod at said region of said bend and counteracting forces exerted by said concave die member at regions remote from said region of bend.

8. The method of forming corner bends in, and transverse to the corrugations of, stainless steel sheet or plate metal provided with corrugations of isosceles trapezoidal cross-sectional configuration while maintaining substantially uniform corrugation cross-sectional configuration and smooth corrugation wall surfaces throughout the bend comprising: positioning the corrugated sheet or plate metal between spaced-apart and mating corner bending convex and concave dies one of which includes grooves having a cross-sectional configuration corresponding to that of said corrugations to receive said corrugations as the bend progresses, the corrugations of said sheet or plate metal spanning said concave die, including within each corrugation on the side of said sheet or plate opposite said grooved die and extending over the span of said concave die an elongated linear relatively rigid lubrica-

tion-free temporary deformable die member of low-carbon-content steel having a circular cross-section dimensioned to maintain corrugation wall spacing, and closing said dies to exert by said convex die a bending force on said sheet or plate metal and said deformable die members at the region of said bend and counteracting forces by said concave die on said sheet or plate metal and said temporary die members at regions removed from said region of said bend to form said bend while concurrently conformably bending each said temporary die member by bending stresses imparted thereto through said sheet or plate metal.

9. A corrugated sheet or plate metal corner bending machine comprising, a pair of mating convex and concave corner bending dies supported for relative movement between open position receiving said sheet or plate metal therebetween with the corrugations spanning said concave die in the direction of their length and closed position at which a desired corner bend is formed, one of said dies having corrugation-receiving grooves of cross-section substantially corresponding to that of the corrugations of said sheet or plate metal, a temporary deformable metal die member individual to and positionable within and extending substantially throughout the ultimate die-engaged length of each corrugation included in a corner bend, each said temporary die member being dimensioned with relation to the corrugation wall spacing to maintain said wall spacing during corner bending thereof, and means for effecting forced movement of said corner bending dies to said closed position concurrently to bend said sheet or plate metal and each said temporary die member.

10. A corrugated sheet or plate metal corner bending machine comprising, a pair of mating convex and concave corner bending dies supported for relative movement between open position receiving said sheet or plate metal therebetween with the corrugations spanning said concave die in the direction of their length and closed position at which a desired corner bend is formed, the corrugations of said sheet or plate metal having isosceles trapezoidal cross-section, one of said dies having corrugation-receiving grooves of cross-section substantially corresponding to that of the corrugations of said sheet or plate metal, a temporary deformable metal die member of circular cross-section individual to and positionable within and extending substantially throughout the ultimate die-engaged length of each corrugation included in a corner

bend, each said temporary die member being dimensioned with relation to the corrugation wall spacing to maintain said wall spacing during corner bending thereof, and means for effecting forced movement of said corner bending dies to said closed position concurrently to bend said sheet or plate metal and each said temporary die member.

11. A corrugated stainless steel sheet or plate metal corner bending machine comprising, a pair of mating convex and concave corner bending dies supported for relative movement between open position receiving said sheet or plate metal therebetween with the corrugations spanning said concave die in the direction of their length, and closed position at which a desired corner bend is formed, the corrugations of said sheet or plate metal having isosceles trapezoidal cross-section and one of said dies having corrugation-receiving grooves of cross-sectional dimensions and configuration substantially corresponding to that of the corrugations of said sheet or plate metal, an elongated linear temporary deformable die member of low-carbon-content steel rod individual to and positionable within and extending substantially throughout the ultimate die-engaged length of each corrugation included in a corner bend, each said temporary die member being dimensioned with relation to the corrugation wall spacing to maintain said wall spacing during corner bending thereof, and means for effecting forced movement of said corner bending dies to said closed position concurrently to bend said sheet or plate metal and each said temporary die member.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

35	810,818	Stevenson	Jan. 23, 1906
	1,344,105	Vance	June 22, 1920
	2,115,441	Black	Apr. 26, 1938
	2,279,654	Carter	Apr. 14, 1942
	2,326,493	Pringle	Aug. 10, 1943
40	2,452,125	Ingalls et al.	Oct. 26, 1948
	2,490,269	Johnson	Dec. 6, 1949
	2,702,578	Hoffmann	Feb. 22, 1955

##### FOREIGN PATENTS

45	4,787	Great Britain	Nov. 25, 1878
	17,486	Sweden	Apr. 23, 1904
	118,695	Great Britain	Sept. 18, 1918