April 13, 1954 LE ROY EABY ET AL 2,674,764

METHOD OF FORMING FLANGED ARTICLES

Filed Oct. 31, 1950 2 Sheets-Sheet 1

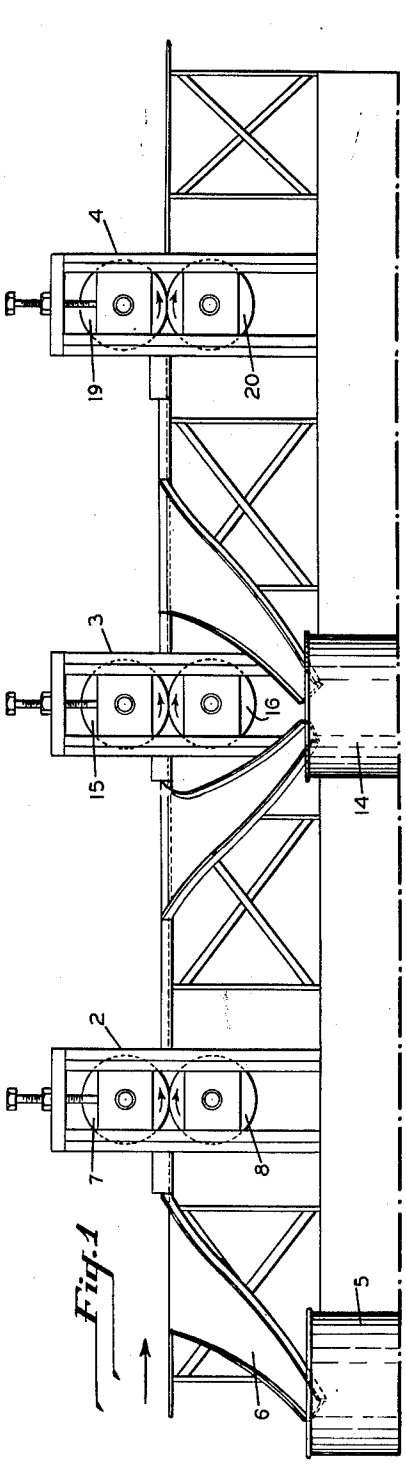


Fig. 1

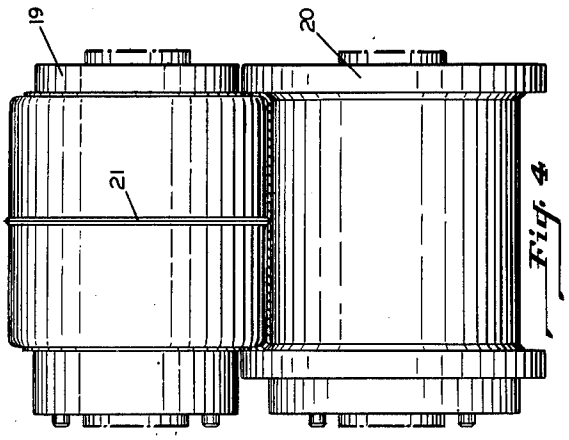


Fig. 4

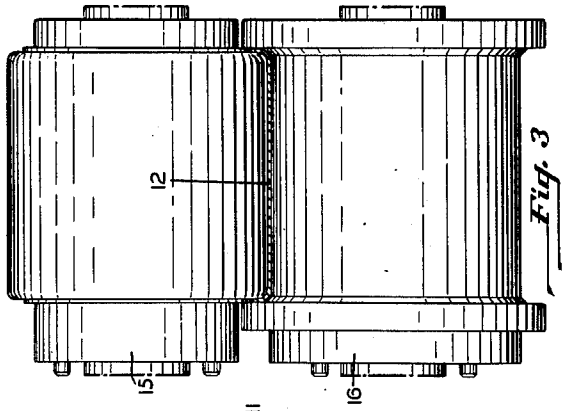


Fig. 3

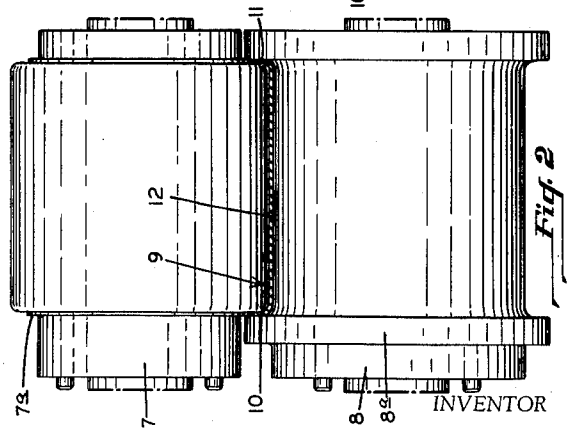


Fig. 2

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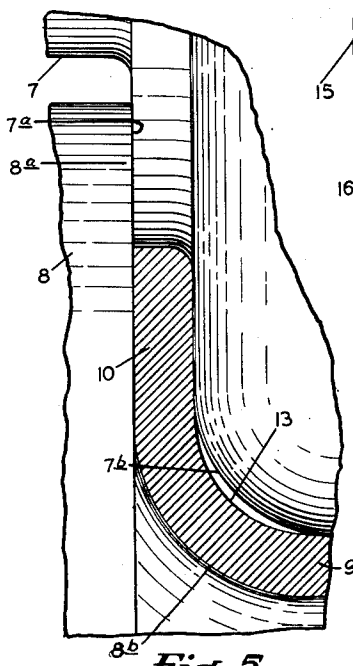


Fig. 5

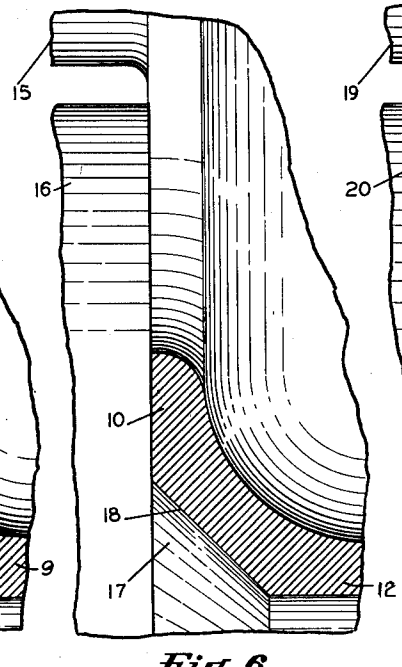


Fig. 6

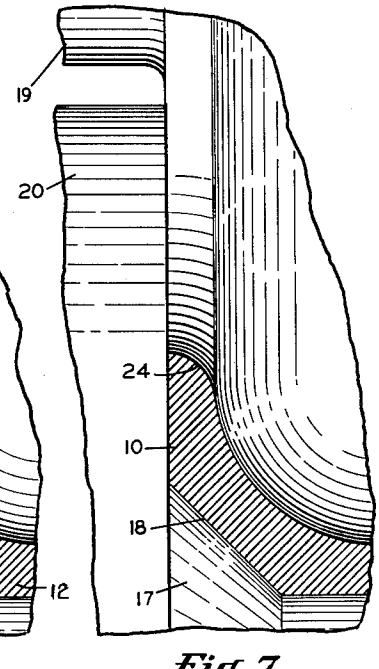
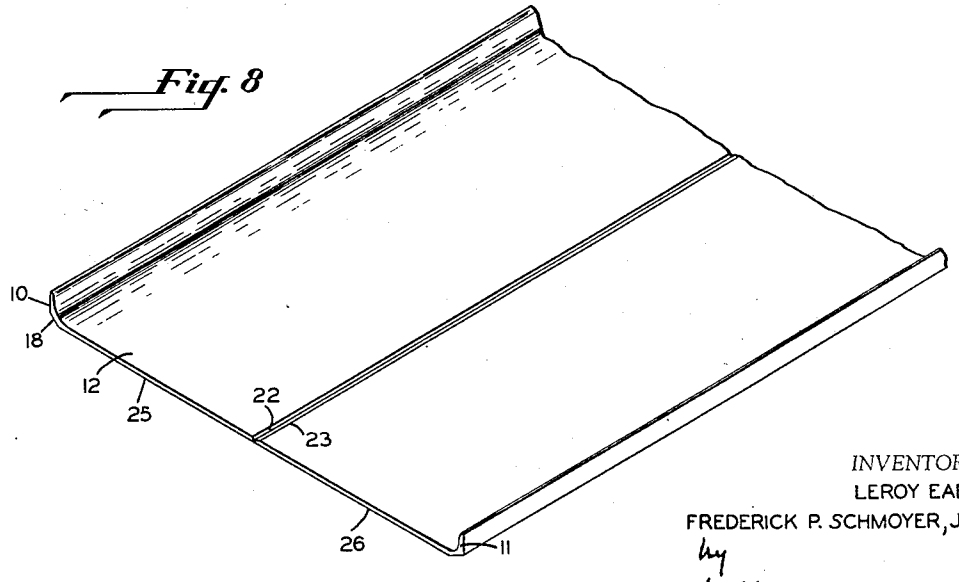


Fig. 7

Fig. 8



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METHOD OF FORMING FLANGED ARTICLES

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8 Claims. (Cl. 18—47.5)

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This invention relates to a method of roll forming thermoplastic sheet materials. It is concerned more particularly with the roll forming of cove base elements from compositions similar to those employed in the manufacture of asphalt type floor tiles.

There are preformed cove base elements on the market which are formed by disposing a sheet of thermoplastic composition in a mold and applying heat and pressure to cause the thermoplastic composition to assume a shape corresponding to the mold configuration. These cove base elements have a flat body portion, generally 4'' to 6'' high and about 4' long, and have a laterally directed flange which constitutes a foot adapted to overlie the edge of the floor covering when the cove base is installed with its flat body portion lying in engagement with a wall surface contiguous to the floor.

The mold method of forming these cove base elements is relatively slow and, consequently, expensive.

It is an object of the present invention to provide a method whereby such elements may be roll formed.

Another object of the invention is to provide a method of roll forming a cove base or similar piece having a flange of nonuniform cross-sectional shape projecting laterally from one edge thereof, without setting up within the body of the piece objectionable stresses which might result in curling or other undesired deformation.

According to this invention, a flat sheet of thermoplastic material of substantially uniform thickness is first rolled to provide substantially equal, laterally directed flanges on both of the edges of the sheet. Thereafter, the formed piece is rolled to reduce the thickness of the same substantially uniformly throughout the extent of the flat body portion thereof between the laterally directed flanges while, at the same time, substantially contouring both of said flanges in a substantially identical manner into a nonuniform cross-sectional shape and thickness. In this contouring, the height of the flanges is reduced and their thickness is increased.

Where cove base pieces and similar articles are formed in multiples, the roll-formed piece may be severed into two pieces, each having a similar laterally projecting flange. Preferably, the line of severance is disposed longitudinally of the strip

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midway between the flanges and may be accomplished by roll forming a rounded depression in the longitudinal center of the strip, such depression extending substantially completely through the thickness of the sheet.

In the accompanying drawings which illustrate apparatus suitable for carrying out the method of the invention and show a small section of a complete blank prior to severance into two cove base pieces:

Figure 1 is a generally diagrammatic view showing a roll-forming apparatus set up for straight line production of formed pieces;

Figure 2 is a front elevational view illustrating the first pass forming rolls;

Figures 3 and 4 are similar to Figure 2 and show the second and third pass forming rolls;

Figures 5, 6, and 7 are enlarged, partial sectional views showing the flange formation by the rolls of Figures 2, 3, and 4; and

Figure 8 is a perspective view of a portion of a blank formed in accordance with the method, prior to severance into cove base elements.

Referring first to Figure 1, there are shown three pairs of forming rolls at roll-forming stations 2, 3, and 4. The rolls are mounted in suitable adjustable bearings and are driven in the direction of the arrows by suitable drive mechanism which is not illustrated in the diagrammatic showing of Figure 1.

The following is a typical example of a composition suitable for use in the formation of cove base elements in accordance with the method of the present invention.

Example I

	Pounds
Asphalt	129
Gilsonite	31
Asbestos	255
Pigment	86

The ingredients are conventional tile-forming constituents.

The mass of Example I is heated in an internal mixer and then formed into a sheet about .165'' thick which is severed into pieces about 9½'' wide by about 41'' long. The sheet thus formed is heated to a temperature of about 120 to 130° F. on its outer surfaces to render it sufficiently plastic for roll formation.

It is preferred to effect heating of the piece by

dipping the sheet into a tank 5 which contains a heated water emulsion wax which may be formulated as follows:

Example II

Powdered soap	ounces	4
Carnauba wax	do	8
Water	gallons	5

This wax emulsion is preferably heated to a temperature of about 180° F. The sheet is immersed in the solution for a period of time sufficient to elevate the temperature at the surfaces thereof to the desired degree, and then the sheet is carried over a guiding chute and drain trough 6 and is fed to the first roll-forming station 2.

At station 2 there are provided an upper roll 7 and a lower roll 8, shown in Figures 1, 2, and 5. The rolls are contoured so as to form the flat sheet 9 in such manner as to provide laterally projecting flanges 10 and 11 thereon, as shown in Figure 2, and to a larger scale on one end in Figure 5. In the operation at this station 2 the sheet is bent, but there is no substantial reduction in its thickness either in the unformed flat body portion 12 thereof or in the flanges 10 and 11. Also, as will be observed by reference to Figure 5, there is no substantial contouring of the corners 13 which connect the flanges 10 and 11 to the flat body portion 12. Essentially, the first pass is a bending operation combined with a sizing operation. It will be noted by reference to Figures 2 and 5 that the lower roll 8 is provided with a pair of radial flanges 8*a*, one of which is shown in Figure 5, which receive the bosses 7*a* formed on the upper roll 7 and define therebetween a compartment into which the flanges 10 and 11 of the piece being formed are turned. This combination of surfaces serves as a positive or closed pass, automatically shearing the piece along the edges of the flanges as the piece passes through the first station.

The upper roll 7 is preferably so contoured at its edges 7*b* that the sheet 9 is not confined at the corners 13 but is free to assume the curvature imparted by the filleted corner 8*b* of the lower roll 8, the corner as formed actually clearing the edge surface 7*b* of the upper roll. This permits substantially unrestricted flow of the material of the sheet 9 during the initial roll forming or bending. While the flange 10 is shown in Figure 5 substantially filling the radially disposed space between the rolls, there is no need to effect reduction in thickness of the flange. In fact, the rolls may be shaped to provide a slight clearance between the end surfaces of the roll 8 and the flanges.

The sheet as it leaves the first roll-forming station 2 may be about 42" long, about 8¼" wide, about .160" to .165" thick, and will have flanges about ⅞" high projecting from opposite ends of the flat body portion 12. The slight reduction in thickness of the sheet results in the minor elongation thereof. As previously mentioned, no effort is made to effect reduction in thickness in this pass, only sufficient compression being applied to the sheet between the rolls to insure that the sheet will be moved through the pass and its flanges bent to shape.

The blank formed at station 2 is then passed into forming station 3. Prior to delivery of the blank to station 3, it is preferably dipped into a tank 14 containing wax emulsion similar to that

contained in the tank 5. The emulsion is heated to a temperature of about 170° F. and serves to provide a lubricant on the surfaces of the blank. The bath is heated in order to avoid cooling of the surfaces of the blank. It is not necessary to permit the blank to remain in the lubricant; it is merely dipped in and immediately removed. Other systems of applying lubricant to the faces of the blank may be accomplished, such as a spray application or a dip trough through which the blank may be passed between stations 2 and 3.

The lubricant-coated blank is fed between the closed pass rolls 15 and 16 at forming station 3, and a substantial reduction in thickness of the blank is effected in the flat body portion 12. (The major portion of blank deformation may be effected at this station.) This reduction is substantially uniform throughout the extent of the body portion between the laterally directed flanges 10 and 11. Simultaneously with this reduction in thickness, substantial contouring of both of the flanges 10 and 11 is effected, the length of the flanges being reduced and the thickness in the corner area being increased. As will be observed by reference to Figure 6, the lower roll 16 is provided with a conical surface 17 which forms a flat surface 18 on the under or back side of the blank, and the composition in the flanges 10 and 11 is forced to fill the space between rolls 15 and 16 at the corner, increasing the thickness of the blank in the corner area as will be observed by comparing Figures 5 and 6. It is to provide for proper contouring in the corner areas where an increase in thickness of the piece is desired for reinforcing that the flanges are initially formed to a height greater than desired in the final piece. This makes it possible upon compression of the flanges in a closed pass to effect the required deformation of the flanges to obtain an increase in thickness of the flanges and proper filling of the space between the rolls at the flanges to obtain the desired contour. This cannot be obtained successfully on a production basis by lateral extrusion of the material obtained exclusively by reducing the thickness of the sheet in the flat portion 12; but, by a combination of compression in the direction of the flange and maintenance of pressure on the flat portion between the flanges in the zone where reduction in height of the flanges is being effected, good conformation of the flanges with the roll contours is obtained.

It will be clear that a symmetrical piece is being formed and that while reduction in thickness is being accomplished in the flat portion 12 of the blank, increase in thickness is being accomplished simultaneously in the flange portions of the blank. With the rolls shaped as shown in Figure 3, any desired change in thickness of the portion 12 may be accomplished by adjusting the rolls 15 and 16 in a direction which is normal to their axes. This will not effect a proportionate reduction in thickness of the flanges, for they are not disposed parallel to the roll axes. Thus it is possible to form a piece having a controlled thickness dimension in the base portion 12 without affecting to any major extent the shape or the strength of the flange portions 10 and 11.

Roll forming at station 3 converts the blank to a piece about 48" long, about 8¼" wide, and about .135" to .140" thick, with flanges about ⅝" high projecting from the flat body portion 12. The piece is substantially completely formed

in the second pass roll-forming station 3. However, if desired a third roll-forming step may be accomplished to finally contour the blank and improve the surface finish thereof. In the third pass, provision may be made for forming a slitting recess in the blank parallel to the length thereof, midway between the laterally projecting flanges, along which severance of the blank into two cove base pieces may be effected. Where only two passes are employed this may be accomplished in the second roll-forming station.

As shown in Figure 4, there is an upper roll 19 and a lower roll 20 at station 4. The upper roll 19 is provided with a circumferential slitting and forming projection 21 contoured to form a pair of generally rounded ends 22 and 23 on the edges of the cove base pieces upon severance of the blank at the base of the formed depression.

The blank as delivered from station 3 may be reduced slightly in thickness at station 4, and the flanges may be further contoured as indicated in Figure 7 where it will be observed that the toe end 24 of the projecting flange 10 is slightly changed in curvature and a slight reduction in thickness of the whole blank is accomplished. In this station a substantially uniform and symmetrical forming action is accomplished and no objectionable stresses are imparted to the blank. Prior to feeding the blank into the third pass, it is preferably dipped into the wax emulsion in tank 14 to provide proper lubrication for the blank. After passing between the rolls 19 and 20 of the third pass station, the finished blank will be about 54" long, 8" wide, and .125" thick. The flanges will remain about 5/8" high.

Where the composition of Example I is employed, the various rolls which are used in the forming operations may be heated to a temperature from about 110° F. to about 120° F. and may be rotated at a peripheral speed of about 65 to 150 feet per minute in the center portions which form the flat portion 12 of the blank. The upper and lower rolls of each pair operate at about the same surface speeds in such portions. This avoids the creation of uneven stresses within the thickness of the main body of the blank which might tend to cause it to curl. If the roll surfaces are well lubricated, some differences in surface speeds may be tolerated and some improvement in surface finish may be obtained. Of course, the surface speeds at the flanges will be different than at the main body portions.

By initially forming the sheet with laterally projecting flanges on both of its longitudinal edges, balanced extrusion pressures are developed in the subsequent roll-forming operations, and any tendency for the finished piece to curl along its length is minimized. The same is true even though the blank of the first pass is altered in cross-sectional shape to provide areas such as the corner surface 18 and the toe portion 24 which are nonuniform in cross section. By forming a symmetrical blank having complementary flanges on opposite longitudinal edges and simultaneously reducing thickness in the body portion 12 with increase in thickness of the flanges by compression of them in the direction of their height, extrusion pressures are balanced and nonuniform stressing of the blank is avoided.

If the rib 21 is not effective for complete severance of the blank into two cove base pieces, this severing operation may be effected manually by merely bending the piece to bring the back surfaces 25 and 26 together, which will cause the thin web of material which remains to sever or be broken. If desired, knife severance may be effected as the sheet leaves the third station, or manual severance may be effected subsequently. Of course, the formed blank may be severed into two pieces by use of a saw or other cutter; but it is preferred to roll a rounded edge for each piece, and this automatically reduces the blank in thickness in this area and severance or rupture is readily accomplished. Some articles which require flanges on opposite sides may be formed completely on the rolls, without severance.

The blanks are preferably sheared to a uniform length, say 48", after separation into two cove base elements.

Cove base elements have been chosen for illustration of an article which may be produced by practice of the method of this invention. Other flanged articles may be similarly produced.

We claim:

1. In a method of forming from a flat sheet of thermoplastic material a piece having flanges projecting from the longitudinal edges thereof which are of nonuniform cross-sectional shape and thickness, the steps comprising forming substantially equal laterally directed flanges on both of the longitudinal edges of a sheet of substantially uniform cross-sectional shape and thickness and thereafter rolling said formed piece and reducing the thickness of the same in the portion thereof between said flanges while increasing the thickness of said flanges and contouring them substantially identically into a nonuniform cross-sectional shape and thickness.

2. In a method of roll forming from a flat sheet of thermoplastic material a piece having flanges projecting from the longitudinal edges thereof which are of nonuniform cross-sectional shape and thickness, the steps comprising rolling substantially equal laterally directed flanges simultaneously onto both of the longitudinal edges of a sheet of substantially uniform cross-sectional shape and thickness and thereafter rolling said formed piece and reducing the thickness of the same substantially uniformly throughout the extent of the flat surface thereof between said laterally directed flanges while increasing the thickness of said flanges and contouring both of them substantially identically into a nonuniform cross-sectional shape and thickness.

3. In a method of roll forming from a flat sheet of thermoplastic material a piece having flanges projecting from the longitudinal edges thereof which are of nonuniform cross-sectional shape and thickness, the steps comprising rolling substantially equal laterally directed flanges simultaneously onto both of the longitudinal edges of a sheet of substantially uniform cross-sectional shape and thickness without substantially decreasing the thickness of the sheet, thereafter rolling said formed piece and reducing the thickness of the same substantially uniformly throughout the major extent of the flat surface thereof between said laterally directed flanges, and simultaneously therewith reducing the height of both of said flanges while increasing the thickness thereof and contouring both of them substantially identically into a nonuniform cross-sectional shape and thickness.

4. In a method of forming from a flat sheet of thermoplastic material a piece having flanges projecting from the longitudinal edges thereof which are of nonuniform cross-sectional shape and thickness, the steps comprising bending substantially equal laterally directed flanges onto

both of the longitudinal edges of a sheet of substantially uniform cross-sectional shape and thickness, said flanges being of a height greater than desired in the finally formed piece, and thereafter rolling said formed piece in a closed pass to reduce the height of said flanges and increase the thickness thereof while contouring both of them substantially identically into a nonuniform cross-sectional shape and thickness and simultaneously rolling the portion of the piece between said flanges to reduce the thickness thereof.

5. In a method of forming from a flat sheet of thermoplastic material a piece having flanges projecting from the longitudinal edges thereof which are of nonuniform cross-sectional shape and thickness, the steps comprising bending substantially equal laterally directed flanges onto both of the longitudinal edges of a sheet of substantially uniform cross-sectional shape and thickness, said flanges being of a height greater than desired in the finally formed piece, thereafter rolling said formed piece in a closed pass to reduce the height of said flanges and increase the thickness thereof while contouring both of them substantially identically into a nonuniform cross-sectional shape and thickness while simultaneously rolling the portion of the piece between said flanges to reduce the thickness thereof, and subsequently further reducing the thickness of the piece in said portion between said flanges while forming a slitting recess in said piece parallel to the length thereof in said portion between said flanges.

6. In a method of roll forming from a flat sheet of thermoplastic material a cove base or similar piece having a flange projecting laterally from one edge thereof, the steps comprising rolling substantially equal laterally directed flanges simultaneously onto both of the longitudinal edges of a sheet of substantially uniform cross-sectional shape and thickness, thereafter rolling said formed piece and reducing the thickness of the same substantially uniformly throughout the extent of the flat surface thereof between said laterally directed flanges while increasing the thickness of said flanges and substantially contouring both of said flanges substantially identically into a nonuniform cross-sectional shape and thickness, and severing the piece thus formed into two pieces, each having a similar laterally projecting flange.

7. In a method of forming from a flat sheet of thermoplastic material a cove base or similar piece having a substantially flat body portion with a curved flange projecting laterally from one edge thereof, which flange is of nonuniform cross-sectional shape and thickness and has an enlarged reinforcing portion disposed intermediate the terminal end of the flange and the body portion, the steps comprising forming a laterally projecting flange of a height greater than desired in the finally formed piece on the edge of a strip of thermoplastic material of substantially uniform cross-sectional shape and thickness, thereafter rolling said formed piece in a closed pass, reducing the thickness of said body portion and causing the material from said body portion to be displaced laterally into said reinforcing portion of said flange and simultaneously reducing the height of said flange and causing material therein to be displaced into said reinforcing portion thereof, whereby an article is formed having a substantially flat body portion and a projecting flange, the portion disposed intermediate the projecting end thereof and said body portion being of increased thickness and constituting a reinforcing portion.

8. In a method of roll forming from a flat sheet of thermoplastic material a piece having flanges projecting from the longitudinal edges thereof which are of nonuniform cross-sectional shape and thickness as defined in claim 2 in which the initial step of rolling substantially equal laterally directed flanges simultaneously onto both of the longitudinal edges of the sheet is effected with the inner surfaces of said flanges adjacent to the corners where they adjoin the main body of the piece being unrestricted during such roll formation step.

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