United States Patent [19]

Moller

[11] **3,832,941**

[45] **Sept. 3, 1974**

[54] **FLATTENING METAL CANS**

[76] Inventor: **Bynum W. Moller,** P.O. Box 688, Kerrville, Tex. 78028

[22] Filed: **May 3, 1973**

[21] Appl. No.: **356,895**

Related U.S. Application Data

[62] Division of Ser. No. 104,266, Jan. 6, 1971, Pat. No. 3,732,804.

[52] **U.S. Cl.** **100/137,** 241/99

[51] **Int. Cl.** **B30b 7/04,** B30b 9/32

[58] **Field of Search** 241/99; 100/DIG. 2, 137, 100/244, 295, 232, 233, 215, 218

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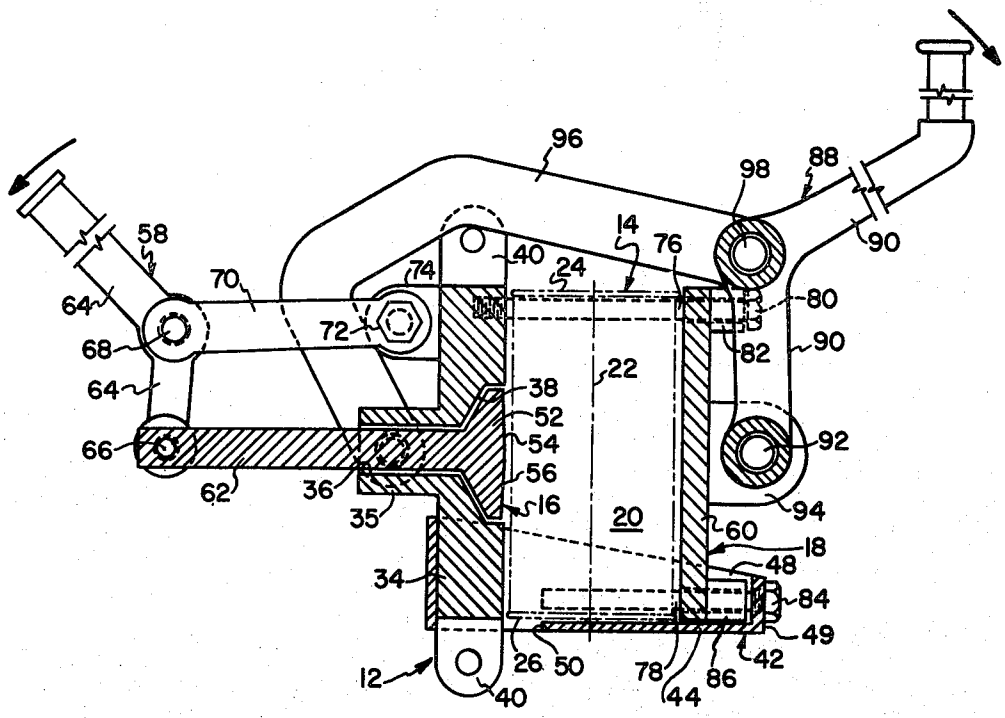
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Primary Examiner—Billy J. Wilhite
Attorney, Agent, or Firm—G. Turner Moller

[57] **ABSTRACT**

An apparatus for flattening thin metal cans is disclosed wherein the can is first creased or notched to incline the can ends with respect to the can axis and each can end is then folded about an axis adjacent the juncture of the respective can end and the can side into a generally flat configuration.

13 Claims, 26 Drawing Figures



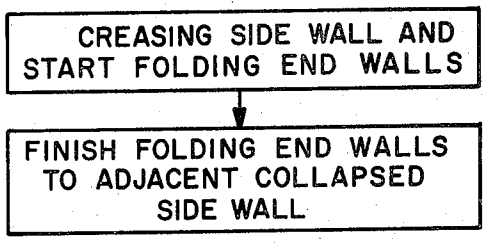


FIG. 1

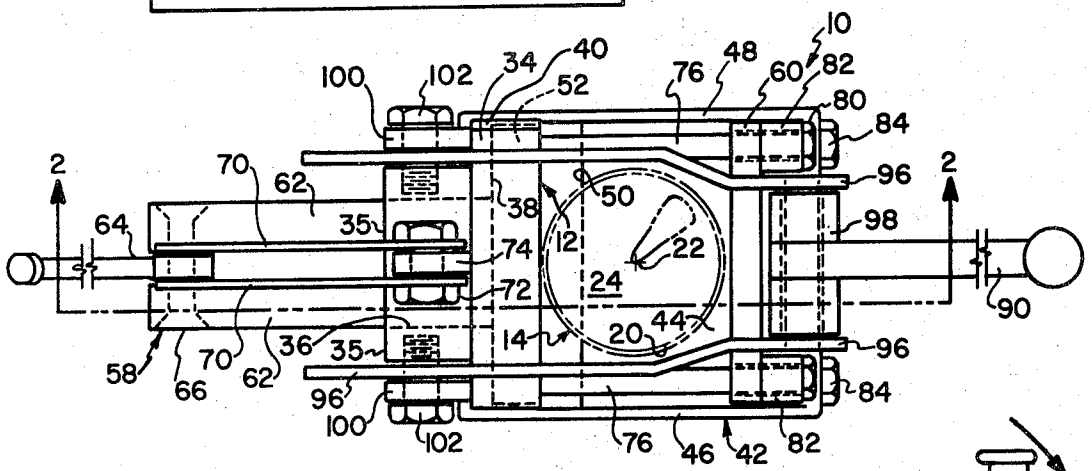


FIG. 2

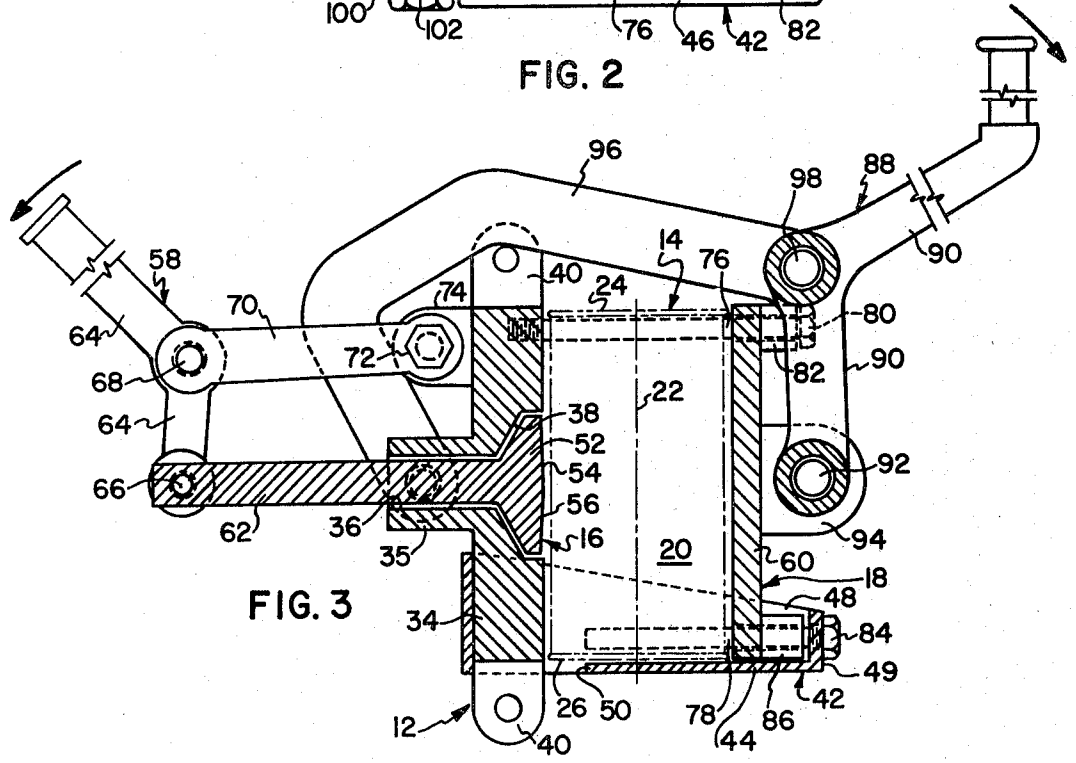


FIG. 3

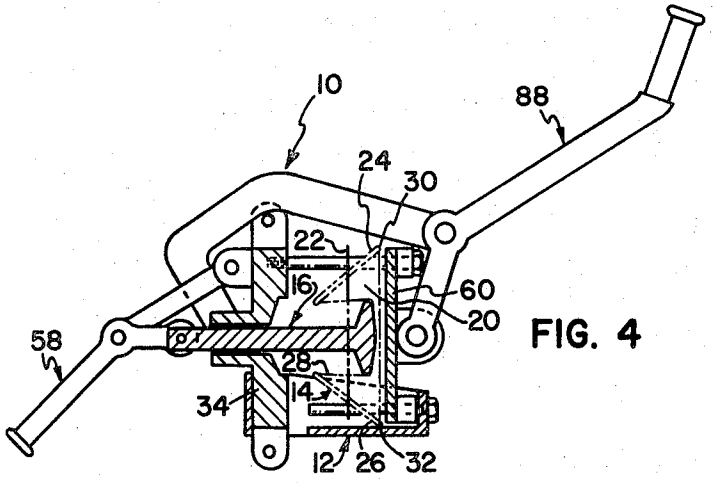


FIG. 4

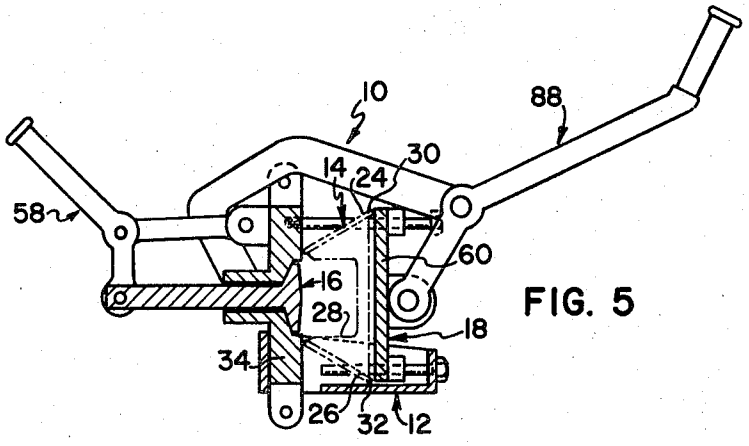


FIG. 5

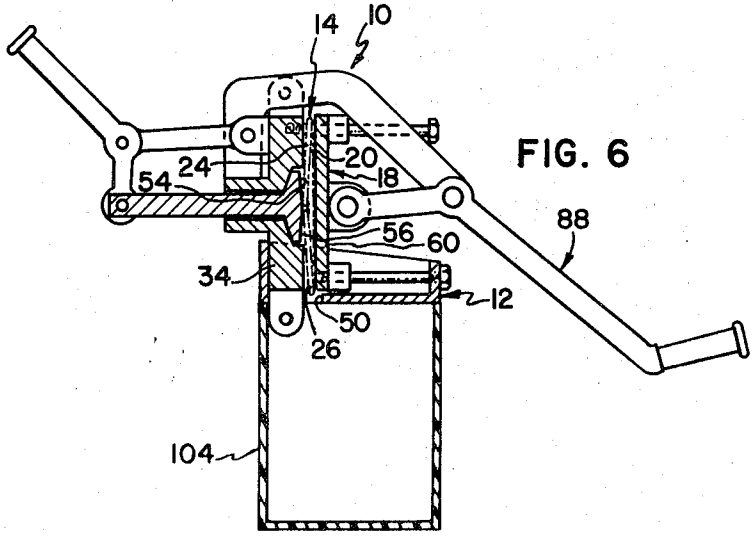


FIG. 6

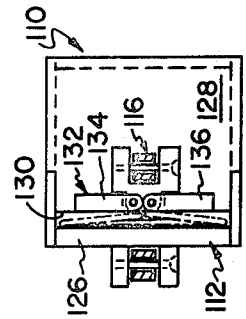


FIG. 9

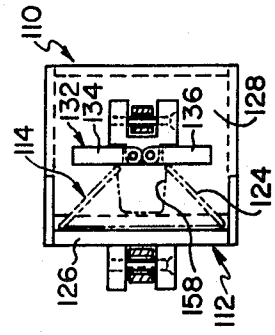


FIG. 8

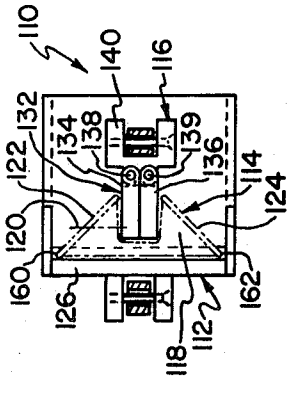


FIG. 7

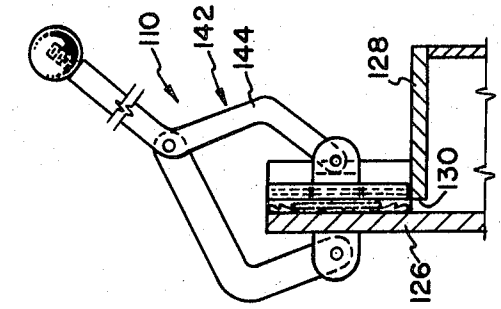


FIG. 12

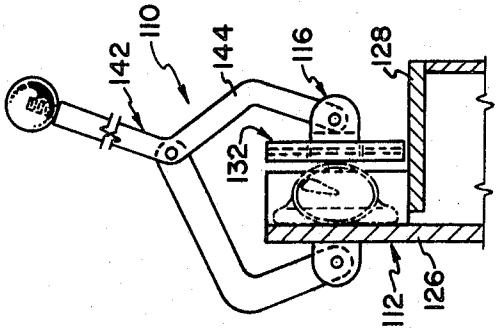


FIG. 11

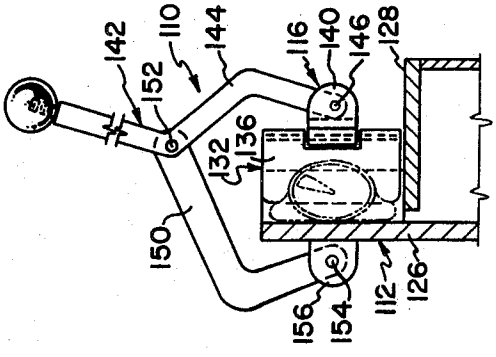


FIG. 10

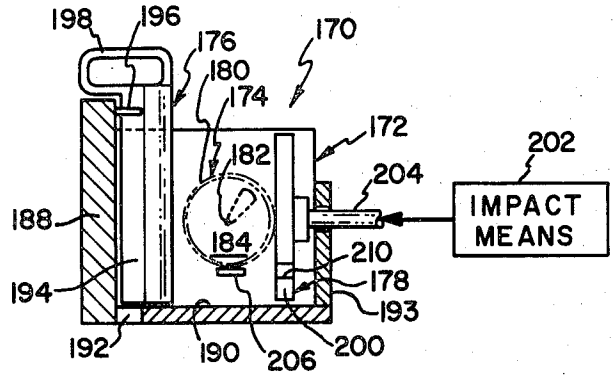


FIG. 13

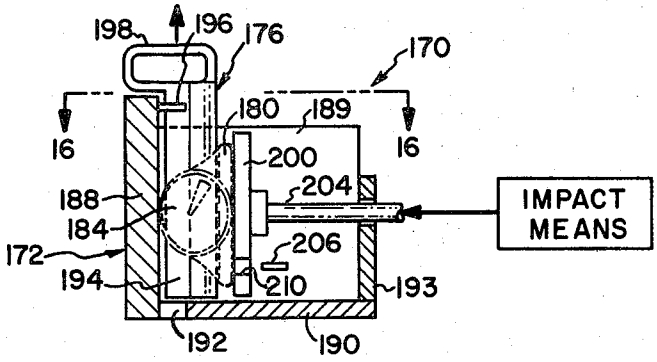


FIG. 14

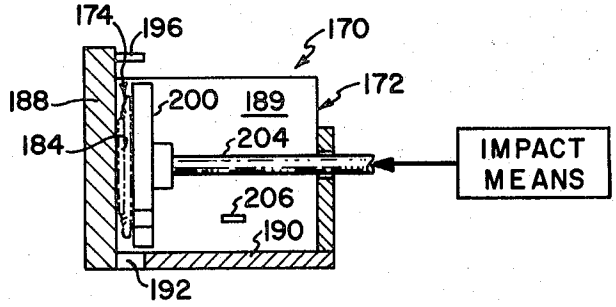


FIG. 15

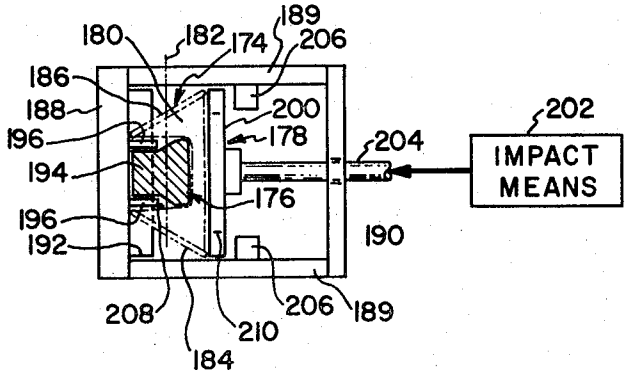


FIG. 16

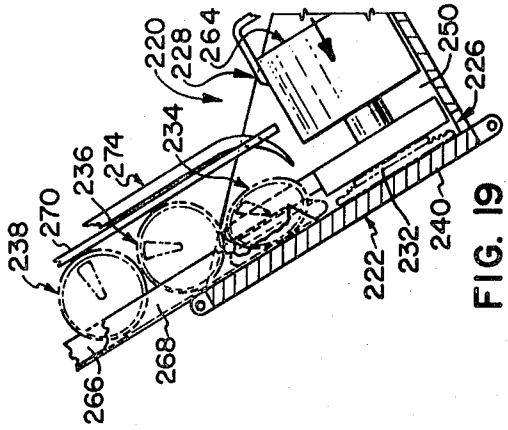


FIG. 19

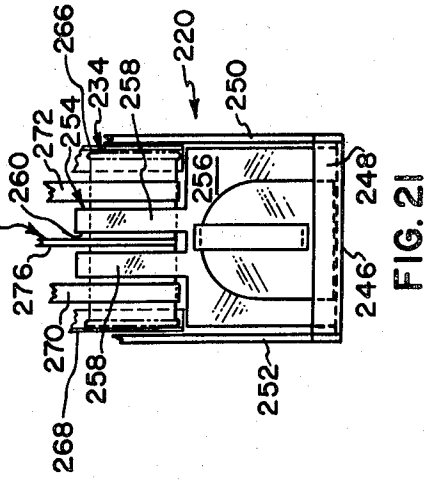


FIG. 21

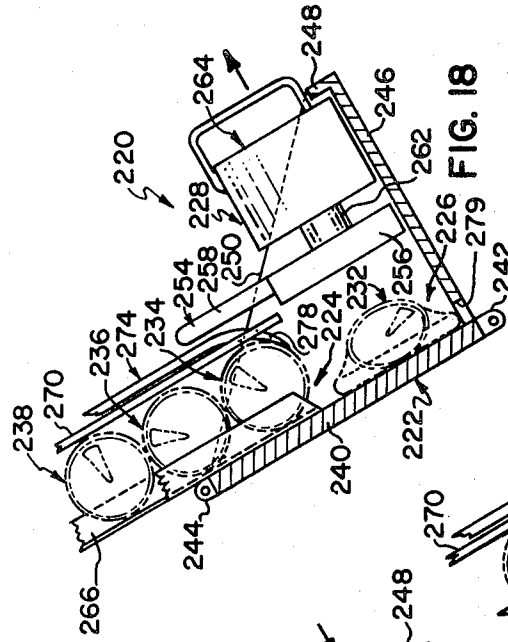


FIG. 18

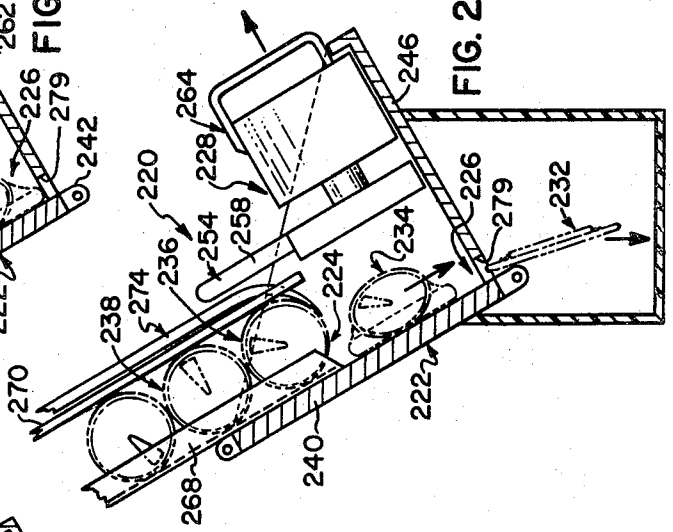


FIG. 20

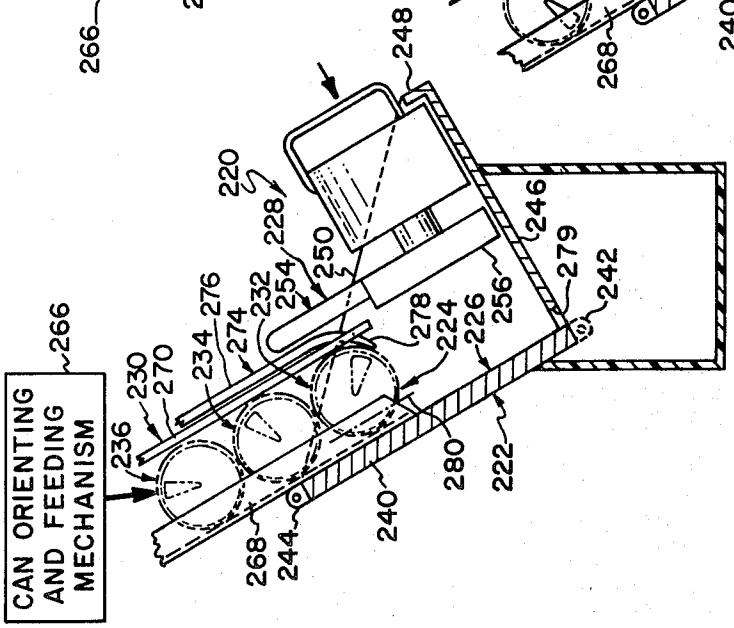


FIG. 17

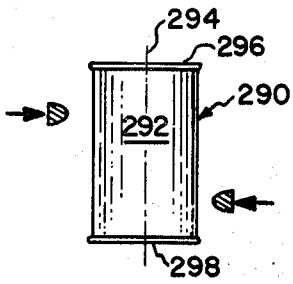


FIG. 22

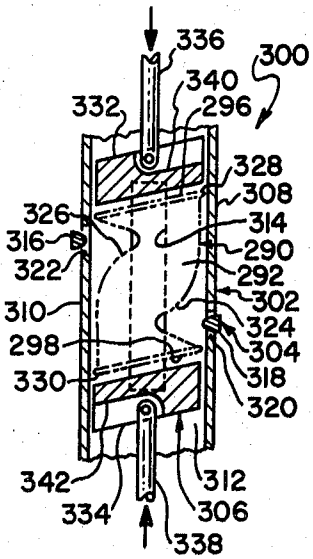


FIG. 23

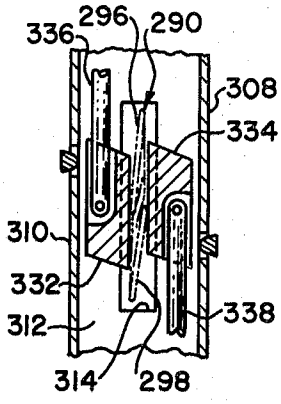


FIG. 24

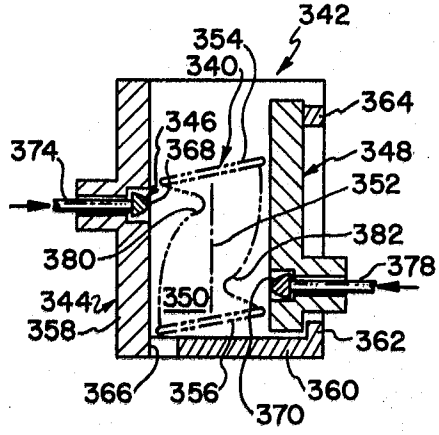


FIG. 25

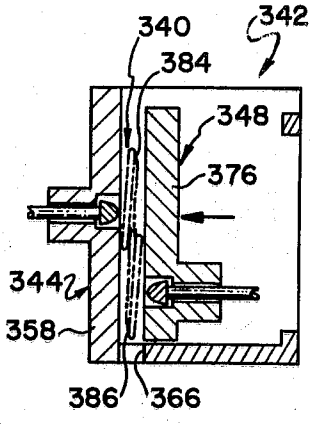


FIG. 26

FLATTENING METAL CANS

This application is a division of Application Ser. No. 104,266, filed Jan. 6, 1971 now U.S. Pat. No. 3,732,804 which issued May 15, 1973.

BACKGROUND OF THE INVENTION

It hardly needs stating that the collection and disposal of metal containers, for example beer and soft drink cans, has become a matter of acute concern. This particular aspect of the litter problem may further be divided into the problem of collecting and disposing of so-called "tin" cans and the collection and disposal of aluminum cans. Since the metal values in used aluminum cans is significant, several programs have been instituted to collect used aluminum cans and treat the collected cans for reuse, as by melting the cans to form ingots and then extruding or rolling the ingots to form other useful articles.

One of the limitations inherent in the collection and disposal of used aluminum cans is the transporation costs involved in shipping the cans to a central facility for treatment. In one collection program, it is estimated that transportation costs limit the collection effort to within 50 miles of the treatment facility. It will accordingly be apparent that the effect of these programs will necessarily be limited.

Since empty aluminum cans have a high ratio of bulk to weight, transporation costs are governed by the volume of such containers rather than the weight thereof. As an example, a 55 gallon drum was filled with conventional cans by randomly throwing the cans therein. Three hundred twenty cans were required to fill the drum which calculates to be 44 cans per cubic foot. In contrast, by flattening the cans in accordance with one manually operated version of this invention, can counts in the range of 180 per cubic foot are typically obtained. The flattened cans accordingly comprise about 24 percent of the volume of the unflattened cans. The power operated versions of the invention should, of course, provide somewhat greater can counts. It will accordingly be apparent that the transportation costs of collection programs may be substantially reduced by flattening the cans before movement to the treating facility.

There are, of course, many diverse types of can flattening deivces known in the prior art. One approach has been to pierce the ends of the can to destroy the mechanical strength thereof and then press the cylindrical side wall flat. Such devices are shown in U.S. Pat. Nos. 2,178,461; 2,622,316 and 2,905,079. Such an approach is practicable with respect to socalled "tin" cans but has not operated satisfactorily on aluminum cans. This approach has proved unsatisfactory with aluminum cans since the sides are thin and flexible and tend to collapse before piercing of the ends is accomplished.

Other disclosures more pertinent to this invention are found in U.S. Pat. Nos. 2,603,270 and 3,095,806. The devices disclosed in these references crease the can longitudinally during the flattening operation by forcibly applying a relatively thin member to the edge of the can. This approach requires the expenditure of substantial effort since both can ends are simultaneously creased and since the can ends are remarkably strong in the plane thereof. In contrast, this invention comprises forming a transverse notch in the can side wall, which is of relatively low strength. The creasing or notching of the can side wall angularly disposes the can ends with respect to the can axis. This step is followed, in the practice of this invention, by folding the can ends about parallel axes intersecting the end walls and side wall at opposite ends of the can.

The most pertinent prior art known is the time honored method used by beer drinkers to exhibit their strength. This approach is to sqeeze the can side in the middle thereof which creases both sides of the can into shallow V-shaped configurations facing along the can axis in opposite directions away from the can. The can ends and a significant portion of the can side wall are then folded about a common axis in the center of the can so that the can assumes a generally V-shaped configuration. This approach is not suitable for present purposes since the can, as so collapsed, retains a significant proportion of its original volume.

Also of interest is the disclosure in U.S. Pat. No. 2,773,536 wherein a can flattening apparatus is provided with a slot therein for passing the flattened can into a suitable receptacle.

SUMMARY OF THE INVENTION

It is an object of this invention to provide a convenient and simple apparatus for flattening thin metal cans.

Another object of this invention is to provide an apparatus for flattening metal cans by creasing or notching the side wall and folding the can ends about parallel axes adjacent the juncture of each can end and the can side wall.

In summary, the apparatus of this invention comprises a frame for receiving the can and providing a first path of platen movement transverse to the can axis; means for deformably creasing a notch into the side wall transverse to the can axis and for thereby including the can ends to the can axis, the creasing means comprising first platen means mounted for approaching movement in the first path of platen movement including a first platen element having a dimension parallel to the can axis substantially less than the distance between the can ends; and means for folding each can end about an axis adjacent the juncture of the side wall and the respective can end to increase the angle of inclination between the can ends and the can axis, the folding means including second platen means mounted for approaching movement toward the notched can for engaging the can ends and substantially simultaneously applying thereto a moment about the respective axis thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram showing the sequence of operations in the practice of this invention;

FIG. **2** is a top view of one embodiment of this invention;

FIG. **3** is a longitudinal cross sectional view of the embodiment of FIG. **2**, taken substantially along line **2—2** thereof as viewed in the direction indicated by the arrows, illustrating a can about to be flattened;

FIGS. **4–6** illustrate the sequence of operation of the embodiment of FIGS. **2** and **3**;

FIGS. **7–9** are a series of partially sectioned top views of another embodiment of this invention illustrating the sequence of operation thereof;

FIGS. 10–12 comprise a series of side views of the embodiment of FIGS. 7–9 illustrating, in side view, the sequence of operation thereof;

FIGS. 13–15 illustrate, in sectioned side views, the sequence of operation of another embodiment of this invention;

FIG. 16 is a cross sectional view of the embodiment of FIGS. 13–15 taken substantially along line 16—16 of FIG. 14 as viewed in the direction shown by the arrows;

FIGS. 17–20 comprise a series of cross sections views of a preferred embodiment of this invention illustrating the sequence of operation thereof;

FIG. 21 is a partial rear view of the embodiment of FIGS. 17–20;

FIG. 22 is a schematic view of a can being creased in accordance with an alternate mode of practicing this invention;

FIGS. 23 and 24 comprise sectional views of another embodiment of this invention for folding the can ends after creasing has been accomplished in accordance with FIG. 22; and

FIGS. 25 and 26 comprise sectional views of another embodiment of this invention for folding the can ends after creasing has been accomplished in accordance with FIG. 22.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, there is shown in block diagram a convenient breakdown or analysis of the operation of this invention. As will be seen, the first step in the operation of the invention is to crease the side wall of a typical metal can and begin the folding of the end walls followed by folding the end walls of the can to juxtapose the collapsed side wall.

Referring to FIGS. 2–6, there is illustrated a can flattener 10 comprising one embodiment of the apparatus of this invention. The can flattener 10 comprises as major components a frame 12 arranged to receive a can 14, means 16 for creasing the can 14 and means 18 for folding and flattening the can 14.

The can 14 is illustrated as a conventional beer or soft drink can comprising a cylindrical side wall 20 defining a can axis 22 and a pair of ends or end walls 24, 26 perpendicular to the can axis 22 and facing in opposite directions.

FIG. 3 illustrates the beginning of the sequence of operation of the can flattener 10. In FIG. 4, the creasing means 16 has been actuated to crease or form a notch 28 in one side of the wall 20. It will be seen that the ends 24, 26 of the can 14 are thereby inclined to the can axis 22. It will be apparent that the can ends 24, 26 have been respectively folded about an axis 30, 32 passing through the juncture of the end walls 24, 26 and the side wall 20. Concurrently with the formation of the notch 28, the side of the wall 20 opposite therefrom is flattened against the folding and flattening means 18 causing an expansion of the lateral dimension of the can 14. For example, in a conventional can 2⅝ inches in diameter, the transverse dimension thereof increases to about 4 inches during the creasing step.

FIG. 5 illustrates the next event in the sequence of operation where the creasing means 16 has been retracted from the notch 28. Actuation of the folding and flattening means 18 causes the ends 24, 26 to be further respectively folded about the axes 30, 32 to increase the angle of inclination between the can ends 24, 26 and the can axis 22. FIG. 6 illustrates the termination of movement of the folding and flattening means 18 and shows that the ends 24, 26 have closed the notch 28 and have come to reside in a common plane generally parallel to the side wall 20 which has now been flattened. It will also be seen that the ends 24, 26 now face in the same direction generally perpendicularly away from the can axis 22.

Referring to FIGS. 2 and 3, a detailed view of the can flattener 10 is illustrated. The frame 12 comprises a stationary plate or member 34 having a boss 35 projecting from one side thereof. A pair of passages 36 extend through the plate 34 and boss 35 and communicates with an enlarged recess 38 which is at least as wide as the can 14 as may be seen in FIG. 2. As will be more fully apparent hereinafter, the stationary plate 34 comprises the base to which the moving members of the can flattener 10 are ultimately connected and also functions as a stationary platen in the folding and flattening means 18. To mount the can flattener 10 in a vertical attitude, the plate 34 may be provided with suitable ears 40.

The frame 12 also comprises a shallow tray 42 secured to the frame 12 and comprising a bottom wall 44 for supporting the can 14, a pair of side walls 46, 48 substantially wider than the can 14 to allow the can 14 to grow in the lateral direction which occurs initially in the creasing operation, and a front wall 49. The bottom wall 44 provides a slot 50 adjacent the stationary plate 34 to allow the can 14 to fall therethrough upon completion of the flattening operation.

The creasing means 16 comprises a movable platen 52 which is at least substantially as wide as the can 14 and which is preferably substantially wider, as shown in FIG. 2. As exemplary, in a conventional can of 2⅝ inches diameter, the movable platen preferably measures about 4 inches in the direction transverse to the can axis 22. The platen 52 has a vertical dimension substantially less than the vertical dimension of the can 14. As exemplary, when flattening a conventional can, the platen 52 is preferably slightly less than about half the height of the can. Best results have been obtained with a 2 inches vertical dimension and 2⅛ inches appears to be the upper limit for optimum results. It will be appreciated by those skilled in the art that the preferred dimensions of the platen 52 vary with the size and length-to-width ratio of the cans being flattened.

The platen 52 has converging faces 54, 56 which serve to ease the creasing of the can 14 and which also provide a function in the folding and flattening operation to be discussed hereinafter. The intersection of the faces 54, 56 conveniently lies in a plane substantially midway along the height of the can 14 perpendicular to the axis 22.

The creasing means 16 also comprises means 58 for applying a force to the movable platen 52 for advancing the same toward a second platen 60, which comprises part of the folding and flattening means 18 and acts as the stationary platen of the creasing means 16. The force applying means 58 comprises a pair of spaced rods 62 connected to the movable platen 52 and extending outwardly through the passages 36. A handle 64 is connected to the rods 62 by the provision of a suitable pivotal connection 66. An intermediate portion of the handle 64 is connected by a suitable pivotal connection 68 to a pair of links 70 pivotally mounted

by a suitable pin **72** to an ear **74** connected to the frame member **34.**

As will be apparent to those skilled in the art, rotation of the handle **64** in the direction shown by the arrow advances the rods **62** substantially linearly through the passage **36** until the pivot connection **66** engages the boss **35.** The length of travel afforded by the force applying means **58** is sufficient to move that segment of the can side wall **20** engaged by the platen **52** a substantial distance toward the opposite side of the can **14.** It is preferred that the platen **52** move at least as far as the can axis **22** and preferably to a location closely adjacent the second platen **60** as may be seen best in FIG. **4.**

The folding and flattening means **18** comprises several elements previously discussed, specifically the frame member **34** and the platen **52** which together comprise a stationary platen and the second platen **60** which comprises the movable platen. The movable platen **60** is mounted for reciprocating movement by a pair of upper guide rods **76** and a pair of lower guide rods **78.** The upper guide rods **76** are secured to the frame member **34** and provide an enlarged head **80** on the end thereof. A pair of bosses **82** are integrally provided by the platen **60** and slidably receive the rods **76.** The guide rods **78** comprise a threaded section adjacent an enlarged head **84** on one end thereof and are threadably received by the front wall **49** of the tray **42.** A pair of bosses **86** are provided on the lower section of the platen **60** and slidably receive the guide rods **78.** The bosses **82, 86** provide greater bearing surface on the rods **76, 78** and accordingly lend greater vertical stability to the platen **60** during reciprocation toward the platen **34.**

As seen in FIG. **3,** the lower guide rods **78** extend toward the plane member **34** no farther than the slot **50** since the central part of the can **14** expands laterally during creasing to occupy substantially the entire distance between the side walls **46, 48** of the tray **42.** By shortening the guide rods **78,** the flattened can **14** has free access for exit through the slot **50.**

The folding and flattening means **18** also comprises a force applying means **88** comprising a handle **90** mounted by a pivot connection **92** to an ear **94** affixed to the movable platen **60.** The handle **90** is connected to a pair of links **96** by a pivot connection **98.** Each of the links **96** is pivotally connected between an ear **100,** carried by the frame member **34,** and the boss **35** by a suitable fastener **102.** It will be seen that rotation of the handle **90** in the direction shown by the arrow in FIG. **3** acts to advance the movable platen **60** toward the stationary platen comprised of the frame member **34** and the platen **52.**

Referring to FIG. **5,** it will be seen advancement of the platen **60** causes the leftmost edges of the can ends **24, 26** to engage the stationary frame member **34.** Further advance of the platen **60** creates a moment in the can ends **24, 26** to fold the same about the respective axis **30, 32.** Although some incidental tearing of the side wall **20** may occur, the flattening of the can **14** is not dependent thereon. Similarly, some deformation of the can ends **24, 26** may occur depending on the constructional details of the can being flattened.

Referring now to FIG. **6,** it will be seen that the can **14** is flattened by folding the ends **24, 26** into a common plane generally parallel to the flattened side wall **20.** It will be noted that the converging edges **54, 56** of the platen **52** act as an anvil to apply increased forces to the inner edges of the can ends **24, 26.**

There is disposed beneath the slot **50** a receptacle **104,** such as a box, a plastic bag or the like. After the can **14** has been flattened as shown in FIG. **6,** the operator releases the force applying means **88** whereupon the can **14** falls by gravity into the receptacle **104.** Upward movement of the force applying means **88** retracts the movable platen **60** to the position shown in FIG. **3** in order to receive an unflattened can.

A model in accordance with FIGS. **2–6** has been constructed in which the handle **64** provides a 4:1 mechanical advantage and the handle **90** provides a 10:1 mechanical advantage. The mechanical advantage of the handles **64, 90** may obviously be increased merely by lengthening the free ends thereof. The effort expended in flattening aluminum cans was rather moderate and the effort expended on tinplate cans was somewhat greater. The conventional 2⅝ inches diameter by 4⅞ inches tall cans were deformed into a flat configuration approximately 4⅞ inches long, 4 inches wide and about ⅜ inch thick.

Referring to FIGS. **7–12** there is schematically illustrated a can flattener **110** comprising another embodiment of this invention. FIGS. **7–9** illustrate a top view of the can flattener **110** in various stages of operation and correspond respectively to the side views shown in FIGS. **10–12.** The can flattener **110** comprises as major components a frame **112** adapted to receive a conventional can **114** therein and means **116** for creasing the can **114** transversely of the longitudinal axis thereof and for folding and flattening the can **114.**

The can **114** comprises a cylindrical side wall **118** defining a can axis **120** and a pair of ends or end walls **122, 124** facing in opposite directions along the can axis **120.**

The frame **112** comprises a stationary plate or member **126** acting as a base for the moving parts of the can flattener **110** and also comprising a stationary platen of the creasing, folding and flattening means **116.** The frame **112** also comprises a platform or base **128** on which the can **114** is disposed during flattening thereof. As shown best in FIG. **12,** the base **128** provides a slot **130** to pass the flattened can into a convenient receptacle.

The means **116** comprises a foldable platen **132** which may be manipulated to present a relatively narrow creasing surface as shown in FIG. **7** and alternatively to present a relatively wide flattening surface as shown in FIG. **8.** The platen **132** is mounted by suitable means (not shown) for reciprocating movement toward and away from the stationary plate **126** and is illustrated as comprising platen segments **134, 136** hinged about vertical axes **138, 139.** The platen **132** is supported by a yoke **140** acting through the axes **138, 139.** Suitable means are provided (not shown) to automatically move the platen segments **134, 136** between the positions shown in FIGS. **7** and **8.** For example, a suitable indexing mechanism may be provided which operates during the retraction of the creasing means **116** from the position shown in FIG. **7** to expand the platen **132** into the position shown in FIG. **8.** Similarly, the indexing mechanism may operate upon withdrawal of the flattening means **116** from the position shown in FIG. **9** to collapse the platen **132.**

The creasing, folding and flattening means **116** preferably includes means **142** for applying a force to the

movable platen **132.** The force applying means **142** conveniently includes a handle **144** connected by a pivot connection **146** to the end of the yoke **140.** A link **150** is connected at one end by a pivot connection **152** to the handle **144** and by a pivot connection **154** to an ear **156** on the frame member **126.**

The operation of the can flattener **110** should now be apparent. A can **114** is placed on the platform **128** with the can axis **120** being generally horizontal. The creasing means **116** is advanced by the force applying means **142** with the platen **132** in the collapsed or creasing position shown in FIG. **7.** A notch **158** transverse to the can axis **120** is accordingly formed in much the same manner as the creasing means **16** forms the notch **28.** It will be noted that the can ends **122, 124** are folded about axes **160, 162** to converge in the same general direction as the opening provided by the notch **158.** Retraction of the creasing means **116** causes the platen **132** to expand to the position shown in FIG. **8.**

Manipulation of the force applying means **142** again advances the platen **132** so that the inner edges of the ends **122, 124** engage the platen segments **134, 136** to fold the ends **122, 124** further inwardly thereby increasing the angle of convergence thereof and closing the notch **158.** The resultant flattened can is illustrated in FIG. **9** with the can ends **122, 124** lying generally coplanar and parallel to the side wall **118** which has now been flattened. It will be seen that the can ends **122, 124** face in generally the same direction substantially perpendicular to the can axis **120.** The release of forces on the handle **144** allows the can **114** to pass through the slot **130** into a suitable receptacle for ultimate disposal.

The can flatteners **10, 110** have been illustrated as hand operated devices. This invention is equally susceptible of use with power devices as illustrated in FIGS. **13–16.** Referring to FIGS. **13–15,** there is illustrated in sectioned side views a rudimentary can flattener **170** comprising another embodiment of this invention. The can flattener **170** comprises as major components a frame **172** for receiving a can **174** thereon, means **176** for creasing the can **174** and means **178** for folding and flattening the can **174.**

The can **174** comprises a cylindrical side wall **180** defining a can axis **182** with a pair of can ends **184, 186** perpendicular to the can axis **182** and facing in opposite directions.

The frame **172** comprises a vertical stationary plate or member **188,** a pair of stationary side walls **189,** a horizontal base or platform **190** providing an exit slot **192** and a front wall **193.** The creasing means **176** comprises a creaser bar **194** having a depth slightly less than the can diameter and a length somewhat larger than the maximum lateral dimension of the can **174** as shown in FIG. **14.** The creaser bar **194** is positioned by any suitable means to engage the center part of the can **174** upon advance thereof toward the creasing means **176.** This positioning may conveniently be accomplished by the provision of a pair of pegs **196** extending from the frame member **188.** As shown best in FIG. **16,** the creaser bar **194** has an enlarged section for engagement with the can **174** and a rearward section of reduced width to facilitate withdrawal of the creaser bar **194** from the position shown in FIG. **16.** The creasing means **176** also includes a suitable handle **198** so that the creaser bar **194** may be manually removed after the creasing operation is completed.

The creasing means **176** also comprises a movable platen **200** for forcibly advancing the can **174** into engagement with the creaser bar **194.** The movable platen **200** is connected to any suitable force applying means, for example a powered impact hammer or hydraulic cylinder **202** by a suitable rod **204.** The creasing means **176** also comprises an abutment **206** extending inwardly from each of the frame side walls **189** to support the can **174** in the position shown in FIG. **13.** As will be appreciated, the axis **182** of the can **174** is generally horizontal and the abutments **206** support the can **174** away from the base **190** to prevent the expanding can side **180** from contacting the base **190.** If the can **174** were supported by the base **190** during the creasing operation, the expanding side wall **180** tends to drag on the base **190** and deform improperly.

As may be seen by a comparison of FIGS. **13, 14** and **16,** advancement of the platen **200** toward the creaser bar **194** forms a notch **208** in the can **174** while the abutments **206** pass through a pair of suitable slots **210** in the movable platen **200.** The notch **208** is formed in much the same manner as the cans are notched by the previously described embodiments of the invention such that the can ends **184, 186** are folded into converging relation.

The folding and flattening means **178** is comprised of elements previously mentioned, specifically the vertical plate **188,** the movable platen **200,** the rod **204** and the impact means **202.** The vertical plate **188** acts as a stationary platen. Before operation of the folding and flattening means **178,** the creaser bar **194** is removed from adjacent the vertical plate **188,** as by grasping the handle **198** and pulling thereon transversely of the direction of movement of the platen **200.** Further advancement of the platen **200** causes the can ends **184, 186** to abut the stationary platen **188** to fold the can ends **184, 186** thereby increasing the angle of convergence therebetween and closing the notch **208** as may be seen best in FIG. **15.** After the platen **200** advances to the position shown in FIG. **15,** retraction thereof allows the can **174** to pass through the slot **192** into a suitable container for disposal.

Referring to FIGS. **17–21,** there is illustrated a can flattener **220** comprising an improved, simplified and preferred embodiment of this invention. The can flattener **220** comprises as major components a frame **222** providing a creasing station **224** and a flattening station **226,** means **228** for creasing and flattening the cans presented at the creasing and flattening stations **224, 226** respectively and means **230** for feeding the cans to the creasing and flattening stations **224, 226.** The cans pass sequentially through the flattener **220** and are denominated as cans **232, 234, 236, 238** to distinguish therebetween during the sequence of operation.

FIGS. **17–20** disclose a complete sequence of operation. FIG. **17** illustrates the beginning of the can flattening operation where no can is present at the flattening station **226** while the can **232** is located at the creasing station **224.** Advancement of the creasing and flattening means **228** causes the can **232** to be creased or notched in much the same manner that the cans are notched by the previously discussed embodiments. FIG. **18** discloses a successive stage of operation where the creasing and flattening means **228** has been retracted whereupon the can **232** passes to the flattening station **226** while the can **234** is presented at the creasing station **224.** FIG. **19** illustrates the advancement of

the creasing and flattening means **228** to substantially simultaneously crease the can **234** at the creasing station **224** and flatten the can **232** at the flattening station **226.** FIG. **20** illustrates the retraction of the creasing and flattening means **228** whereupon the flattened can **232** is discharged from the can flattener **220,** the can **234** is moved to the flattening station **226** and the can **236** is presented at the creasing station **224.** It will be apparent that the association of elements shown in FIG. **17** occurs only during the startup of the can flattener **220** while the sequence of operation illustrated in FIGS. **18–20** occurs successively during the continued operation of the can flattener **220.**

The frame **222** comprises a stationary plate or member **240** which may be secured to any stationary support as by the provision of ears **242, 244.** The frame **222** also comprises a platform **246** for supporting a can at the flattening station **224,** a front wall **248** providing an abutment for the creasing and flattening means **228** and a pair of side walls **250, 252** which act to constrain the cans laterally in the flattener **220** and to constrain movement of the creasing and flattening means **228.** The frame **222** is desirably positioned so that the path of can movement therethrough is inclined about 30° to the vertical for purposes more fully explained hereinafter.

The creasing and flattening means **228** comprises a bifurcated creaser bar **254** arranged in a plane common with a movable platen **256.** As shown best in FIG. **21,** the creaser bar **254** comprises a pair of upstanding spaced apart cylindrical pins **258** defining therebetween a slot **260.** The leading edge of the pins **258** is offset, away from the stationary frame member **240,** when compared to the leading edge of the movable platen **256** for purposes more fully apparent hereinafter. The platen **256** is connected by a force transmitting element **262** to means **264** for applying force thereto. Although the force applying means **264** may comprise a suitable lever-linkage arrangement for manual operation, a power operator such as an impact tool is highly desirable.

The feeding means **230** may comprise a suitable orienting and feeding mechanism **266** to deliver the cans into the frame **222.** The feeding means **230** preferably comprises guide means including a first pair of guide elements **266, 268** for delivering the cans into the flattener **220** between the side walls **250, 252** as may be seen in FIG. **21.** The guide means further includes second guide elements **270, 272** which cooperate with the guide elements **266, 268** to constrain the cans for movement into the frame **222** in single file to present a single can at the creasing station **224** with the can ends spaced on opposite sides of the creaser pins **258** as may be seen best in FIG. **21.**

An important part of the feeding means **230** comprises a retainer **274** for holding a can at the creasing station **224** as may be seen in FIGS. **17, 18** and **20.** The retainer **274** comprises a thin strap **276** having a hook **278** on the end thereof extending into the path of can movement. As shown best in FIG. **21,** the strap **276** is positioned to pass through the slot **260** upon advancement of the creasing means **254** into the creasing station **224.** The hook **278** extends inwardly past the guide elements **270, 272** to prevent passage of the undeformed cans toward the flattening station **226.** It will accordingly be apparent that the cans moving into the flattener **220** are held by the retainer **274** at the creasing station **224.**

As in the previous embodiments, the frame **222** includes a slot **279** at the juncture of the platform **246** and the vertical member **240** to allow cans to pass therethrough into a convenient receptacle as shown in FIGS. **17–20.**

When the can flattener **220** is initially started, the cans **232, 234, 236** are sequentially guided by the elements **266, 268, 270, 272** so that the can **232** is held at of the force applying means **264** advances the creasing station **224** by the hook **278.** Operation the creasing means **254** such that the creaser pins **258** pass the retainer **274** and notch or crease the can **232** in much the same manner as cans are creased by the previously discussed embodiments. The forward travel of the creaser pins **258** is arrested by engagement of the platen **256** with the frame member **240.** The creaser pins **258** accordingly have a forward limit of travel indicated by a dot dash line **280** in FIG. **17.** Since the hook **278** engages the can **232** only at the center thereof (see FIG. **21**), retraction of the creasing and flattening means **228** allows the can **232** to pass out of the feeding means **230** to the flattening station **226** as shown in FIG. **18.** Tilting of the frame **222** allows the can **232** to slide freely down the wall afforded thereby without tipping the can over onto the platform **246.** It will be apparent that if the can **232** should tip over onto the platform **246,** the final flattening operation will not occur as designed since the can ends will not be folded further to close the notch formed by the creaser pins **258.**

As will be appreciated at this point, the formation of a notch in the can **234** causes the can ends to incline with respect to the can axis and causes the edges thereof adjacent the notch to move toward each other. This may be seen, for example, in the FIGS. **4, 7** and **16.** This peculiarity allows the retainer **274** to be constructed, in the alternative, by positioning a lug to extend from the side walls **250, 252** to engage the lower right edge of the ends of the can **234** as viewed in FIG. **18.**

Actuation of the force applying means **264** advances the creasing and flattening means **228** to the position shown in FIG. **19.** It will be apparent that the can **232** is flattened by the platen **256** while the can **234** is creased or notched by the creaser pins **258.** Flattening of the can **232** is accomplished by folding the can ends to increase the angle of convergence thereof and close the notch formed by the creasing means **254** in the preceding step of operation. Rearward movement of the creasing and flattening means **228** to the position illustrated in FIG. **20** allows the can **232** to exit through the slot **279** while the can **234** passes under the hook **278** to the flattening station **226.** The can **236** is then presented to the creasing station **224** and held therein by the retainer **274.** It will be apparent that forward and backward movement of the creasing and flattening means **228** will eject flattened cans from the frame **222** and accept undeformed cans at the creasing station **224** for as long as the supply of undeformed cans lasts.

The previously discussed embodiments of the invention have formed a notch in one side of the can and then folded the can ends to close the notch. This invention is also susceptible of deforming opposite sides of the cylindrical can wall and then folding the can ends to reside in substantially a common plane with the flattened side wall. In this regard, reference is made to

FIGS. 22–24 which schematically illustrate such a technique. A familiar can **290** comprises a cylindrical side wall **292** defining a can axis **294** with a pair of can ends **296, 298** closing the side wall **292** and residing in parallel planes perpendicular to the can axis **294.**

A can flattener **300** has, as the now familiar major components, a frame **302,** means **304** for creasing the can side wall **292** and means **306** for folding and flattening the can **290.** The elements of the can flattener **300** may be of any desired configuration to accomplish creasing on opposite sides of the can **290** and folding of the can ends **296, 298.** One exemplary arrangement is shown in FIGS. **23** and **24** where the frame **302** comprises a trough-like structure having side walls **308, 310** and a bottom wall **312** having a slot **314** therein to discharge the flattened can **290** from the flattener **300.**

The creasing means **304** may comprise creaser bars **316, 318** on opposite sides of the can **290** and extending through suitable apertures **320, 322** in the side walls **308, 310.** It will be noted that the creaser bars **316, 318** are positioned to provide a notch **324, 326** in the can **292** adjacent the ends **296, 298** and thereby fold the can ends **296, 298** about axes **328, 330** at the juncture of the ends **296, 298** and the side wall **292.**

As shown in FIG. **23,** the creaser bars **316, 318** are retracted through the slots **320, 322** to allow advancement of the folding and flattening means **306.** The folding and flattening means **306** is illustrated as comprising a pair of relatively movable platens **332, 334** each of which is pivotally mounted on a force applying rod **336, 338.** Application of forced in the direction shown by the arrows in FIG. **23** causes the platens **332, 334** to engage the respective end walls **296, 298** and further fold the end walls **296, 298** about the axes **328, 330.** In contrast to the operation provided by the previous embodiments, the end walls **296, 298** are not convergent but are instead substantially parallel in planes angularly intersecting the can axis **294.**

The platens **332, 334** are provided with suitable slots **340, 342** to accommodate rotation of the platens **332, 334** as may be seen in FIG. **24.** It will be apparent from FIG. **24** that the advancement of the platens **332, 334** toward each other causes folding of the can ends **296, 298** into more or less parallel planes parallel to the can axis **294** so that the can ends **296, 298** face generally perpendicularly therefrom in opposite directions. Retraction of the platens **332, 334** releases the can **290** for passage through the slot **314** into a suitable disposal receptacle.

It will be immediately apparent that other suitable arrangements may be provided for creasing the can sides and then folding the can ends to achieve a folded configuration similar to that illustrated by the can **290** in FIG. **24.** One such arrangement is shown in FIGS. **25** and **26** where a can **340** is shown in the process of being flattened by a can flattener **342.** The can flattener **342** comprises a frame **344,** means **346** for creasing the can **340** and means **348** for folding and flattening the can **340.** As will be apparent by a comparison of FIGS. **3** and **25,** the can flattener **342** is an adaptation of the can flattener **10** to crease the can **340** on both sides thereof.

The can **340** comprises a cylindrical side wall **350** defining a can axis **352** and a pair of end walls **354, 356** which reside in parallel planes perpendicular to the can axis **352** when the can **340** is undeformed.

The frame **344** comprises a stationary plate or member **358** and a platform **360** for supporting the can **340** during the creasing and flattening operations. A pair of abutments **362, 364** provide one limit of movement of the folding and flattening means **348** for purposes which will become more fully apparent hereinafter. A slot **366** is provided in the platform **360** for passing the flattened can **340** out of the frame **344** as will be apparent from FIG. **26.**

The creasing means **346** is a hybrid of the creasing mechanisms shown in FIGS. **3** and **23** and comprises a pair of creaser bars **368, 370** on opposite sides of the side wall **350** adjacent the end walls **354, 356** respectively. The creaser bar **368** is mounted in a recess provided by the stationary plate **358** and is connected to a force applying rod **374.** The creaser bar **370** is mounted in a recess provided in a platen **376** and has a force applying rod **378** connected thereto. It will be apparent that the application of force to the rods **374, 378** causes the creaser bars **368, 370** to engage the can side wall **350** and form notches **380, 382** therein. The formation of the notches **380, 382** causes the can ends **354, 356** to become inclined with respect to the can axis **352.** It will be seen that the platen **376** is supported by the abutments **362, 364** and acts as an anvil with respect to the creaser bar **368.** The creaser bars **368, 370** are then retracted in preparation for the next step of operation.

The folding and flattening means **348** comprises the platen **376** which is mounted by a suitable means (not shown) for reciprocating movement from the position shown in FIG. **5** toward the frame member **358** which constitutes a stationary platen. A suitable force applying member (not shown) is provided to forcibly advance the platen **376** as indicated by the arrow in FIG. **26.** As the platen **376** advances toward the frame member **358,** the ends **354, 356** of the can **340** are further folded about the axes **384, 386** and come to reside in substantially the configuration shown in FIG. **26.** Relaxation of the force applied to the platen **376** allows the flattened can **340** to pass through the slot **366** out of the frame **344.**

It will now be seen that there is provided an improved method and apparatus for flattening metal cans.

I claim:

1. A mechanism for flattening a can having a generally cylindrical side wall defining a can axis and ends generally perpendicular to the can axis, the mechanism comprising

a frame providing a can receiving area;

means for deformably creasing a notch into the side wall transverse to the can axis thereby inclining the can ends to the can axis, the creasing means comprising

first means comprising first and second platen elements mounted for approaching movement in a path of platen movement intersecting the can receiving area, the first platen element having a dimension parallel to the can axis substantially less than the distance between the can ends, the second platen element spanning the can receiving area and being imperforate opposite the first platen element in the path of platen movement; and

means for folding each can end about an axis adjacent the juncture of the side wall and the respective can end for increasing the angle of inclination between the can ends and the can axis, the folding means including

second means comprising platen elements mounted for approaching movement in a second path intersecting the can receiving area for engaging the can ends and substantially simultaneously applying thereto a moment about the respective axis thereof.

2. The mechanism of claim **1** wherein the second path is generally parallel to the first path.

3. The mechanism of claim **2** wherein the second means comprises the second platen element and a third platen element mounted in the first path of movement; and further comprising means for moving the first platen element out of the first path of movement.

4. The mechanism of claim **3** wherein the last mentioned means comprises means on the third platen element for telescopingly receiving the first platen element.

5. The mechanism of claim **3** wherein the last mentioned means comprises a foldable platen element presenting a first narrow surface comprising the first platen element and a second wider surface comprising the third platen element and means enabling movement of the foldable platen element to present the first and second surfaces successively to the can receiving area.

6. The mechanism of claim **2** wherein the platen elements of the second means comprise a third platen element and a fourth platen element mounted for movement in a path spaced from the first path; and further comprising means for moving cans from a position between the first and second platen elements to a position between the third and fourth platen elements.

7. The mechanism of claim **6** wherein the first and third platen elements are mounted for simultaneous movement for simultaneously folding the ends of a can between the third and fourth platen elements and creasing a can between the first and second platen elements.

8. A mechanism for flattening a plurality of cans each having a generally cylindrical side wall defining a can axis and ends generally perpendicular to the can axis comprising

a frame for receiving the cans and providing a creasing station and a flattening station;

means for moving the cans through a path of can travel successively including the creasing station and the flattening station; and

means for deformably creasing a notch into the side wall transverse to the can axis, for inclining the can ends to the can axis and for folding each can end about an axis adjacent the juncture of the side wall and the respective can end to increase the angle of inclination between the can ends and the can axis, the creasing and folding means comprising

first and second pairs of cooperating platen elements on opposite sides of the creasing and flattening stations respectively and means mounting the first and second pairs of cooperating platen elements for movement in first and second paths respectively intersecting the creasing and flattening stations; and

means for relatively forcibly advancing the respective cooperative platen elements simultaneously toward each other for simultaneously creasing a can at the creasing station and folding can ends of another can at the flattening station.

9. The mechanism of claim **8** wherein the first pair of cooperating platen elements comprises a first platen element having a dimension parallel to the can axis substantially less than the distance between the can ends and a second platen element spanning the creasing station and being perforate opposite the first platen element in the first path of movement.

10. The mechanism of claim **8** wherein the creasing station is spaced upwardly from the flattening station and the moving means includes means for holding an undeformed can at the creasing station.

11. The mechanism of claim **10** wherein the moving means includes means positioning the can axes generally horizontally for gravitational transfer from the creasing station to the flattening station.

12. The mechanism of claim **11** wherein the holding means comprises an abutment position centrally of the path of can travel adjacent the lower end of the creasing station for engaging an undeformed can at the creasing station; and the creasing means comprises means deforming the side wall out of engagement with the abutment for releasing a creased can from the creasing station.

13. The mechanism of claim **12** wherein

the abutment is supported by a strut extending from above the creasing station into the first path of movement; and

the first pair of cooperating platen elements includes a first platen element having a dimension parallel to the can axis substantially less than the distance between the can ends and providing a slot parallel to the first path of movement for passing the first platen element past the strut.

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