March 18, 1941. E. LAXO 2,235,377

GRAIN BREAKER

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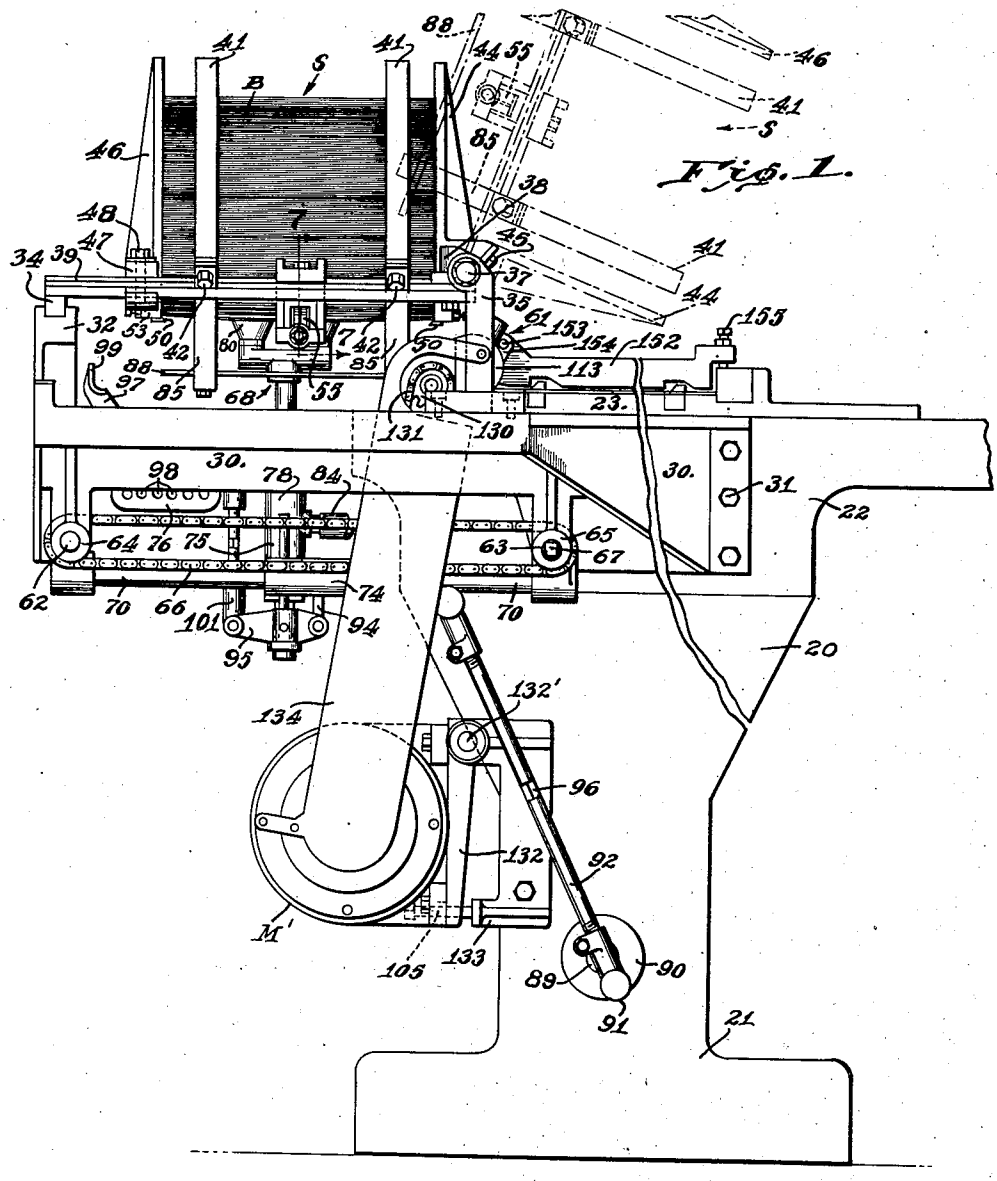


Fig. 1.

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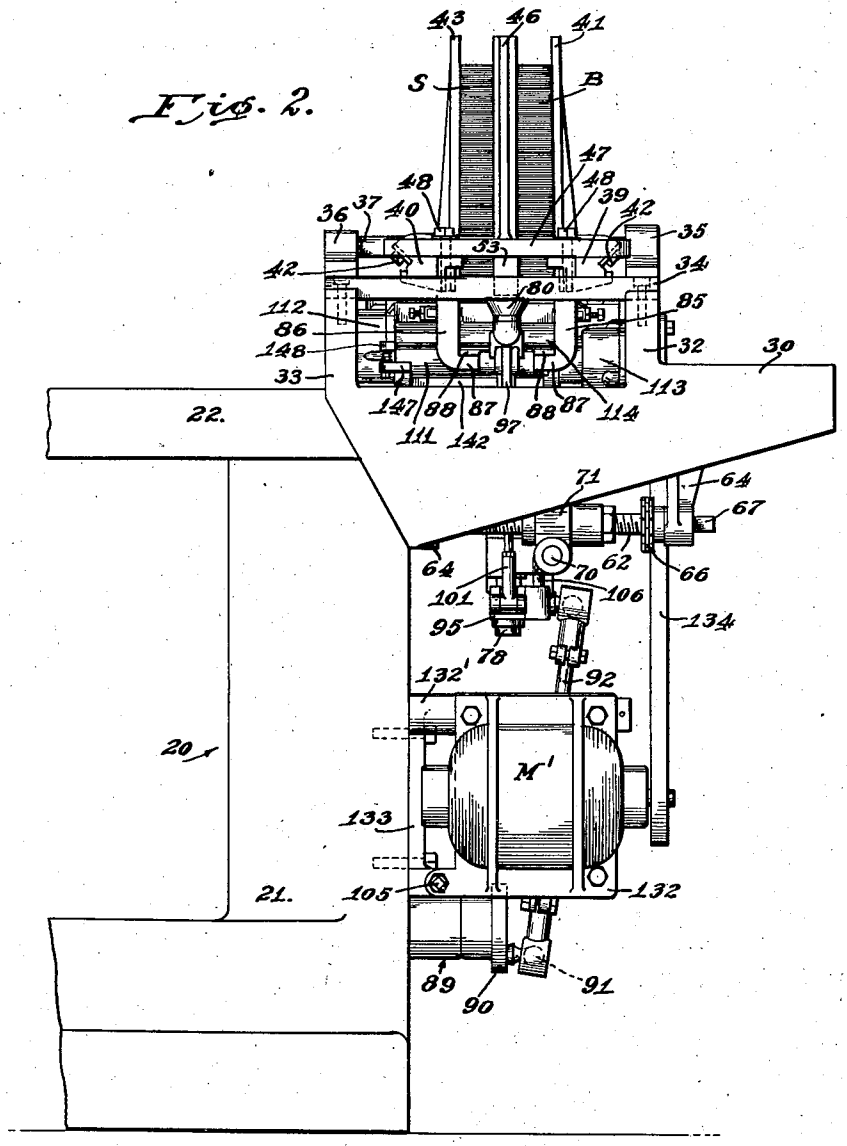
Rule & Hoge
ATTORNEYS

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GRAIN BREAKER

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Fig. 2.



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INVENTOR

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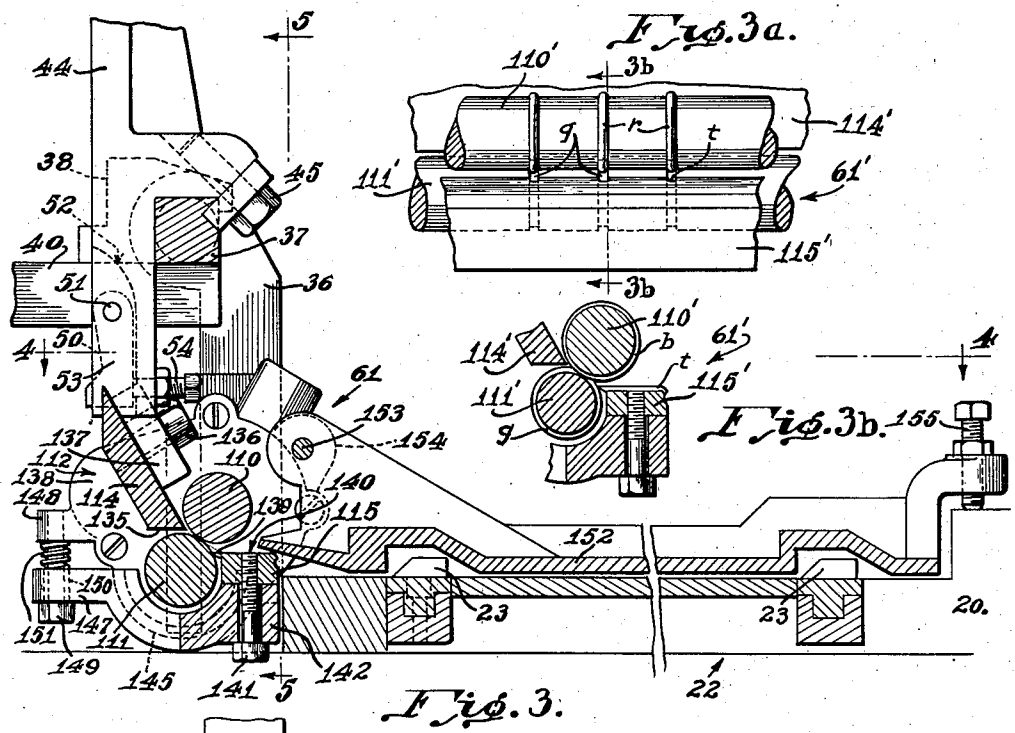


Fig. 3.

Fig. 3a.

Fig. 3b.

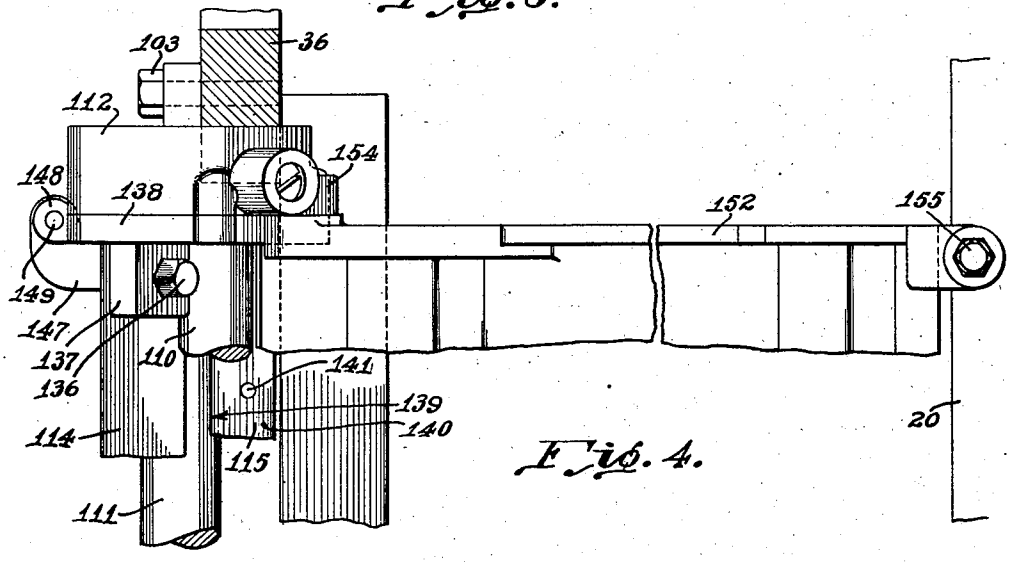


Fig. 4.

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INVENTOR

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GRAIN BREAKER

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Fig. 5.

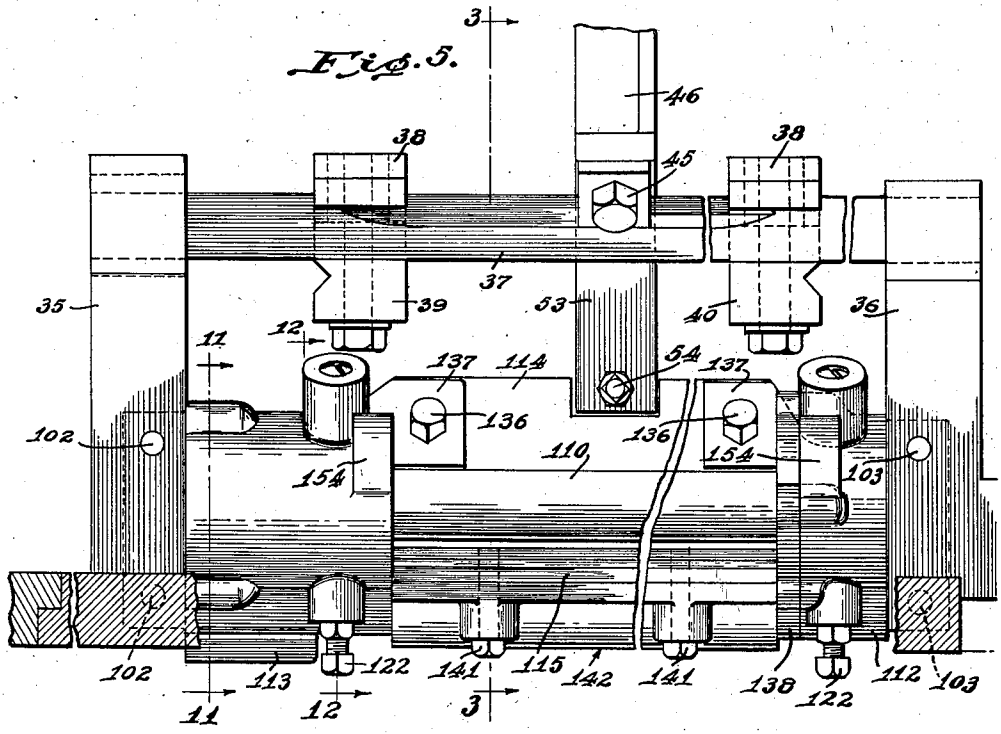


Fig. 6.

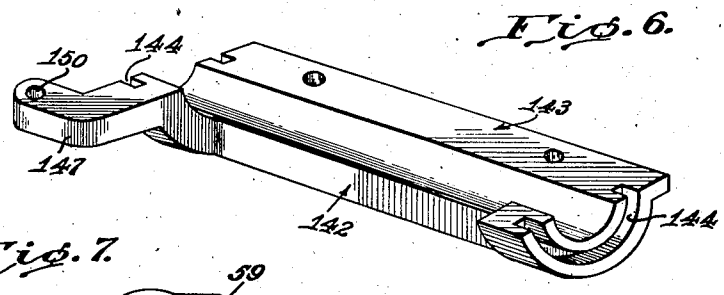


Fig. 7.

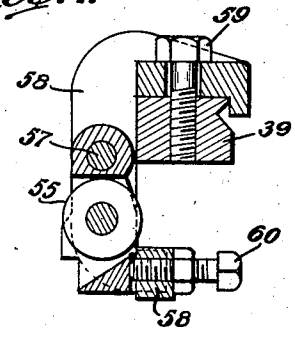
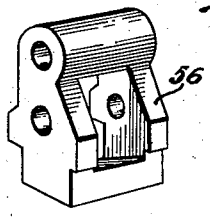


Fig. 8.



ED LAXO
INVENTOR

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Fig. 9.

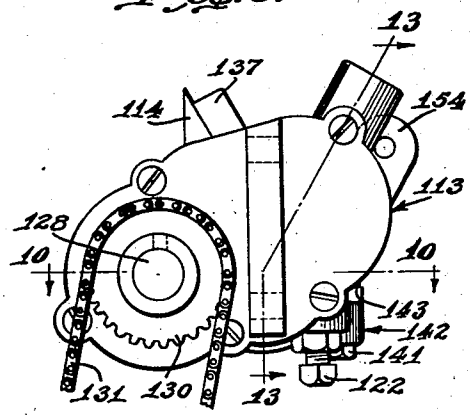


Fig. 10.

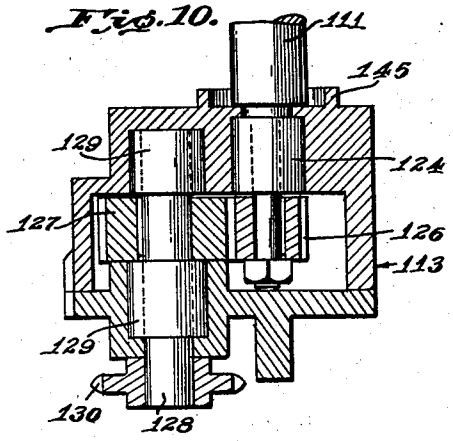


Fig. 11.

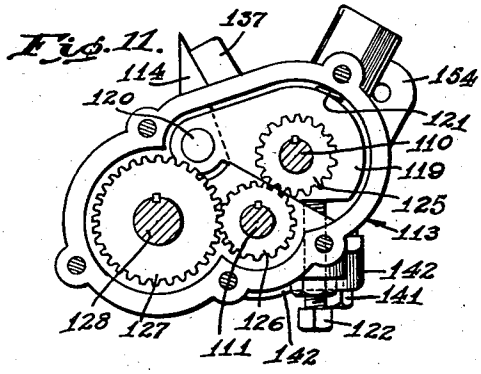


Fig. 12.

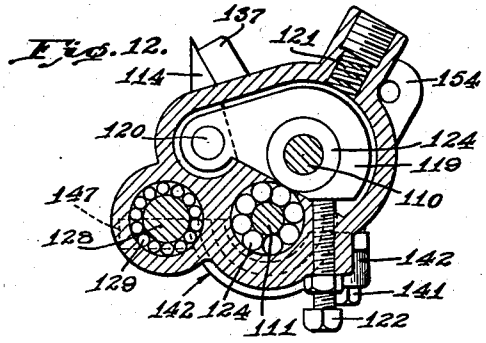
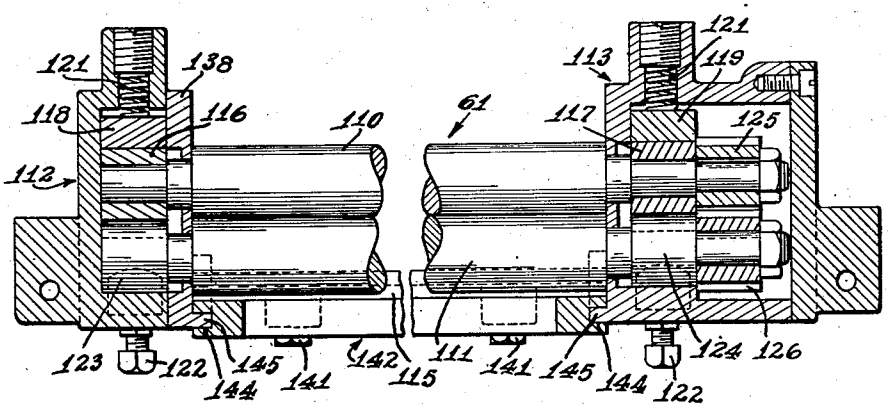


Fig. 13.



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INVENTOR

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Fig. 14.

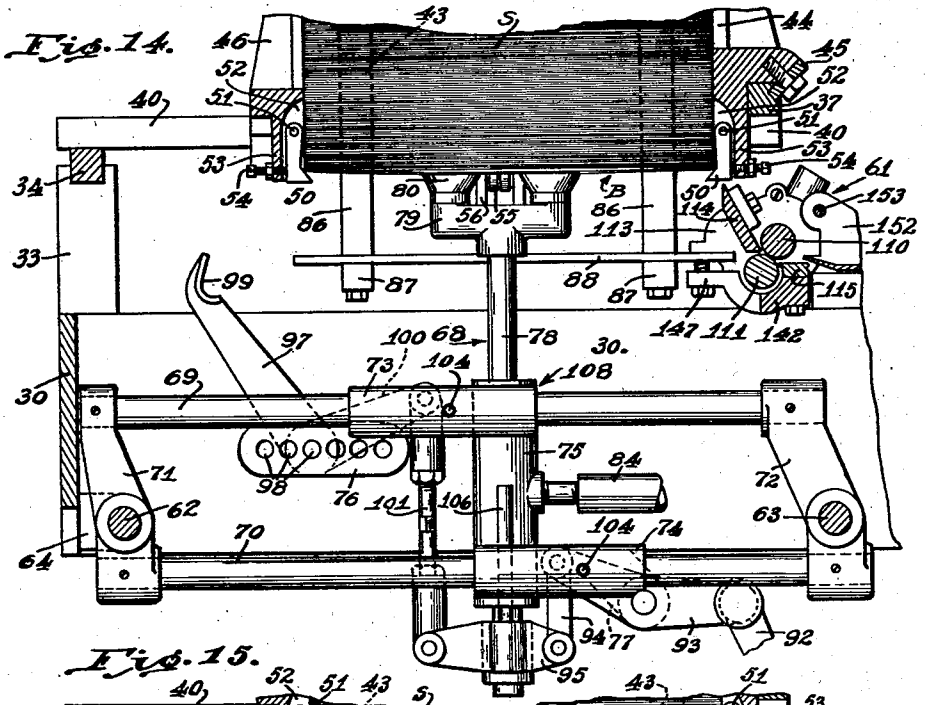
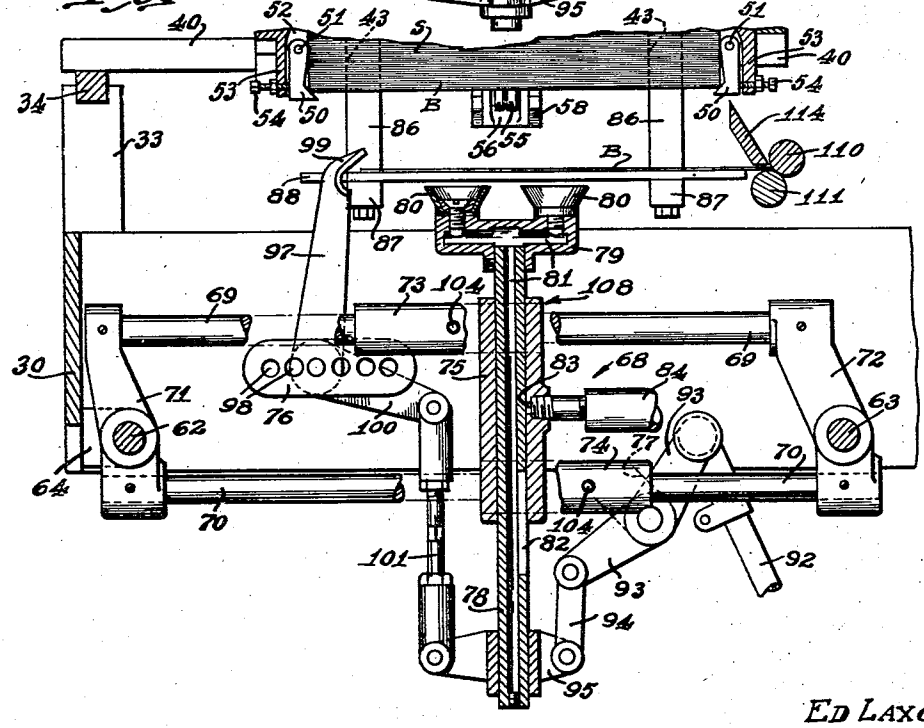


Fig. 15.



ED LAXO
INVENTOR

Rule & Hoge
ATTORNEYS

Patented Mar. 18, 1941 2,235,377

UNITED STATES PATENT OFFICE

2,235,377

GRAIN BREAKER

Ed Laxo, Riverside, Ill., assignor to Owens-Illinois Can Company, a corporation of Delaware

Application July 21, 1938, Serial No. 220,471

17 Claims. (Cl. 153—2)

The present invention relates to an apparatus for treating or processing sheet metal designed to be employed in the manufacture of round can bodies by the body making machinery now in general use. This application is a continuation in part of my copending application, Serial No. 135,480, filed April 7, 1937, for Grain breakers.

In the commercial manufacture of can bodies from commercial tinned plate, made commonly of open hearth steel, considerable difficulty has been encountered due to the tendency of the soft steel blanks to bend irregularly when wrapped around the body forming mandrel. The tubular body produced in this manner exhibits localized irregularities in the form of flattened areas which not only mar the appearance of the finished product, but also interfere with the subsequent soldering, flanging and seaming operations by means of which the disk-like ends of the can are attached to the can body.

The principal object of the invention is to provide an apparatus by means of which the physical properties of sheet metal blanks designed to be formed into can bodies, will be altered or processed whereby the metal thereof is rendered what is known in the art as "plastic" in order that the blanks may immediately be put through the body making machine to produce can bodies having uniform contours.

Another object of the invention is to provide an apparatus capable of and designed for attachment to an existing form of body making machine which will receive the body blanks in stacked relationship and will withdraw the blanks from the stack one at a time and deliver the same in rapid succession to a pair of processing rolls wherein the "grain" of the metal is broken and finally deliver the processed blanks to the feed carriage of the body making machine.

Another object of the invention is to provide a novel means for withdrawing the blanks in rapid succession from a stack preparatory to delivery of the same to the processing rolls which means will effectively overcome the vacuum tendency of each blank to adhere to the stack by initially relieving the partial vacuum existing between adjacent blanks in the stack.

A still further object of the invention is to provide an apparatus for processing and delivering sheet metal blanks to a can body making machine which includes a pair of processing or breaker rolls and cooperating processing or breaker steels which are adjustable with respect to each other to accommodate blanks of varying thickness, ductility, malleability or hardness.

It is often desirable, particularly in connection with extremely tall cans which are to be vacumized, to provide can bodies with vertically spaced annular beads for strengthening the same against collapse. It has been the usual practice to form the can bodies and then, by a separate operation, to subject the can body to bead forming rolls. It has also been common practice to progressively bead the can body as it is progressively curved in the body making machine.

Because of the fact that according to the present invention the metal from which the blanks are formed is processed or rendered "plastic," it is possible to bead the can body blanks in the flat state simultaneously with the processing operation and immediately thereafter, before the metal has had time to become set, put the blanks through the body making machine to produce substantially cylindrical cans having circumferential reinforcing beads thereon.

It is another object of the invention therefore to provide an apparatus of the character set forth above which will not only process the entire body of metal constituting each blank, but which will additionally bead the blank while simultaneously processing the bead or beads in order that the beaded blank may be put through the body making machine and shaped into cylindrical form without danger of localized irregularities occuring in the cylindrical regions or in the beaded regions of the finished can body.

Other objects and advantages of the invention will become apparent as the description ensues.

In the accompanying drawings:

Fig. 1 is a side elevational view of the apparatus showing the same applied to a conventional can body forming machine;

Fig. 2 is an end elevational view of the apparatus shown in Fig. 1;

Fig. 3 is a longitudinal sectional view of the apparatus taken transversely through a processing unit employed in connection with the present invention. This view is taken substantially along the line 3—3 of Fig. 5.

Fig. 3*a* is a fragmentary rear elevational view of a modified form of processing unit employed in connection with the invention;

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

Fig. 4 is a sectional view taken substantially along the line 4—4 of Fig. 3;

Fig. 5 is a sectional view taken substantially along the line 5—5 of Fig. 3;

Fig. 6 is a perspective view of an adjustable breaker steel element employed in connection with the present invention;

Fig. 7 is a sectional view taken substantially along the line 7—7 of Fig. 1;

Fig. 8 is a perspective view of a roller support employed in connection with the present invention;

Fig. 9 is a side elevational view of a roller bearing housing employed in connection with the present invention;

Fig. 10 is a sectional view taken substantially along the line 10—10 of Fig. 9;

Fig. 11 is a sectional view taken substantially along the line 11—11 of Fig. 5;

Fig. 12 is a sectional view taken substantially along the line 12—12 of Fig. 5;

Fig. 13 is a sectional view taken substantially along the line 13—13 of Fig. 9;

Fig. 14 is a longitudinal section view taken through the apparatus, certain parts being shown in elevation, showing a vacuum cup assembly employed in connection with the present invention engaging a can blank preparatory to removing the same from a stack; and

Fig. 15 is a sectional view similar to Fig. 14 showing the blank removed from the stack preparatory to introduction thereof to the processing or breaker mechanism.

Referring now to Figs. 1 and 2, the conventional type of can body forming machine to which the improved feeding and processing apparatus is attached is designated in its entirety at 20 and includes a supporting structure 21 and a table portion 22 adapted to receive thereon successively the processed blanks B which are to be delivered to the forming roll or mandrel (not shown) of the machine. A suitable reciprocable feeder mechanism 23 is incorporated in the table portion 22 of the apparatus and is designed to rapidly propel the blanks B as they are delivered to the table portion 22 laterally to the forming mandrel. The mechanism thus far described is purely conventional in form and no claim is made to any novelty existing in connection therewith, the invention consisting in the feeding and processing apparatus which is attached to the body forming machine and which will now be fully described.

The feeding and processing apparatus involves in its general organization a casting 30 (Figs. 1 and 2) which is bolted as at 31 or otherwise secured to the table portion 22 of the forming machine. The casting 30 includes an open frame-like structure provided at the rear end (Fig. 2) thereof with a pair of upstanding supports 32 and 33 across the upper end of which there extends a cross bar 34. Adjustably secured to the casting 30 on opposite sides thereof and in the front region thereof are a pair of upstanding supports 35 and 36 across the upper end of which there extends a rock shaft 37. Loosely supported on the rear cross bar 34 and suspended from the rock shaft 37 by means of suspension clamps 38 (Figs. 1 and 3) are a pair of longitudinal bars 39 and 40. A pair of side stack supports 41 are adjustably clamped as at 42 to the longitudinal bar 39, while a similar pair of stack supports 43 are likewise adjustably clamped to the longitudinal bar 40. A front stack support 44 (Figs. 1 and 3) is adjustably clamped as at 45 to the rock shaft 37. A rear stack support 46 (Figs. 1 and 2) of T-shaped design provided with a foot 47 is adjustably clamped as at 48 to the longitudinal bars 39 and 40.

The blanks B are designed to be supported in a stack S within the confines of the stack supports 41, 43, 44 and 46 in a manner subsequently to be described. It will be noted from the above description of parts that the stack supports are, by virtue of the various clamping devices 42, 45 and 48, adjustable toward and away from the center of the stack to accommodate blanks B of varying dimensions. Thus the apparatus is adaptable to body forming machines designed to manufacture different sizes of can bodies.

The lower longitudinal edges of the stack S are supported upon a pair of dogs 50 (Fig. 14) which are pivoted as at 51 within recesses 52 formed in extensions 53 of the front and rear stack supports 44 and 46. Set screws 54 extend through the extensions 53 and bear against the dogs 50 for the purpose of adjusting the latter toward and away from the stack S.

Referring now to Figs. 1, 7 and 8, the lower front and rear edges of the stack S are each supported upon a ball bearing roller 55 which is rotatably supported within a cage 56 (Fig. 8), suspended from and pivoted as at 57 to a suspension bracket 58 which is bolted as at 59 to either the front or rear longitudinal bar 39 or 40 as the case may be. The rollers 55 are capable of adjustment toward and away from the stack S by means of adjusting screws 60 which pass through the lower portions of the brackets 58.

The blanks B are adapted to be rapidly withdrawn one at a time from the underneath side of the stack S and fed laterally to a processing unit 61 wherein the "grain" of the metal of which the blanks are formed is broken and the metal is processed prior to delivery of the blanks to the table 22 of the can body forming machine 20. Toward this end, a pair of threaded supporting shafts 62 and 63 (Figs. 1 and 2) extend transversely across the apparatus at the front and rear thereof respectively and are suspended from the frame-like casting 30 by means of depending brackets 64 and 65 respectively. A chain and sprocket mechanism 66 connects the two shafts 62 and 63 to insure synchronous turning movement thereof. One end of the shaft 63 is squared as at 67 to facilitate angular adjustment thereof.

The supporting shafts 62 and 63 serve to adjustably support thereon in the medial regions thereof a blank withdrawal and blank feeding or kicker mechanism designated in its entirety at 68 and best illustrated in Figs. 14 and 15. The mechanism 68 is slidably mounted for longitudinal movement on upper and lower guide rods 69 and 70 respectively which are anchored at their ends in end pieces 71 and 72 respectively. The end pieces are threadedly mounted upon the threaded supporting shafts 62 and 63.

Referring now to Fig. 14, the upper and lower guide rods 69 and 70 serve to support thereon a unitary casting 108 which consists of upper and lower sleeves 73 and 74 which are mounted upon the rods 69 and 70 respectively, and are secured thereto in any desired adjusted position by means of set screws 104, and a vertical sleeve 75 extending at right angles thereto. A bracket 76 is formed on the sleeve 73 while an angularly disposed bracket 77 is formed on the sleeve 74. A hollow tubular rod 78 is vertically slidable in the sleeve 75 and a hollow crosshead 79 is mounted on the upper end thereof. A pair of readily removable vacuum cups 80 are carried by the crosshead 79 at opposite ends thereof and are designed for engagement with the central regions of the underneath side of the lowermost blank B of the stack S. In order to apply vacuum pressure to the interior of the vacuum cups 80 when the rod 78 is in its uppermost position and the cups are in engagement with the underneath side of the

lowermost blank B, a vacuum conduit 81 extends through the hollow rod 78 and crosshead 79 and communicates with the interior of the cups 80. A port 82 is formed in the side of the rod 78 and this port 82 is adapted to register with a port 83 formed in the sleeve 75 when the rod 78 is in its uppermost position. The port 83 is connected through a pipe 84 to a source of vacuum pressure (not shown). From the above description, it will be seen that when the rod 78 is moved to its uppermost position, vacuum pressure will be applied to the vacuum cups 80 through the pipe 84, and conduit 81. Thus the vacuum cups will by suction engage the lowermost blank B of the stack S in the central regions thereof. As the rod 78 is moved downwardly, the lowermost blank B will be flexed so as to withdraw the same from the dogs 50 and rollers 55 which support the same.

The stack supports 41 and 43 are provided with extensions 85 and 86 respectively (Figs. 2 and 14) which extend below the stack S. The lower ends of the extensions 85 and 86 are turned inwardly as at 87 and a pair of blank supports 88 in the form of longitudinally extending parallel bars are secured to the upper surface of the inturned ends 87. Upon downward movement of the rod 78 the vacuum port 82 moves out of register with the vacuum port 83 to shut off the supply of vacuum pressure to the vacuum cups 80 immediately prior to engagement of the blank B carried by the cups 80 with the blank supports 88. Simultaneously with the movement of the ports 82 and 83 out of register, the port 82 communicates with the atmosphere as shown in Fig. 15. Thus the interior of the vacuum cups 80 is relieved of its subatmospheric pressure and the withdrawn blanks B are released by the vacuum cups and placed on the blank supports 88.

In order to withdraw the blanks B in rapid succession from the bottom of the stack S, means is provided for causing vertical reciprocation of the rod 78. Toward this end, a take off shaft 89 (Fig. 1) of the can body forming machine 20 has a disk 90 mounted on the free end thereof, which disk is provided with an eccentric pin 91 which is connected by means of an extensible link 92 to one end of a bell crank lever 93 mounted on the angular bracket 77. The other end of the bell crank lever 93 is connected through a link 94 to a head 95 which is secured to the lower end of the reciprocable rod 78 and which is prevented from turning by a pin 106 that projects through an aperture 107 in the casting 108. Thus it will be seen that as the take off shaft 89 of the can forming machine 20 rotates, movement thereof will be transmitted to the rod 78 through the connections 92, 93 and 94. The link 92 is provided with a squared portion 96 to facilitate adjustment thereof, and thus the uppermost position of the rod 78 may be varied.

The vacuum cups 80 are replaceable on the crosshead 79 and in order to permit access thereto, the entire stack support including the longitudinal bars 39 and 40, the side stack supports 41, 43, the front and rear stack supports 44, 46, the extensions 85 and blank supports 88, is tiltable about the axis of the rock shaft 37 to the position shown in dotted lines in Fig. 1.

Referring now to Fig. 14, it will be seen that the processing unit 61 is positioned adjacent an edge of the table portion 22 of the can body forming machine 20 between the machine and the stack S. Means is provided for periodically feeding or "kicking" the blanks B placed on the blank supports 88 longitudinally of the apparatus thus feeding the same to the processing unit 61. Toward this end, a kicker arm 97 in the form of a bell crank lever is adjustably fulcrumed in one of a series of apertures 98 provided in the bracket 76. One end of the bell crank lever or kicker arm 97 is provided with a hooked portion 99 designed for engagement with the edges of the blanks to be transferred to the processing unit 61 while the other end 100 thereof is connected through an extensible link 101 to the head 95. Thus it will be seen that upon reciprocation of the vertical rod 78, the kicker arm 97 will periodically be moved into engagement with the adjacent edge of the blanks B resting on the blank supports 88 in such a manner as to move the blanks longitudinally and feed the same to the processing unit 61.

The details of construction of the processing unit 61 are best illustrated in Figs. 5, 6 and 9 to 14 inclusive. The unit 61 is positioned adjacent an edge of the table portion 22 of the machine 20 and includes upper and lower processing rollers 110 and 111 the ends of which are rotatably journalled in a journal housing 112 and a gear housing 113 (Fig. 13) respectively. The housings 112 and 113 are bolted as at 102 and 103 to the supports 35 and 36 respectively. Upper and lower polished breaker steels or bars 114 and 115 respectively cooperate with the processing rollers 110, 111 in a manner subsequently to be described to process or break the "grain" of the body blanks B fed thereto. The breaker steels 114 and 115 extend across the apparatus between the housings 112 and 113 in close proximity to the rollers 110 and 111, the upper steel 114 being positioned ahead of the rollers just above the path of the oncoming blanks, while the lower steel 115 is positioned behind the rollers and engages the blanks after they have passed between the same.

Referring now to Figs. 11, 12 and 13, the upper roller 110 is supported at its ends in the housings 112 and 113 in floating roller bearings 116 and 117 which are carried by bearing cages 118 and 119 respectively pivoted as at 120 within the housings. The bearing cages 118 and 119 are capable of limited pivotal movement within their respective housings against the action of coil springs 121 which bear against these cages and yieldably maintain the same in adjusted position in contact with respective adjusting screws 122 that extend through the housings 112 and 113 and support the free ends of the cages. By turning the adjusting screws 122 in one direction or the other the bearing cage 119 may be swung about the axis of the pivot 120 to adjust the distance between the processing rollers 110 and 111 to accommodate blanks of varying thickness. Roller bearings 123 and 124 mounted within the housings 112 and 113 serve to support the lower processing roller 111 therebetween.

The extreme ends of the rollers 110 and 111 in the gear housing 113 are provided with intermeshing gears 125 and 126 respectively (Figs. 10, 11 and 13). The gear 126 meshes with a driving gear 127 which is mounted on a stub shaft 128 journalled in roller bearings 129 mounted within the housing 113. The stub shaft 128 projects outwardly from the housing 113 and carries at its projecting end a sprocket 130 (Fig. 10) which is driven by means of a chain 131 from an electric motor M' the support 132 for which is pivotally suspended as at 132' (Fig. 1) from a face plate 133 secured to the supporting structure 21 of the machine 20. An adjusting screw 105 passes through the support 132 and

bears against the face plate 133 to regulate the tension of the chain 131. A chain guard 134 conceals and protects the chain 131.

Referring now to Figs. 3 and 4, the upper breaker steel 114 is in the form of a trapezohedron of narrow width, the lower face 135 of which extends horizontally and is positioned immediately in front of the processing rollers 110 and 111 slightly above the plane of contact therebetween. The steel 114 is adjustably bolted as at 136 to a lug 137 formed on the cover plate 138 of the housing 112. The lower roller 111 is positioned slightly in advance of the upper roller 110 and thus, as the blanks B enter and pass between the rollers, their path of movement is a downwardly inclined one. As the blanks B are fed to the unit 61, the advance edges thereof enter the space between the breaker steel 114 and the lower roller 111 and pass between the lower and upper rollers. After the blanks have been engaged by the rollers 110 and 111, the rear portion of the blanks bear upwardly against the breaker steel 114 while the rollers 110 and 111 impart an initial bending to the blanks far beyond the elastic limit of the material from which the blanks are formed.

The lower breaker steel 115 is best illustrated in Fig. 3 and comprises an elongated rectilinear member or bar provided with a lip 139 extending along one longitudinal edge thereof. The upper face 140 of the steel 115 extends substantially horizontally and is positioned immediately behind the processing rollers 110 and 111 slightly below the plane of contact therebetween. The lip 139 bears against the lower roller 111 and prevents the blanks B issuing from the processing rollers from passing between the lower roller and breaker steel 115. The steel 115 is bolted as at 141 to a support or cradle 142, the details of construction of which are best illustrated in Fig. 6. The cradle 142 consists of an elongated casting having a clamping surface 143 to which the steel 115 is bolted. A pair of arcuate guideways 144 are formed in the ends of the cradle 142 and are designed for cooperation with a pair of arcuate ribs 145 formed on the cover plate 138 of the housing 112 and on the body of the housing 113, in supporting the cradle 142 for tilting adjustment about a horizontal axis. The cradle 142 partially encircles the lower roller 111 and is spaced therefrom in such a manner that the center of curvature of the guideways and ribs 145, 146 falls on the axis of the lower roller 111. Thus regardless of the angular adjustment of the support or cradle 142, the longitudinal rib 139 of the breaker steel 115 will bear against the roller 111 and prevent the forward edges of the blanks B from entering the space between the steel 115 and roller 111. In order to adjust the position of the lower steel 115, a lug 147 projects outwardly from the cradle 142 in alignment with a lug 148 (Fig. 3) formed on the cover plate 138 of the housing 112. An adjusting bolt 149 extends through an aperture 150 provided in the lug 147 and is threadedly received in the lug 148. A relatively heavy coil spring 151, the ends of which bear against the lugs 147 and 148, normally urges the lug 147 downwardly into engagement with the head of the adjusting bolt 149 and thus the steel 115 carried by the cradle 142 is yieldingly held in any desired adjusted position behind and in close proximity to the processing rolls 110, 111.

Referring now to Fig. 3, it will be seen that as the blanks B which have already been given an initial bend beyond the elastic limit of the material thereof issue from the processing rollers, 110, 111, the forward edges thereof are directed into engagement with the upper surface 140 of the breaker steel 115 and a reverse bend is imparted to the blanks B which is also beyond the elastic limit of the metal from which the same are formed.

From the above description, it will be seen that the processing unit 61 is adapted to accommodate blanks of varying physical characteristics and thickness. By adjusting the angular position of the cradle 142 or of the breaker steel 114, or both, so that the blanks will issue from the unit 61 in a substantially flat condition, the proper adjustment thereof for any type of blank is attained.

After receiving the reverse bend, the blanks B pass beneath a cover plate 152 which overlies the table portion 22 of the can body forming machine 20 and from thence they are conveyed by the feeder mechanism 23 directly to the forming mandrel thereof (not shown).

The cover plate is pivoted as at 153 to a pair of lugs 154 formed on the gear housing 113 and journal housing 112 and the free end thereof is supported on a stationary portion of the machine 20 by means of adjusting screws 155 which may be turned in one direction or the other to adjust the height of the plate above the processed blanks.

As previously stated, the initial bend imparted to the blanks B by the rollers 110 and 111 and by the cooperating breaker steel 114 is carried beyond the elastic limit of the material from which the blanks are formed and thus the "grain" of the metal is broken in one direction and the tendency of the blanks is to curl into cylindrical form. A characteristic curve of the relation of bending stress to the distortion of the blanks exhibits two outstanding points, namely the elastic limit and the ultimate strength of the material. The present case is concerned with the behavior of the metal above the elastic limit but below the ultimate strength which is the point at which the metal, if bent sharply enough would crack or rupture along the line of bending. Up to the elastic limit the metal behaves elastically, returning to its former flat state upon release of the bending force. When the elastic limit is passed, the rate of increase of strain or distortion changes, and is no longer proportional to the rate of increase of bending stress, but is greater. As the elastic limit is passed a marked change in the rate of increase of distortion occurs and distortion takes place even without change in bending stress. With the passing of the elastic limit, the metal no longer recovers its original flat state but assumes a permanent distortion, "set" or "curl." It will be found that such bending of the metal in one direction beyond the elastic limit thereof increases the elastic limit proportionately to the amount of bending stress applied. It will also be found that the behavior of the metal above its elastic limit will be, or may be said to be, "plastic" to distinguish over its former state and ability to return to its original flat condition. On the other hand, the elastic limit of the metal as far as bending stress in the opposite direction is concerned is decreased, and as the blanks are bent in the reverse direction by the application of stress thereto by the lower breaker steel 115 the metal is carried beyond its elastic limit again even before the original bend is nullified. A new elastic limit is attained for the metal and the reverse bend of the metal is carried sufficiently beyond the elastic limit of the metal

that the metal recovers its original flat condition upon returning to a state of equilibrium as the distortion decreases through the elastic range in direct proportion to the decrease in bending stress which finally carried the metal up to the new elastic limit. Thus the material is rendered "plastic" as far as bending in either direction is concerned and for a short time after stressing beyond the elastic limit, the metal will exhibit lack of a yield point and will possess a characteristic that has heretofore been termed "cold plasticity" which adapts it to a forming process without the occurrence of localized irregularities or flattened areas in the finished can body. The period during which the metal retains its characteristic of "cold plasticity" varies with the physical characteristics of the metal and with the thickness of the blanks. Generally speaking, the thinner the blanks, the more rapidly will the metal thereof lose the characteristic which renders it "plastic." Thus it is advantageous to conduct the processed blanks directly to the forming machine from the processing unit 61 and it is for this reason that the present apparatus has been designed as an auxiliary attachment for an existing form of can body forming machine rather than as a separate entirety in itself.

The modified form of processing unit 61' shown in Figs. 3*a* and 3*b* is designed for use with can body blanks which are to be formed into extremely tall cans that are to be vacuumized. By means of the processing unit 61' the can body blanks are beaded in the flat state simultaneously with the processing operation and immediately thereafter the can body blanks are put through the body making machine to produce can bodies having circumferential reinforcing beads thereon. The construction of the processing unit 61' is substantially identical with the construction of the processing unit 61 as far as the various mountings for the upper and lower processing rollers 110' and 111' and the breaker steels 114' and 115' are concerned. The upper roller 110' is provided with a series of bead forming ribs *r* which register with a similar series of bead forming grooves *g* formed in the lower roller 111'. The ribs *r* conform in shape to the grooves *g* and, contacting with the blanks, will roll corresponding beads in the same. Inasmuch as the body blanks pass through the processing rollers 110' and 111' in a definite lateral position, the beads formed on the body blanks will be parallel and located the same distance apart in successive blanks. As shown in the drawings, the forming rollers are provided with three bead forming devices but it is to be understood that the number of such devices may be varied, only one being employed if desired.

In order to accommodate the beads thus formed in the body blanks, the breaker steel 115' has formed therein a series of parallel troughs *t* in the upper surface thereon into which the corresponding beads formed in the blanks are projected and by means of which the metal of the beads are processed while the metal of the remainder of the blanks is processed in the manner previously described by contact with the flat portions of the upper surface of the breaker steel 115'.

It will be seen therefore that not only are the flat portions of the blanks processed so as to exhibit "cold plasticity" as set forth above, but so also are the beaded portions thereof. The lack of a yield point attained by the beaded portions as well as by the flat portions will enable them to be formed with the remainder of the blanks into cylindrical shape without danger of localized buckling of the bead, providing however that the blanks are put through the body making machine within a reasonable time after the processing operation and before the metal has time to become set and attain a definite yield point.

Modifications and variations may be resorted to within the spirit and scope of the present invention.

I claim:

1. An apparatus for processing blanks to be used in the making of can bodies comprising a pair of horizontally disposed cooperating processing rolls between which the blanks are adapted to pass; means positioned in close proximity to the roll pass and above the level of one of said rolls and against which said blanks are adapted to bear while passing through said rolls for progressively bending said blanks beyond the elastic limit thereof in one direction; and means positioned in close proximity to the roll pass and below the level of the other roll and against which said blanks are normally directed solely by the rolls and are adapted to bear while passing through said rolls for progressively bending said blanks beyond the elastic limit thereof in the other direction, said rolls being so relatively positioned that a plane containing their axes is inclined to the line of delivery of the blanks.

2. An apparatus for processing blanks to be used in the making of can bodies comprising a pair of horizontally disposed cooperating processing rolls between which the blanks are adapted to pass; means positioned in close proximity to the roll pass and above the level of one of said rolls on one side of a plane common to the axes of said rolls and against which said blanks are adapted to bear while passing through said rolls for progressively bending said blanks beyond the elastic limit thereof in one direction; and means positioned in close proximity to the roll pass and below the level of the other roll and on the other side of said plane and against which said blanks are normally directed solely by the rolls and are adapted to bear while passing through said rolls for bending said blanks beyond the elastic limit thereof in the other direction, said rolls being so relatively positioned that a plane containing their axes is inclined to the line of delivery of the blanks.

3. An apparatus for processing blanks to be used in the making of can bodies comprising a pair of horizontally disposed cooperating processing rolls between which the blanks are adapted to pass, a breaker steel having a substantially horizontal surface positioned in close proximity to the roll pass and above the level of one of said rolls, said blanks being adapted to bear against said surface while passing through said rolls to bend the same beyond the elastic limit thereof in one direction, and a second breaker steel having a substantially horizontal surface positioned in close proximity to the roll pass and below the level of the other roll and directly in the path of the blanks issuing from the rolls, said blanks being adapted to bear against said latter surface while passing through said rolls to bend the same beyond the elastic limit thereof in the other direction, said rolls being so relatively positioned that a plane containing their axes is inclined to the line of delivery of the blanks.

4. An apparatus for processing blanks to be

used in the making of can bodies comprising upper and lower cooperating rolls which are substantially tangentially disposed with respect to each other and between which said blanks are adapted to pass downwardly and rearwardly; means positioned in close proximity to the roll pass and above the level of said lower roller and against which said blanks are adapted to bear while passing through said rolls for progressively bending said blanks beyond the elastic limit thereof in one direction; and means positioned in close proximity to the roll pass and below the level of said upper roller, against which said blanks are normally directed solely by the rolls and are adapted to bear while passing through said rolls for progressively bending said blanks beyond the elastic limit thereof in the other direction, said rolls being so relatively positioned that a plane containing their axes is inclined to the line of delivery of the blanks.

5. An apparatus for processing blanks to be used in the making of can bodies comprising upper and lower cooperating rolls which are substantially tangentially disposed with respect to each other and between which said blanks are adapted to pass downwardly and rearwardly; a breaker steel having a substantially horizontal surface positioned in close proximity to the roll pass and above the level of said upper roll, said blanks being adapted to bear against said surface while passing through said rolls to bend the same beyond the elastic limit thereof in one direction; and a second breaker steel having a substantially horizontal surface positioned in close proximity to the roll pass and below the level of said upper roll directly in the path of the blanks issuing therefrom, said blanks being adapted to bear against said latter surface while passing through said rolls to bend the same beyond the elastic limit thereof in the other direction, said rolls being so relatively positioned that a plane containing their axes is inclined to the line of delivery of the blanks.

6. An apparatus for processing blanks to be used in the making of can bodies comprising upper and lower cooperating rolls which are substantially tangentially disposed with respect to each other and between which said blanks are adapted to pass downwardly and rearwardly; means positioned in close proximity to the roll pass and forwardly of said rolls and above the level of said lower roller and against which said blanks are adapted to bear while passing through said rolls for progressively bending said blanks beyond the elastic limit thereof in one direction; and means positioned in close proximity to the roll pass and rearwardly of said rolls and below the level of said upper roller directly in the path of the blanks issuing therefrom and against which said blanks are adapted to bear while passing through said rolls for progressively bending said blanks beyond the elastic limit thereof in the other direction, said rolls being so relatively positioned that a plane containing their axes is inclined to the line of delivery of the blanks.

7. An apparatus for processing blanks to be used in the making of can bodies comprising upper and lower cooperating rolls which are substantially tangentially disposed with respect to each other and between which said blanks are adapted to pass downwardly and rearwardly; a breaker steel having a substantially horizontal surface positioned in close proximity to the roll pass and forwardly of said rolls and above the level of said lower roll, said blanks being adapted to bear against said surface while passing through said rolls to bend the same beyond the elastic limit thereof in one direction; and a second breaker steel having a substantially horizontal surface positioned in close proximity to the roll pass and rearwardly of said rolls and below the level of said upper roll and directly in the path of the blanks issuing from the rolls, said blanks being adapted to bear against said latter surface while passing through said rolls to bend the same beyond the elastic limit thereof in the other direction, said rolls being so relatively positioned that a plane containing their axes is inclined to the line of delivery of the blanks.

8. An apparatus for processing blanks to be used in the making of can bodies comprising upper and lower cooperating rolls which are substantially tangentially disposed with respect to each other and between which said blanks are adapted to pass downwardly and rearwardly; a breaker steel having a substantially horizontal surface positioned forwardly of said rolls and above the level of said lower roll, said blanks being adapted to bear against said surface while passing through said rolls to bend the same beyond the elastic limit thereof in one direction; a second breaker steel mounted for pivotal movement about the longitudinal axis of said lower roll and having a surface positioned below the level of said upper roll directly in the path of movement of the blanks issuing from said rolls and against which said blanks are adapted to bear while passing through said rolls to bend the same beyond the elastic limit thereof in the other direction; and means for clamping said latter breaker steel in a desired adjusted position.

9. An apparatus for processing blanks to be used in the making of can bodies comprising upper and lower cooperating rolls which are substantially tangentially disposed with respect to each other and between which said blanks are adapted to pass downwardly and rearwardly; a breaker steel having a substantially horizontal surface positioned forwardly of said rolls and above the level of said lower roll, said blanks being adapted to bear against said surface while passing through said rolls to bend the same beyond the elastic limit thereof in one direction; a second breaker steel having a substantially horizontal surface positioned rearwardly of said rolls directly in the path of the blanks issuing from said rolls and below the level of said upper roll, said blanks being adapted to bear against said latter surface while passing through said rolls to bend the same beyond the elastic limit thereof in the other direction; and means for adjusting the height and inclination of said latter breaker steel within relatively narrow limits.

10. An apparatus for processing blanks to be used in the making of can bodies comprising upper and lower cooperating rolls which are substantially tangentially disposed with respect to each other and between which said blanks are adapted to pass downwardly and rearwardly; means positioned above the level of said rolls forwardly thereof and cooperating with said rolls for progressively bending said blanks beyond the elastic limit thereof in one direction; a breaker steel mounted for pivotal movement about the longitudinal axis of said lower roll and having a surface positioned below the level of said upper roll against which said blanks are adapted to bear while passing through said rolls

to bend the same beyond the elastic limit thereof in the other direction; and means for adjustably clamping said breaker steel in a desired angular position.

11. An apparatus for processing blanks to be used in the making of can bodies comprising upper and lower cooperating rolls which are substantially tangentially disposed with respect to each other and between which said blanks are adapted to pass downwardly and rearwardly, a breaker steel having a substantially horizontal surface positioned above the level of said lower roll, said blanks being adapted to bear against said surface while passing through said rolls to bend the same beyond the elastic limit thereof in one direction; a second breaker steel mounted for limited pivotal movement about the axis of said lower roll; and means for clamping said latter breaker steel in an adjusted position, said latter breaker steel having a surface against which said blanks are adapted to bear while passing through said rolls for progressively bending the same beyond their elastic limit in the other direction.

12. An apparatus for processing blanks to be used in the making of can bodies comprising a pair of cooperating rolls which are substantially tangentially disposed with respect to each other and between which said blanks are adapted to pass; means positioned forwardly of said rolls in close proximity to the line of tangency between the rolls and disposed between said line and a plane tangent to both rolls and cooperating with the rolls for progressively bending said blanks beyond the elastic limit thereof in one direction; a breaker steel mounted for pivotal movement about the longitudinal axis of one of said rolls and extending to a region in close proximity to the line of tangency between the rolls and disposed between said line and a plane also tangent to both rolls and cooperating with the rolls for bending the blanks beyond their elastic limit in the other direction, and means for adjustably clamping said breaker steel in a desired angular position.

13. An apparatus for processing blanks to be used in the making of can bodies comprising a pair of cooperating rolls which are substantially tangentially disposed with respect to each other and between which said blanks are adapted to pass; a breaker steel positioned forwardly of said rolls in close proximity to the line of tangency between the rolls and disposed between said line and a plane tangent to both rolls and cooperating with the rolls for progressively bending said blanks beyond the elastic limit thereof in one direction; a breaker steel positioned rearwardly of said rolls in close proximity to the line of tangency between the rolls and disposed between said line and a plane also tangent to both rolls and cooperating with the rolls for progressively bending said blanks beyond the elastic limit thereof in the other direction; and cooperating means on said rolls for forming a bead in the blanks while simultaneously processing the same.

14. An apparatus for processing blanks to be used in the making of can bodies comprising a pair of cooperating rolls which are substantially tangentially disposed with respect to each other and between which said blanks are adapted to pass; a breaker steel positioned forwardly of said rolls in close proximity to the line of tangency between the rolls and disposed between said line and a plane tangent to both rolls and cooperating with the rolls for progressively bending said blanks beyond the elastic limit thereof in one direction; and a breaker steel positioned rearwardly of said rolls in close proximity to the line of tangency between the rolls and disposed between said line and a plane also tangent to both rolls and cooperating with the rolls for progressively bending said blanks beyond the elastic limit thereof in the other direction, there being a circumferential groove in one of said rolls and a cooperating rib on the other roll for forming a bead on said blanks while simultaneously processing the same.

15. An apparatus for processing blanks to be used in the making of can bodies comprising a pair of horizontally disposed cooperating processing rolls between which the blanks are adapted to pass; means positioned above the level of one of said rolls and against which said blanks are adapted to bear while passing through said rolls for progressively bending said blanks beyond the elastic limit thereof in one direction; means positioned below the level of the other roll and against which said blanks are normally directed solely by the rolls and are adapted to bear while passing through said rolls for progressively bending said blanks beyond the elastic limit thereof in the other direction; and cooperating means on said rolls for forming a bead in the blanks while simultaneously processing the same.

16. An apparatus for processing blanks to be used in the making of can bodies comprising a pair of horizontally disposed cooperating processing rolls between which the blanks are adapted to pass; means positioned above the level of one of said rolls and against which said blanks are adapted to bear while passing through said rolls for progressively bending said blanks beyond the elastic limit thereof in one direction; and means positioned below the level of the other roll and against which said blanks are normally directed solely by the rolls and are adapted to bear while passing through said rolls for progressively bending said blanks beyond the elastic limit thereof in the other direction, there being a circumferential groove in one of said rolls and a cooperating rib on the other roll for forming a bead on said blanks while simultaneously processing the same.

17. An apparatus for processing blanks to be used in the making of can bodies comprising upper and lower cooperating rolls which are substantially tangentially disposed with respect to each other and between which said blanks are adapted to pass downwardly and rearwardly; a breaker steel having a substantially horizontal surface positioned forwardly of said rolls and above the level of said lower roll, said blanks being adapted to bear against said surface while passing through said rolls to bend the same beyond the elastic limit thereof in one direction; and a second breaker steel mounted for pivotal movement about the longitudinal axis of said lower roll and having a surface positioned below the level of said upper roll directly in the path of movement of the blanks issuing from said rolls and against which said blanks are adapted to bear while passing through said rolls to bend the same beyond the elastic limit thereof in the other direction.

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