April 24, 1945. N. M. OLNEY 2,374,301

TRIMMING APPARATUS

Filed July 4, 1942 2 Sheets-Sheet 1

FIG. 1

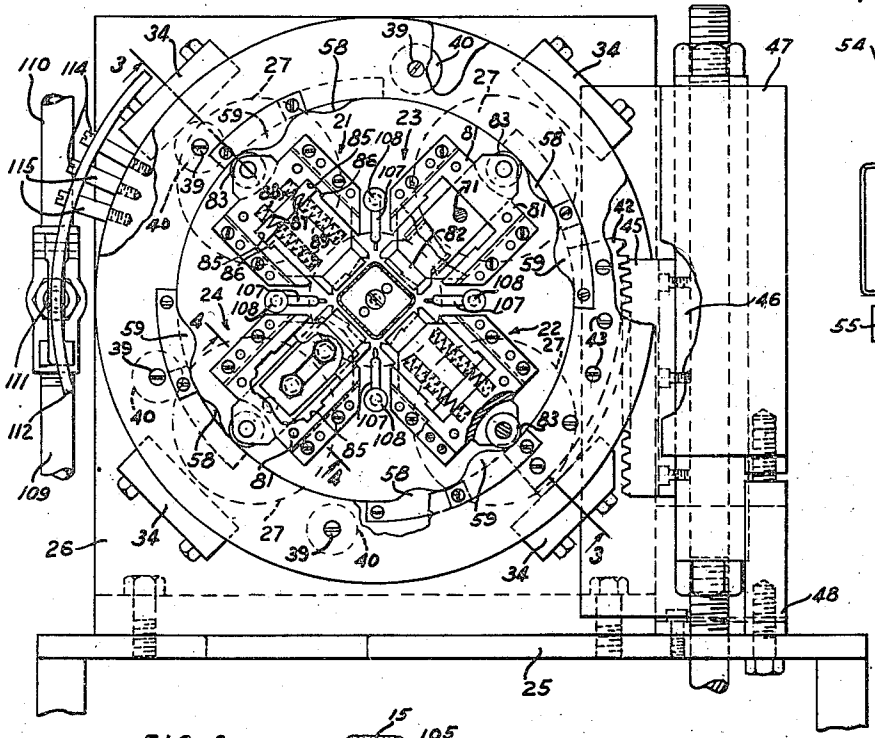

FIG. 2

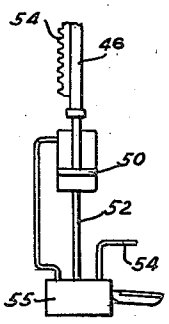

FIG. 3

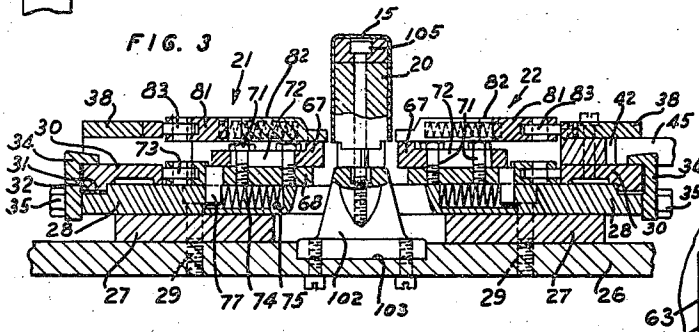

FIG. 4

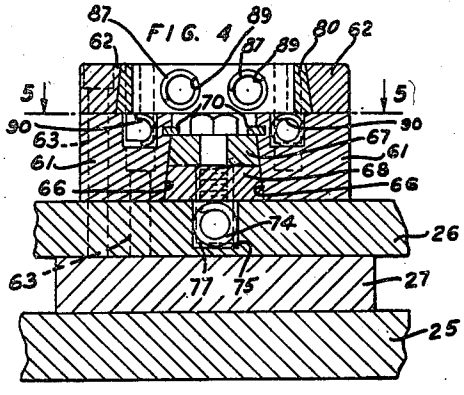

FIG. 5

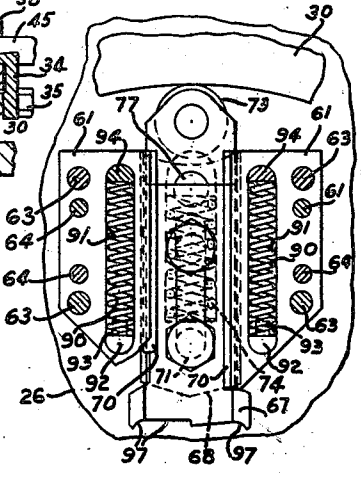

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FIG. 6

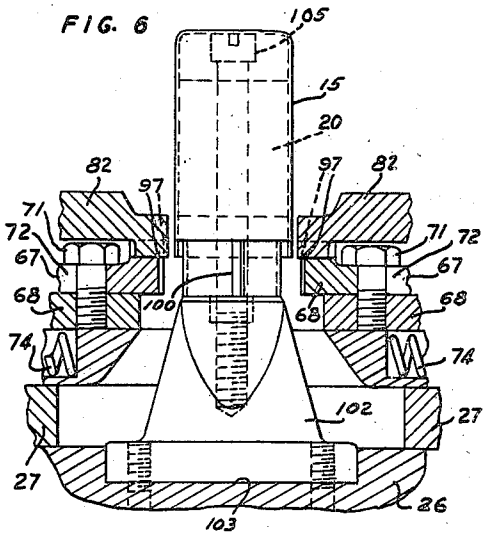


FIG. 7

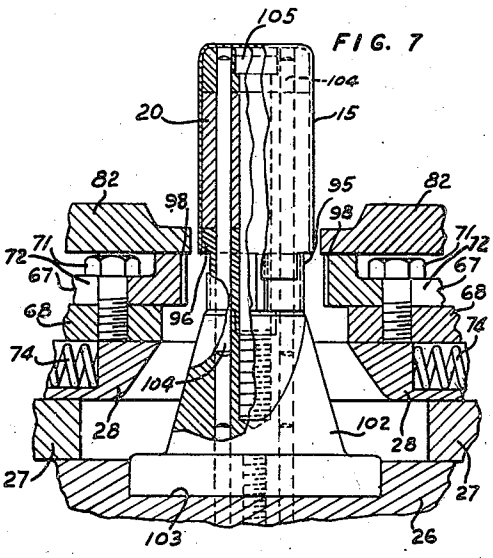


FIG. 8

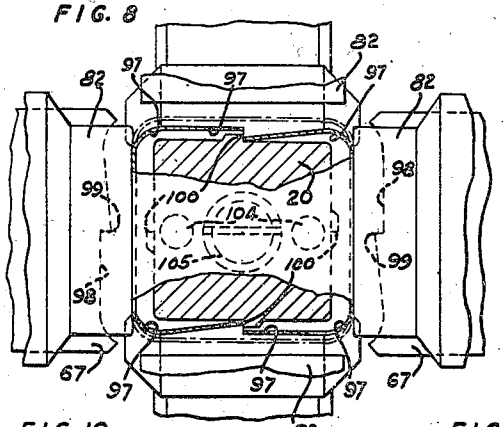


FIG. 9

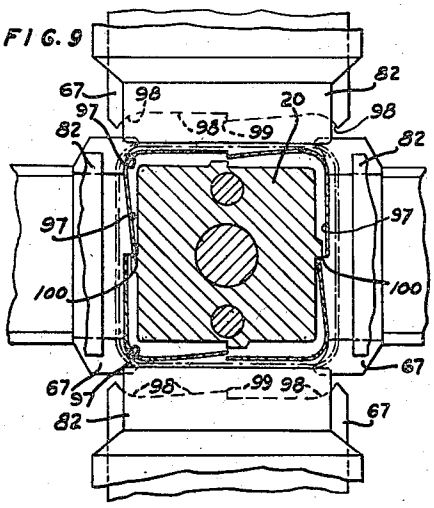


FIG. 10

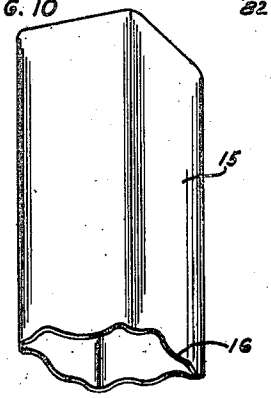
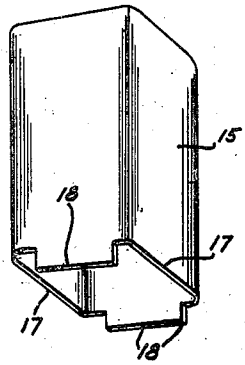


FIG. 11



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Patented Apr. 24, 1945

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UNITED STATES PATENT OFFICE

2,374,301

TRIMMING APPARATUS

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Application July 4, 1942, Serial No. 449,801

12 Claims. (Cl. 164—47)

This invention relates to trimming apparatus, and more particularly to apparatus for trimming and removing scrap material from edges of drawn containers.

Drawn containers formed of sheet metal after passing through the final drawing operation, have edges which are ofttimes irregular or of a contour undesired for the structure in which the container is to be used. In such instances it is necessary to trim the container to form edges of the desired contour without varying the contour of the remaining portion of the container.

An object of the invention is to provide an apparatus which is simple in construction and highly efficient in trimming articles, particularly metal containers.

With this and other objects in view, the invention comprises a mandrel for receiving a hollow article having a continuous edge to be trimmed, and cooperating means to shear material from the continuous edge of the article, shear the said material into and hold the adjacent portions of the article firmly against distortion during the shearing operations.

Other objects and advantages will be apparent from the following detailed description when considered in conjunction with the accompanying drawings, wherein

Fig. 1 is a front elevational view of the apparatus, portions thereof being broken away;

Fig. 2 is a schematic view of the operating means for the apparatus;

Fig. 3 is a sectional view taken substantially along the line 3—3 of Fig. 1;

Fig. 4 is an enlarged fragmentary sectional view taken along the line 4—4 of Fig. 1;

Fig. 5 is a fragmentary sectional view taken along the line 5—5 of Fig. 4;

Fig. 6 is an enlarged fragmentary sectional view illustrating the working ends of one pair of units and their association with a mandrel;

Fig. 7 is a fragmentary sectional view of the mandrel and the inner ends of the other pair of units;

Fig. 8 is a fragmentary top plan view of the structure shown in Fig. 6 at a slightly larger scale, illustrating the relative positions of portions of the units during one trimming operation;

Fig. 9 is a fragmentary detail view of the structure shown in Fig. 8 but with the portions of the units in different positions to illustrate the other or final trimming operation;

Fig. 10 is a perspective view of the article prior to the trimming operation, and

Fig. 11 is a perspective view of the article after the trimming operation.

Referring now to the drawings, attention is first directed to Figs. 10 and 11, Fig. 10 illustrating a metal container 15 which in the present embodiment is the article to be trimmed. The trimming first takes place at the edges of the open end of the container, removing the material of the irregular edge illustrated in Fig. 10 at 16, leaving the contour as illustrated in Fig. 11, that is with opposing side walls of the container having their edges 17 lying in a common plane and continuing around the corners of the container, where they meet with projecting portions 18 having parallel vertical edges and parallel outer edges as shown.

Referring now in general to the structure shown in the other figures, the article 15 as shown in Fig. 10 is placed upon a mandrel 20 which is formed of a contour similar to the container but is adapted for free movement of the container into and out of position thereon. When the container is mounted upon the mandrel as shown in Fig. 3, suitable mechanism, hereinafter described, will be actuated to cause operation of units indicated generally at 21 and 22 to hold the adjacent walls of the container against the mandrel, while trimming elements of units indicated generally at 23 and 24 perform their respective trimming operations, after which holding members of the units 23 and 24 will hold their respective sides of the container on the mandrel while trimming elements of the units 21 and 22 perform their final trimming operation.

Considering now the detailed structure of the apparatus, attention is first directed to Fig. 1, which illustrates a table 25 upon which an upright member 26 is mounted. Four cylindrical spacing members 27 are disposed at equally spaced positions from the face of the upright 26, as shown in Figs. 1 and 2. An annular support 28 is disposed adjacent the spacing members 27 and, through the aid of screws 29 (Fig. 3), the support 28 together with the spacing members is secured rigidly to the upright 26, the support 28 being spaced from the upright by the members 27. A cam supporting member 30, annular in general contour and of the cross-sectional structure as illustrated in Fig. 3, is disposed adjacent the support 28 and is provided for interengagement therewith by an integral annular lip 31 being disposed in an annular recess 32 of the support. Retaining lugs 34, disposed at equally spaced positions about the edges

of the support 28 and the cam supporting member 30, are rigidly mounted upon the support through the aid of screws 35 and are of angular contour to extend about the edge of the cam supporting member, as illustrated in Fig. 3, to retain the cam supporting member in interengagement with the support yet permit movement thereof relative to the support.

Another cam supporting member 38, annular in contour and similar in size to the cam supporting member 30, is secured to the member 30 by screws 39 which also pass through spacers 40 and into threaded apertures (not shown) into the cam supporting member 30. The spacers 40, as illustrated in Fig. 1, are disposed at spaced positions throughout the circular contour of the cam supporting members, excepting at a position where a gear segment 42 is disposed to space these members apart, the gear segment serving in one of its functions to assist in spacing the cam supporting members 30 and 38 apart and, through the aid of screws 43, to secure the cam members in their spaced positions.

The power means for imparting movement to the cam supporting members 30 and 38 is linked with the gear segment 42 through a rack 45 which is rigidly mounted upon a reciprocable rod 46. The rod 46 is supported for its reciprocable movement in a bearing-like member 47 secured to the upright 26 and mounted upon the table 25 as indicated at 48. The rod 46 may be operatively connected to any suitable means to cause reciprocation thereof at desired time intervals, one illustration being shown in Fig. 2. In this figure there is schematically shown the rod 46, with the rack 45, having its lower end connected to a piston 50 which is in a cylinder 51. The piston 50 may be of the double-acting type moved in opposite directions by fluid under pressure supplied to the cylinder through respective fluid lines 52 and 53 from a supply, indicated at 54, through the control of a foot operated valve 55. Suitable exhaust lines, not shown, may also be provided and controlled through the valve 55. The details of this structure are not believed essential for a clear understanding of the invention, as such structures are well known commercially.

Returning now to the cam supporting members 30 and 38, the cam supporting member 30 has cams 58 mounted at desired spaced positions thereon as illustrated in Fig. 1, while the member 38 has cams 59 mounted thereon at positions similar to the cams 58 but out of alignment therewith. The cams 58 are positioned to actuate cutting elements of their respective units 21 to 24 inclusive, while the cams 59 are adapted to actuate the holding members of their respective units, through oscillation of the cam supporting members.

Attention is now directed to the structures of the units 21 to 24 inclusive. These units are identical in structure excepting for their working ends, and these in opposing pairs are of like structure. It is, therefore, believed that a specific description applied to one unit, excepting for the features which differ in the pairs of units, would be sufficient for a clear understanding of all of the units. In Fig. 3 units 21 and 22 have been shown in detail. Attention is first directed, however, to Fig. 4, which shows pairs of side members 61 and 62 secured to the upright 26 through the aid of screws 63 and pins 64 (Fig. 5). The side members 61 have diagonal surfaces 66 cooperating with each other and with the adjacent face of the upright 26 to provide a substantially dovetail groove for a shearing element 67 and its support 68. The side walls of the element and its support, which are movably disposed in the dovetail groove previously described, are of a combined substantially dovetail contour to conform to the groove. To assure against the binding of the shearing element and its support in the groove and for true line movement of the shearing element during operation of the apparatus, guide strips 70 are partially embedded in the inner walls of the member 61 adjacent the surface of the element 67. The support 68 has threaded apertures for screws 71 which are disposed in an elongate aperture 72 in the shearing element 67, to serve in varying the relative positions of the shearing element and the support, or, in other words, to vary the position of the shearing element relative to the mandrel 20. The outer end of the support 68 is of a contour to rotatably support a cam roller 73 positioned to ride upon the inner surface of the cam supporting member 30 and to be moved by its respective cam 58. A spring 74, disposed in a recess 75 in the upright 26, is adapted through the aid of a pin 77, carried by the support 68 and projecting into the recess, to normally urge the support 68 and its shearing element 67 outwardly and cause the cam roller 73 to ride upon the inner surface of the supporting member 30 and its respective cam when the latter is moved into engagement therewith. The contours of the inner or shearing edges of the various shearing elements 67 are shown in detail in Figs. 6 to 9 inclusive and will be more completely described when attention is directed to these figures.

Attention is again directed to Fig. 4, which illustrates the contour of the inner surfaces of the side members 62 cooperating with the adjacent surfaces of the side member 61 to form a substantially dovetail recess or groove, indicated at 80, to slidably receive an outer controlling portion 81 of a holding member 82. The controlling member 81 is substantially U-shaped in general contour, as illustrated in Fig. 1, and supports a cam roller 83, at its outer end, adapted to ride upon the inner surface of the cam supporting member 38 and upon its respective cam 59. The controlling portion 81 is provided with opposing recesses 85 in its inner surfaces, to receive integral tongue portions 86 of the holding member 82 to provide an interlocking connection between the controlling portion of the holding member yet permit relative movement thereof. A pair of springs 87, with the ends thereof embedded in recesses 88 and 89 of the controlling portion 81 and the holding member 82 respectively, serve to hold the portion and member in their relative positions as shown in Fig. 1. The springs 87 also function as a cushioning means between the controlling portion and the holding member. Another set of springs 90, embedded in recesses 91 (Fig. 5) of the side pieces 61, serves to normally hold the controlling portion 81 and thus the holding member 82 outwardly to cause the cam roller 83 to ride upon its respective cam or inner surface of the cam member 38. The inner ends of the springs 90 abut against flat-surfaced members 92 and are held in place by integral portions 93 thereof, while the other ends of the springs abut flat-surfaced pins 94, the latter being carried by the controlling portion 81 and extending into grooves 91.

Attention is now directed to Figs. 6 to 9 in-

clusive. Referring first to the mandrel 20, it will be noted that the main or upper portion is of a contour identical with the inner contour of the completed article illustrated in Fig. 11, yet with sufficiently smaller dimensions to permit free location and removal of containers or articles thereon. Directly beneath the upper or supporting portion of the mandrel, there is provided a reduced or forming portion 95 having shearing edges 96 of the contour to which the open end of the article (Fig. 11) to be formed. The shearing edges 96 will cooperate with similar shearing edges 97 of one set of shearing elements shown in Fig. 6 and with shearing edges 98 of the other set of shearing elements shown in Fig. 7. The shearing elements also have shearing edges 99 extending substantially at right angles to their respective shearing edges 97 or 98 and cooperate with shearing edges 100, of the forming portion 95, to shear the scrap portions, removed by the other shearing edges, into smaller pieces, so that they may be readily removed from the apparatus at the completion of the shearing operations. Attention is directed to the contours of the shearing edges 97 and 98, they being such that the shearing begins at the center of each side of the article and continues in both directions therefrom and finally a little more than half the distance around their corners, the latter resulting from the curved end portions of the shearing edges.

Attention is again directed to Figs. 6 and 7, where it will be observed that a base member 102, rigidly mounted in a recess 103 in an upright 26, serves to support the mandrel 20 and the forming portion 95, through the aid of locating and retaining pins 104 and a central screw 105.

The scrap portions sheared from the article are forced from the apparatus by jets of air applied at convenient locations through the aid of nozzles 107 (Fig. 1). The nozzles are shown conveniently located between units 21 to 24 inclusive and are adapted to direct their jets of air to their respective scrap portions to force the portions free of the apparatus. The nozzles 107 are connected to their respective fluid lines 108 which communicate in any suitable manner (not shown) to a fluid line 109, the latter being connected at a desired interval during the operation of the apparatus to a fluid supply line 110 through a valve 111. A cam 112, carried by the cam supporting member 30 through the aid of screws 114 and spacing sleeves 115, is movable with the cam supporting member and is adapted to open the valve 111 at the completion of the shearing operations, to cause the air under pressure to pass to and through the nozzles to force the sheared portions from the apparatus.

Upon considering the operation of the apparatus, let it be assumed that the units 21 to 24 inclusive are in their normal positions and that the article or container 15, as shown in Fig. 10, is disposed upon the mandrel 20. The apparatus is now ready for operation and upon actuating the valve 55 (Fig. 2) to open communication between the supply line 54 and the fluid line 52, the piston 50 may be moved upwardly to move the rod 46 in the same direction. The movement of the rod 46 will move the rack 45 to cause rotation of the cam supporting members 30 and 38 relative to the units. As previously described, the cams 58 and 59 are so positioned that during the first portion of the operating cycle the holding members 82 of one pair of units will be operated to hold the opposite sides of the article on the mandrel, while the intermediate sides of the article have the shearing operations performed thereon during the actuation of the shearing elements of the other pair of units. As illustrated in Fig. 1, the cams 59 are positioned adjacent the cam rollers 83 for the holding portions of the units 21 and 22. Thus, at the beginning of the movement of the cams with their cam supporting members in a counterclockwise direction, the controlling portions 81 of the units 21 and 22 will be forced inwardly toward each other, moving therewith, against the force of the springs 87, their respective holding members until the engaging ends thereof engage the adjacent walls of the article and, through the cooperation of the mandrel, hold these walls firmly in place. Through the action of the cams 59, the controlling portions of the units 21 and 22 may move inwardly greater distances than their respective holding members, these additional movements of the controlling members compressing the springs 87 to increase the holding force between the holding members and the mandrel.

While the holding members for the units 21 and 22 are completing their movement into holding positions, the shearing elements for the units 23 and 24 are being moved toward each other through the engagement of their cams 58 with their cam rollers 73. Thus, immediately following the positioning of the holding members of the units 21 and 22, to hold their sides of the article against buckling during the shearing operation on the intermediate sides, the shearing elements 67 of the units 23 and 24 begin their shearing operation.

During the movement of the shearing elements into engagement with their respective walls of the article, the cooperating shearing edges 96 and 97 first shear the article at the lines desired to form the final edge of the article, and after this shearing operation has been completed further inward movement of the shearing elements will cause, through the cooperation of the shearing edges 99 and 100, severing at the center line of the sheared portions resulting from the first shearing operation, as illustrated in Fig. 8. As a result of the operation thus far described, two sides of the article have been formed and freed of their excess materials and these materials have been sheared into two portions as illustrated in Fig. 8. These portions, however, remain connected to the portions to be removed from the other two sides of the article. Thus far the apparatus has completed only one half of its cycle of operation in one direction, or one quarter of its complete operating cycle. In other words, only one pair of each set of cams 58 and 59 have been moved into registration with the units to cause the holding means of the units 21 and 22 to hold their respective sides of the article while the shearing elements of the units 23 and 24 perform their shearing operations.

Now consider the remaining movement of the cams and their cam supporting members in the counterclockwise direction, the other pairs of cams are moved into engagement with the units to cause the holding members of the units 23 and 24 to hold their respective sides of the container while the shearing elements of the units 21 and 22 perform their shearing operations. During this portion of the operating cycle, substantially the same operations take place except upon the unfinished side of the article. First, the shearing edges 97 of the shearing elements of the units

23 and 24, in cooperation with the adjacent shearing edges 96 of the forming portion 95, shear the undesired portions from the container at the lines where the finished edges of the container are to be, and immediately thereafter, through the cooperation of the shearing edges 99 and 100, shear the excess material, each into two portions. At this time all of the excess material has been removed from the container, leaving the edges as illustrated in Fig. 11, and the excess material has been sheared into four portions so that, through the aid of the air under pressure directed by the nozzles 107 at these respective portions, they will be forced from the apparatus, leaving the mandrel free thereof to receive another article or container as shown in Fig. 10.

At the completion of the half cycle, when the holding members and the shearing elements of all the units have performed their respective functions and the remaining portions removed from the apparatus, the apparatus may be returned to its normal or starting position through the control of the valve 55 to force fluid under pressure through the line 53 to the top of the cylinder 51. Through this operation the units perform, in reverse order, their cycles of operation, although no shearing operations take place. Upon removal of the finished article (Fig. 11) another article, as illustrated in Fig. 10 may be disposed upon the mandrel and the operation repeated.

In the description of the mandrel 20, the shearing edges 96 and 100 of the forming portion 95 have been described as integral portions of the mandrel. It should be understood that in actual practice it may be desired to have the mandrel and the forming portion formed of different materials, that is, the forming portion with the shearing edges may be formed of tool steel while the mandrel may be formed of other less expensive materials if so desired. Furthermore, in Fig. 6 the interengagement of the working ends of the holding members 82 and their respective shearing elements 67 cooperate in forming the projecting portions 18 of the article (Fig. 11), the forming portion 95 with its shearing edges 96 also being of a contour so that the edges of the finished container may be of the contour shown.

Although specific improvements of the invention have been shown and described, it will be understood that they are but illustrative and that various modifications may be made therein without departing from the scope and spirit of this invention as defined by the appended claims.

What is claimed is:

1. A trimming apparatus comprising a mandrel to receive an article whose edge is to be trimmed, units comprising holding members and shearing elements, and means adapted to actuate the members and elements in a given sequence to cause the holding member of one unit to hold the article during operation of the shearing element of another unit to shear the edge of the article.

2. A trimming apparatus comprising a mandrel to receive an article whose edge is to be trimmed, units comprising holding members and shearing elements, means adapted to alternately actuate the members of the units to cause them to hold the article, and means adapted to alternately actuate the elements of the units in a reverse order to cause shearing of the article by the elements of one unit during the holding of the article by the holding member of the other unit during each shearing operation.

3. A trimming apparatus comprising a mandrel to receive a hollow article having a continuous edge to be trimmed, a shearing member disposed adjacent the mandrel and having a shearing edge disposed adjacent the said continuous edge and another shearing edge disposed at an angle with respect to the first shearing edge, and a shearing element having shearing edges cooperating with the shearing edges of the said member to shear a length of material from the said continuous edge of the article and to shear the said length of material into a plurality of parts.

4. A trimming apparatus comprising a mandrel to receive a hollow article having a continuous edge to be trimmed, a shearing member disposed adjacent the mandrel and having a shearing edge disposed adjacent the said continuous edge and other shearing edges disposed at angles with respect to the first shearing edge, and shearing elements each having shearing edges cooperating with the shearing edges of the said member to individually shear their respective lengths of material from the said continuous edge of the article and to shear their lengths into a plurality of parts.

5. A trimming apparatus comprising a mandrel to receive a hollow article having a continuous edge to be trimmed, a shearing member disposed adjacent the mandrel and having a shearing edge disposed adjacent the said continuous edge and other shearing edges disposed at angles with respect to the first shearing edge, shearing elements each having shearing edges cooperating with the shearing edges of the said member to individually shear their respective lengths of material from the said continuous edge of the article and to shear their lengths into a plurality of parts, and means to remove the parts.

6. A trimming apparatus comprising a mandrel adapted to support a hollow article having flat sides and intermediate corners and an edge to be trimmed, a shearing member with a shearing edge disposed in the article on the mandrel, actuable shearing elements having shearing edges of contours adapted to cooperate with the shearing edge of the member to start shearing their respective flat sides of the article intermediate the corners thereof and continue their shearing in both directions from their starting positions to their corners, and holding members operable to hold sides of the article in engagement with the mandrel during the shearing operations.

7. A trimming apparatus comprising a mandrel adapted to support a hollow article having flat sides and intermediate corners and an edge to be trimmed, a shearing member with a shearing edge disposed in the article on the mandrel, a shearing element having a shearing edge adapted to cooperate with the shearing edge of the member to start shearing a flat side of the article adjacent the center thereof and continue to shear in both directions therefrom, and holding members adapted to externally engage and hold the other flat sides against buckling during operation of the shearing element.

8. A trimming apparatus comprising a mandrel adapted to support a hollow article having flat sides and intermediate corners and an edge to be trimmed, a shearing member with a shearing edge disposed in the article on the mandrel, actuable shearing elements having shearing edges of contours adapted to cooperate with the

shearing edge of the member to start shearing their respective flat sides of the article intermediate the corners thereof and continue their shearing in both directions from their starting positions to their corners, means to actuate alternately positioned elements and subsequently actuate the intermediate elements, and means alternately actuable to hold the sides intermediate those being sheared.

9. A trimming apparatus comprising a mandrel to receive an article whose edge is to be trimmed, units comprising holding members and shearing elements, and cam means adapted to alternately actuate the members in a given sequence to cause the holding members to hold spaced portions of the article and to alternately actuate the elements in a reverse order to cause shearing of the intermediate portions of the article.

10. A trimming apparatus comprising a mandrel to receive an article whose edge is to be trimmed, units comprising holding members and shearing elements, annular cams adapted to actuate the members and elements of each unit in a given alternate sequence to cause shearing of spaced portions by certain of the elements during holding of the intermediate portions and then holding of the sheared portions during shearing of the said intermediate portions, and means to actuate the cams.

11. A trimming apparatus comprising a mandrel to receive a hollow article thereon having a continuous edge to be trimmed, a shearing member disposed adjacent the mandrel in the article and having shearing edges lying in different parallel planes and connected by other shearing edges, and actuable shearing elements having shearing edges of contours adapted to cooperate with the shearing edges of the member to shear the said continuous edge of the contour of the combined shearing edges of the shearing member.

12. A trimming apparatus comprising a mandrel to receive a hollow article thereon having a continuous edge to be trimmed, a shearing member disposed adjacent the mandrel in the article and having shearing edges lying in different parallel planes and connected by other shearing edges extending in transverse directions with respect to the first shearing edges, actuable shearing elements having shearing edges of contours adapted to cooperate with their respective portions of the shearing edges of the member to shear the said continuous edge of the contour of the combined shearing edges of the shearing member, and means to actuate the shearing elements in a given order.

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