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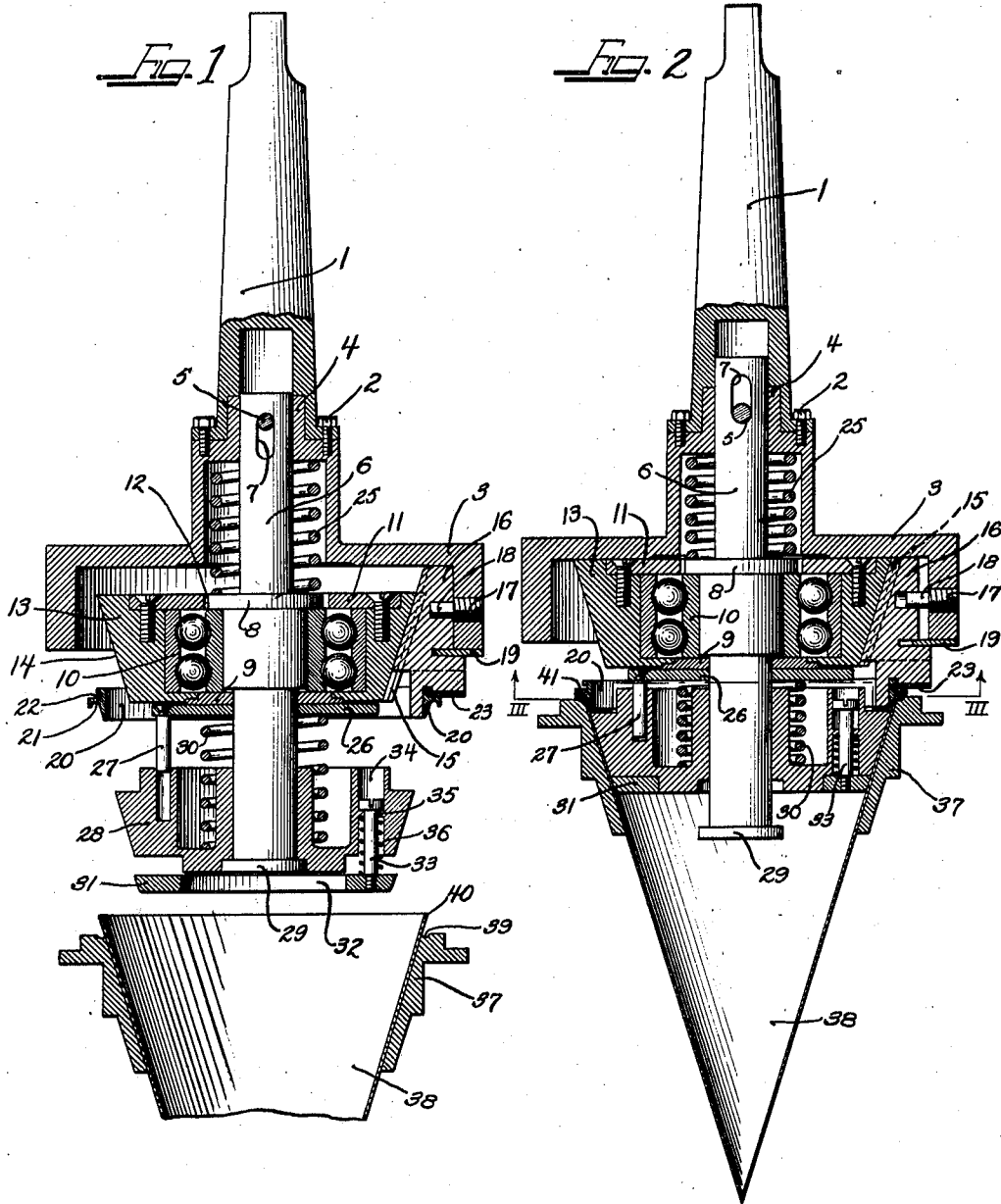
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2,278,299

METHOD OF AND APPARATUS FOR CURLING EDGES ON CONTAINERS

Filed Feb. 26, 1940

4 Sheets-Sheet 1



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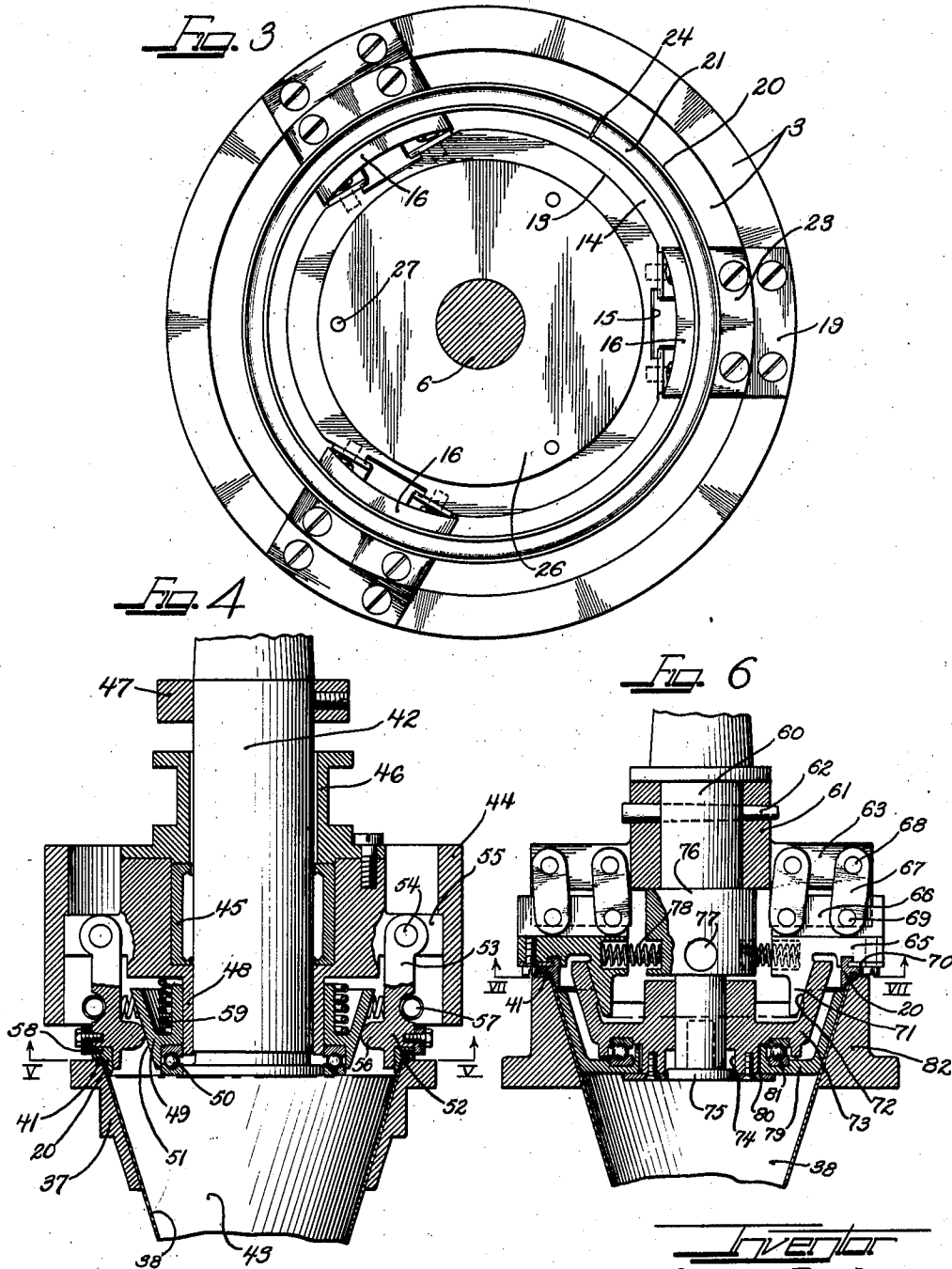
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METHOD OF AND APPARATUS FOR CURLING EDGES ON CONTAINERS

Filed Feb. 26, 1940

4 Sheets-Sheet 2



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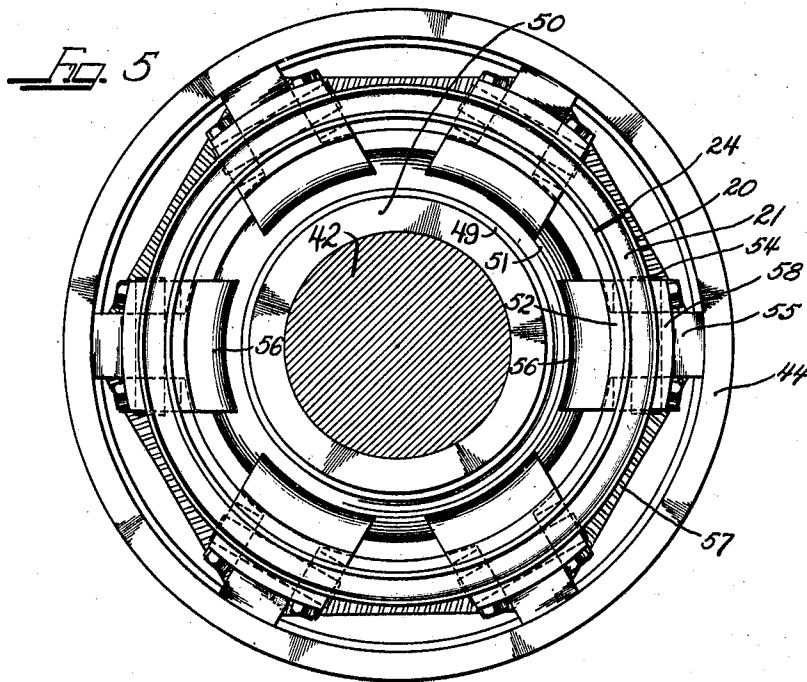
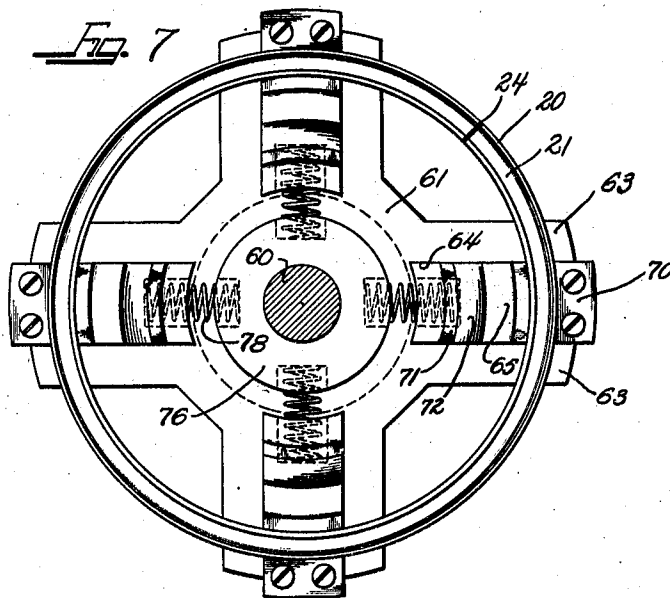
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METHOD OF AND APPARATUS FOR CURLING EDGES ON CONTAINERS

Filed Feb. 26, 1940

4 Sheets-Sheet 3



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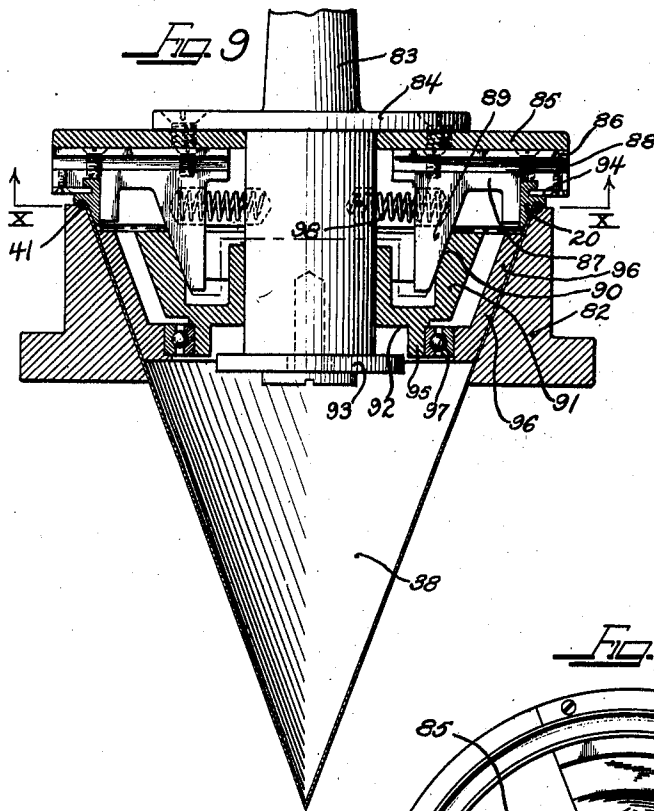
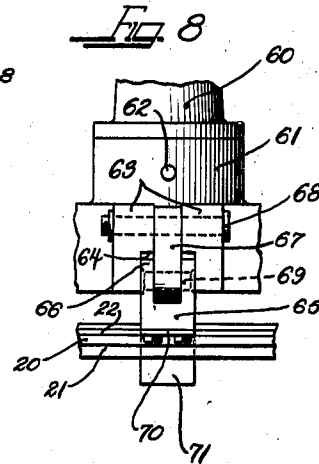
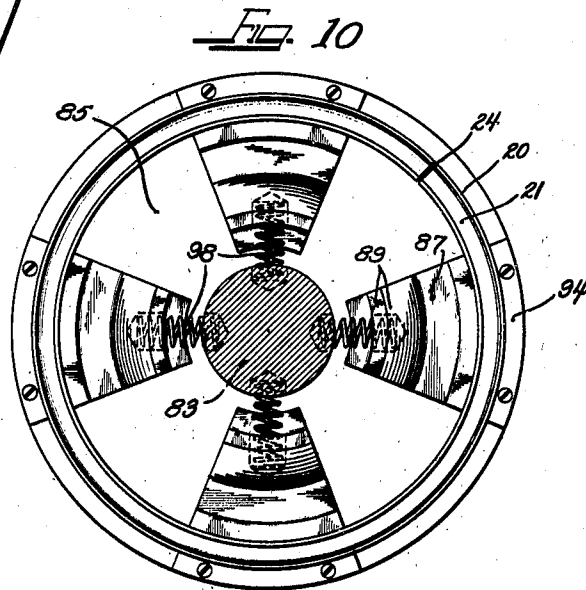
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METHOD OF AND APPARATUS FOR CURLING EDGES ON CONTAINERS

Filed Feb. 26, 1940

4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,278,299

METHOD OF AND APPARATUS FOR CURLING
EDGES ON CONTAINERSCesare Barbieri, New York, N. Y., assignor to
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Application February 26, 1940, Serial No. 320,733

16 Claims. (Cl. 93—36.5)

This invention relates to improvements in a method of and apparatus for curling edges on containers, the invention being highly desirable for curling the edges of containers made of paper or the like, such, for example, as paper drinking cups, ice cream cups, sundae dishes or other dishes, and other paper vessels or containers of the same general character, although the invention may have other uses and purposes as will be apparent to one skilled in the art.

In the past, some difficulty has been experienced in providing a curled edge in the nature of a downward roll upon containers, and especially so in connection with paper containers of the character of paper drinking cups. This difficulty was experienced mostly with vessels having a relatively wide taper in the side walls, for example, a conical paper drinking cup having an angle in excess of 30 degrees between diametrically opposed elements of the cone. This difficulty was caused mainly by the fact that in providing a curled edge in the nature of a complete downward roll of one or more turns, the roll would not follow the downward and inward declination of the container wall, so that an unsatisfactory and unsightly product resulted and the roll itself, being loose, did not function properly nor did it tend to rigidify the container as a whole.

Such difficulty was solved to a material extent by the invention described and claimed in Erik G. Seastrom Patent No. 2,017,018, dated October 8, 1935, and the instant invention embodies structural features not disclosed in the aforesaid Seastrom patent, as will be apparent later herein.

With the foregoing in mind, it is an important object of this invention to provide an improved device for simply and smoothly curling or rolling the edge of a container to provide a rim bead, especially containers having a side wall sloping at an angle in excess of 15 degrees.

Another object of the invention is the provision of apparatus for curling the edge of an inwardly sloping container wall to provide a rim bead, such apparatus embodying a single curling member for contacting the edge of the container wall.

The present invention also provides means for giving a smoother curl to the edge of a container wall by virtue of substantially continuous contact of the curling means with the container when the curl is complete, and with the curl following closely during formation a sloping container wall.

A further object of the present invention is the provision of a contractable curling member which contracts in keeping with the wall slope of a container and at the same time curls the edge of the sloping wall into a rim bead.

Still another object of the invention resides in the provision of apparatus for curling the edges of container walls, especially sloping walls, including a curling iron in the nature of a split ring which, of course, is expansible and contractable.

Another important object of the present invention is the provision of apparatus for curling the edge of a sloping or tapering container wall, which apparatus is arranged to permit the curling means to rotate relatively to the container during the curling operation, or the container rotates relatively to the curling means during the curling operation, or permits both the container and curling means to rotate simultaneously, in the same or opposite directions, as may be deemed most feasible.

It is also an object of this invention to provide an apparatus for curling the edges of containers having materially sloping or tapering walls, which apparatus may be used as an individual and separate unit or incorporated without any substantial change in the curling mechanism in a container making machine to function contemporaneously with the forming of the container.

Still a further object of this invention is the provision of a new and novel method of curling the edge of a sloping walled container to provide a rim bead.

While some of the more salient features, characteristics and advantages of this invention have been above pointed out, others will become apparent from the following disclosures, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a fragmentary, part sectional, part elevational view of apparatus embodying principles of the present invention, showing the mechanism in position prior to the start of a curling operation;

Figure 2 is a fragmentary, part sectional, part elevational view of the structure of Figure 1, showing the same in position at the completion of a curling operation;

Figure 3 is an enlarged, bottom plan sectional view, taken substantially as indicated by the staggered section line III—III of Figure 2;

Figure 4 is a fragmentary, part sectional, part elevational view, illustrating a modified form of

curling mechanism, showing the same in position after the curling operation is completed;

Figure 5 is an enlarged, bottom plan sectional view, taken substantially as indicated by the staggered section line V—V of Figure 4;

Figure 6 is a fragmentary, part sectional, part elevational view, illustrating another modified form of curling mechanism in position after the completion of the curling operation;

Figure 7 is an enlarged, bottom plan sectional view, taken substantially as indicated by the staggered section line VII—VII of Figure 6;

Figure 8 is an enlarged, fragmentary, elevational view taken from the right-hand side of Figure 6, with parts removed;

Figure 9 is a fragmentary, part sectional, part elevational view of still another modified form of curling mechanism in position after the completion of the curling operation; and

Figure 10 is a bottom plan sectional view, taken substantially as indicated by the staggered section line X—X of Figure 9.

As shown in the drawings:

The present invention has been illustrated in several different embodiments to indicate the flexibility of the invention. Certain of these embodiments disclose the invention arranged to permit rotary movement of the curling iron relatively to the container, while others illustrate a construction permitting rotary movement of the container relatively to the curling iron, or both. No vital or substantial change in construction is necessary to have either the container or curling iron rotating while the other is stationary or to have both rotating at the same time.

In the illustrated embodiment of this invention seen in Figures 1, 2 and 3, there is shown an attaching shank 1 which may be secured to any suitable means for imparting a reciprocable movement to the shank, whether those means be separate from or incorporated in a container making machine. Secured to the attaching shank, as by bolts 2, is an outer shell 3 which is provided at its upper end with a portion 4 of reduced diameter connected through a pin 5 to a main shaft or spindle 6. The pin 5 extends through an elongated slot 7 in the shaft 6, which slots limits the stroke of the shaft 6 and likewise the curling mechanism relatively to the outer shell 3. The shaft 6 is provided with an integral collar 8, which together with a supporting ring 9 fixed to the shaft and spaced below the collar provides a seat for a ball-bearing assembly 10.

In the illustrated instance, the ball-bearing assembly performs no real function but is included in the structure so that the mechanism may readily be adapted to permit rotary movement of the curling iron relatively to the container being operated upon. To so adapt the mechanism, it is simply necessary to disconnect the outer shell 3, which may function as a pulley, from the connecting shank 1 and shaft 6 somewhat in the manner to be later described in connection with Figure 4.

Above the ball-bearing assembly is a circular supporting plate 11 spaced from the collar 8, as indicated at 12, and a cam ring 13 having a sloping outer wall 14 is carried by the plate 11. The outer portion of this cam ring is provided with a plurality of spaced T-slots, as indicated at 15, each of which accommodates a similarly shaped projecting portion on a curling ring expander or spreader 16. In this instance, three

such spreaders 16 are shown, although whatever number appears most feasible may be used, depending upon the size of the apparatus. Of course, the inner wall of each spreader 16 is tapered or sloped complementally to the outer wall 14 of the cam ring.

The spreaders are not permitted any axial stroke relatively to the outer shell 3, but are only permitted to move radially with respect to this shell by virtue of one or more studs 17 threaded into the outer shell, each of which has a smooth shank 18 extending into a suitable bore in the spreader, and by virtue of a plate 19 bolted or otherwise secured to the lower end of the shell 3 and extending into a groove in the spreader. With such construction, referring to Figures 1 and 2, it will be seen that the spreader 16 is slidable relatively to the smooth shank 18 and plate 19.

A curling iron 20 having an arcuate annular groove 21 for rolling a container edge is seated in a suitable socket or recess in the respective spreaders 16. The upper portion of the curling iron is provided with a key slot 22, and a key plate 23 bolted or otherwise secured to the lower portion of each spreader is engaged in the slot 22 to hold the curling iron in position. As seen best in Figure 3, the curling iron 20 is in the nature of a split ring with a space 24 between the ends of the ring. With reference to Figure 3, which illustrates the curling iron at the finish of a curling operation, it will be seen that the space 24 is substantially closed so that the curling iron makes substantially complete and uniform contact entirely around the rolled edge of a container.

A compression spring 25, seated in a suitable socket in the upper portion of the outer shell 3 and bearing against the collar 8 on the shaft 6, urges this shaft and likewise the cam ring 13 downwardly relatively to the shell tending to maintain the spreaders 16 in their outermost position as seen in Figure 1, thus tending to maintain the curling iron 20 in its fully expanded position.

Beneath the aforesaid bearing support 9 is a thrust plate 26 also attached to the shaft 6. One or more smooth shanked guiding pins 27 depend from the thrust plate 26 and slides freely in suitable bores in a container clamping element 28, the outer wall of which tapers in keeping with the taper of the particular container being worked upon. This clamp 28 is supported by a collar 29 on the lower end of the shaft 6 and is urged downwardly against this collar by a compression spring 30 bearing against the thrust plate 26 and the clamp. The clamp 28 also carries an auxiliary clamp plate 31 provided with a central bore 32 to receive the lower portion of the clamp 28 when the parts are compressed. Normally, the auxiliary clamp 31 depends beneath the clamp 28, as seen in Figure 1, suspended from one or more bolts 33, the head of each of which is slidable in a smooth bore 34 above an annular shoulder 35 in the clamp 28. A compression spring 36 is disposed between the shoulder and the auxiliary clamp to normally urge this clamp downwardly in spaced relationship to the clamp 28.

The above described structure includes the actuated parts of the curling apparatus. With this structure, it is only necessary to provide a curling plate or container holder 37 for holding a cup or other container 38 in proper position for the edge curling operation. The holder 37, of course,

has an inside taper in keeping with the wall of the container 38, and this holder may be supported by any suitable means embodied in or separate from a container forming machine. It will be noted, especially in Figure 1, that the upper surface of the curling plate or holder 37 is provided with an annular arcuate groove 39 to accommodate a portion of the ultimate rolled rim bead on the container, and to guide the first turned-over edge portion of the container during the formation of this rim bead, so that a proper roll is formed.

In operation, the structure above described is exceedingly rapid and accurate. The container is first mounted in the curling ring or holder 37, as indicated in Figure 1, with the upper edge portion 40 of the container projecting above the holder. Then, the shank 1 together with the apparatus supported thereby is moved towards the container or, if so desired, the container may be moved towards the shank 1. When such relative movement occurs, the auxiliary clamp plate 31 first engages the inside of the container and as the spring 36 is compressed, the main clamp 28 engages the inside of the container. Thus, with the aid of the compression spring 30, the container is positively held between the clamps 28 and 31 on the inside and the curling ring or holder 37 on the outside. The upper edge of the container is next engaged by the sloping wall of the curling ring 20, and when the relative movement occurs between the shaft 6 and the shank 1, a distance limited by the slot 7, the curling ring is contracted by virtue of the spreaders 16 following the slope of the T-slot 15 in the cam ring 13. The upper edge of the container is therefore caused to follow the arcuate groove 21 of the curling ring and the contour of the groove 39 in the container holder to form the tightly rolled rim bead 41 seen in Figure 2.

It will be especially noted that as the rim bead is rolled, the curling iron both contracts and moves axially with respect to the container, so that the curling iron follows the taper of the container wall exactly to provide a rim bead in tight association with the container wall and of such character as not only to provide a neat drinking rim for the container but also to rigidify and strengthen the container as a whole. It will further be noted that by the simple expedient of merely changing the face angles on the respective parts, a container of substantially any taper may be provided with a rim bead with the present invention. The illustrated container, for example, has an angle of approximately 40 degrees between opposed elements of the container.

In Figure 2, the structure is shown at the finish of the curling operation and, with reference to Figure 3, it will be noted that the curling iron is in substantially complete contact entirely around the rim bead 41. In other words, there is substantially complete and uniform contact of the curling iron with the container edge all through the curling operation, thereby giving a smoother, more uniform, and more satisfactory rolled edge.

When the curling mechanism is withdrawn from the container, the parts tend to assume the position seen in Figure 1. However, by virtue of the spring 36, the auxiliary clamp plate 31 is last to release its clamping engagement with the container, thereby insuring a positive freeing of the container from the clamp 28 so that the container will remain in its holder 37 and not tend

to adhere and follow along with the inside clamping mechanism.

It will be appreciated that the entire curling operation need require only a fraction of a second, and the operation may be repeated just as fast as containers may be removed from and inserted in the holder 37.

In Figures 4 and 5, I have illustrated a curling apparatus adapted for use in a container forming machine, a curling operation taking place contemporaneously with the completion of the shaping of a container around a forming mandrel. By way of example, as is the case with all of the other disclosed modifications of my invention, I have illustrated the curling of a rim bead on a conical paper drinking cup having a relatively wide taper.

In this instance, there is shown a spindle 42 carrying on one end a container forming mandrel 43. During the curling operation, the spindle and mandrel do not rotate about their common axis, but the mechanism carrying the curling iron may rotate relatively to the spindle and mandrel. Disposed about the spindle above the mandrel is an outer shell in the form of a pulley 44 so mounted as to permit relative axial movement between the spindle and the pulley. The hub of the pulley is recessed to accommodate a cyclop bearing 45 permitting sliding between the pulley and the spindle. Above the bearing, the pulley carries a flanged collar 46 which may abut a collar 47 fixed to the spindle, thus limiting the axial slope of the pulley and curling apparatus. Below the bearing, the hub of the pulley is provided with a depending sleeve 48, and circumscribing and freely floating on this sleeve is a recessed cam ring 49. The cam ring 49 rests upon the upper part of a ball race 50, and the lower part of the ball race is attached to the end of the mandrel 43. The outer face of the cam ring 49 is tapered, as indicated at 51, in keeping with the taper of the container wall to be acted upon.

In this instance, a plurality of ring spreaders 52 is also provided, six being shown by way of example, although any feasible number, depending upon the size of the apparatus, may be used. Each curling iron spreader is provided with a pair of spaced arms 53 pivoted as at 54 to one of the spokes 55 of the pulley. The spreaders are thereby suspended from the pivot connection 54. Each spreader is also provided with a hump 56 adjacent its lower end to ride the tapering outside surface of the cam ring 49, and the spreaders are urged into contact with the cam ring at all times by a circumscribing spring 57 seated in a suitable recess in each spreader.

A curling iron 20, of the same character as previously described in connection with Figures 1, 2 and 3, is in this instance carried by the spreaders, a key-supporting element 58 being in engagement with the curling iron and attached to each spreader. A spring 59 disposed between the pulley hub and the bottom of the recess in the cam ring 49 constantly urges the pulley away from the cam ring, thus tending to maintain the curling iron in expanded position. This spring can only act, of course, until the flanged sleeve 46 abuts the limiting collar 47 on the mandrel shaft.

In operation, any desired means, not shown in the drawings, may be used both to rotate the pulley 44 and move the pulley towards the mandrel against the action of the spring 59. When the pulley rotates, the spreaders 52, cam ring

49, and curling iron 20 will obviously rotate with the pulley. The cup 38 being worked upon is held clamped rigidly in position by the mandrel 43 and a curling plate or cup holder 37 of the character previously described. By virtue of the spring 51, the curling iron is contracted as it enters the cup in exact keeping with the taper of the cup wall, so that a rolled rim bead 41 is provided.

After the formation of the rim bead, the pulley is released, and the spring 59 urges it along the shaft 42 away from the mandrel, causing the spreaders to expand the curling iron to full position for another operation on a new cup. The space between the ends of the curling iron is so small as to cause no interference whatever with the relative rotation between the curling iron and the cup, so that the rim bead is not only smoothly and positively curled downwardly along the sloping wall of the cup, but is additionally circumferentially ironed.

In that embodiment of the invention illustrated in Figures 6, 7 and 8, provision is made for the container being worked upon to rotate relatively to the curling iron. In this embodiment of the invention, a spindle 60 is provided to which the hub of a supporting spider 61 is keyed or otherwise rigidly secured, as indicated at 62. The radially extending legs 63 of the spider 61 are arranged in pairs, with a slot or other opening 64 between the legs of each pair, as seen best in Figure 7. In this instance, four pairs of legs are shown, although, as explained above, any feasible number may be used, depending upon the size of the apparatus.

A plurality of curling iron spreaders 65 are provided, each of which has a bifurcated upper portion 66. This bifurcated portion is disposed within the slot 64 between a pair of spider legs 63-63, as seen best in Figure 8. The spreader 65 is held in position by a pair of radially aligned links 67, each of which is pivoted at one end, as at 68, to the spider legs, and is pivotally connected at the other end, as at 69, to the bifurcated portion of a spreader. It will therefore be apparent that each spreader may move in an oblique direction which is a combination of vertical and radial movements by swinging on its respective links.

The same character of curling iron, in the nature of a split ring 20, as previously described, is carried by the spreaders 65, each spreader carrying a key element 70 engaged in the slot 22 of the curling iron. Each curling iron also carries a depending cam rider portion 71 which engages an inside cam face 72 of a cam ring 73 (Figure 6). The cam ring is carried by the spindle 60 but is arranged for slidable movement axially of the spindle. This slidable movement or stroke of the cam ring is limited by the bottom of a recess 74 in the lower portion of the cam ring and a collar 75 on the lower end of the spindle. Above the cam ring 73, a socketed bushing 76 is keyed to the spindle, as indicated at 77, and carries a plurality of sockets for the reception of a series of compression springs 78, each of which has one end embedded in a socket in the bushing 76 and the other end in a similar socket in one of the spreaders 65. These springs constantly urge the spreaders upwardly over the inclined cam surfaces 72 of the cam ring, thereby tending to force the cam ring downwardly along the spindle until the collar 75 engages the bottom of the recess 74 opposite to the position shown in Figure 6. Of course, when the spread-

ers are in the uppermost position relatively to the cam surface 72, the curling iron is fully expanded ready to begin an operation upon the upper edge portion of the container 38.

A cup holding clamp 79 is freely disposed below the cam ring 73 and is held in position by a supporting plate 80 bolted or otherwise secured to the bottom of the cam ring. Between the clamp 79 and the cam ring is a ball race 81 which permits relative rotation between the clamp and the cam ring.

In this instance, a somewhat differently shaped cup holder or outside cup support 82 is provided. This cup holder has an annular groove in its upper face of the same character as the previously described outside cup holder to aid in the formation of the rolled rim bead. However, the cup holder 82 may be mounted or associated with a mechanism for rotating or spinning the cup holder during the process of curling the edge of the cup.

In operation, it may be presumed that the spindle, spreaders, curling iron, and cam ring may be non-rotating relatively to the axis of the spindle. It will be appreciated that when the clamp 79 is brought into contact with the inside of the cup 38, the clamp and cam ring will be in the lowermost position with the collar 75 on the spindle contacting the bottom of the recess 74. Consequently, as the axial pressure between the cup and clamp 79 is increased, the cam ring will slide up the spindle to the position shown in Figure 6, which is the completion of the formation of the rim bead 41. The curling iron 20 will, of course, follow the taper of the cup wall in the manner previously described during the formation of the rim bead by virtue of the portions 71 of the spreaders 65 riding the cam surface 72.

During the formation of the rim bead, the cup holder 82 together with the cup may be spinning. When contact is made with the inside of the cup by the clamp 79, this clamp may also spin or rotate with the cup by virtue of the ball race 81. The rim bead 41 is rolled tightly, in keeping with the taper of the cup, smoothly and very rapidly, as set forth above.

That modification illustrated in Figures 9 and 10 is similar in operation to the structure just above described in connection with Figures 6, 7 and 8, in that the external cup holder 82, the cup and the inner clamping ring may rotate relatively to the remainder of the structure while the rim bead is being curled or rolled. The main difference between the showing in Figures 6, 7 and 8 and the showing in Figures 9 and 10 is that the curling iron spreader elements move only radially in T-slots of the character illustrated in Figures 1, 2 and 3. The T-slots of Figures 9 and 10 are disposed horizontally, while the T-slots of Figures 1, 2 and 3 are disposed obliquely, but otherwise the structure of the slots and T-tongues riding in the slots is the same.

Referring now to Figures 9 and 10, there is shown a spindle 83 carrying a relatively large flange 84 and a circular supporting plate 85, with a key-slot arrangement 86 on the under-surface of the supporting plate. In this instance, there are shown four T-slot arrangements equal distances apart, each to accommodate a curling iron spreader. As stated above, there may be as many curling iron spreaders as deemed feasible consistent with the size of the apparatus.

A curling iron spreader 87, provided with a T-tongue 88 for slidable movement in the aforesaid

slot arrangement 86, is associated with each of the slot arrangements. Each spreader 87 is provided with a depending rider portion 89 for slidable engagement with a cam surface 90 on a cam ring 91 slidably disposed on the spindle 83. The stroke of the cam ring relatively to the spindle 83 is limited by the bottom of a recess 92 in the lower portion of the cam ring and a collar 93 carried on the lower end of the spindle. The spreaders 87 carry the split ring curling iron 20 by means of a key plate 94 bolted or otherwise secured to the spreader, as described in connection with Figures 6, 7 and 8. This ring is of the same character as above described and functions in the same way. Between the lower cylindrical portion 95 of the cam ring, outside the recess 92, and an inside clamping member 96 is a ball race 97 which permits rotative movement of the inside clamp 96 relatively to the cam ring.

A cup holder associated with rotative mechanism engages the outside surface of the cup, as described in connection with Figure 6. The body portion of the spindle 83 is provided with a series of recesses, each to accommodate one end of a compression spring 98, the other end of each compression spring being embedded in a recess in its respective spreader 87. These springs constantly urge the spreaders outwardly along the T-slots against the cam surfaces 90 on the cam ring 91, thereby urging the cam ring downwardly relatively to the spindle until the collar 93 contacts the bottom of the recess 92. At that time, the curling iron is in fully expanded position ready to begin a curling operation.

The operation of the structure shown in Figures 9 and 10 is substantially similar to that of Figures 6, 7 and 8, the clamp 96 first contacting the inside of the cup and pressing the cup between itself and the outside holder 82. With the outside holder 82 rotating, the clamp 96 may rotate along with it by virtue of the ball race 97. As the curling iron enters the cup, forming the rim bead 41, the cam ring 91 gradually rises on the spindle 83 until it reaches the position seen in Figure 9 at the completion of the curling operation.

The novel method embodied in the present invention is believed to be sufficiently apparent from the foregoing description of the several modifications of the apparatus. It will suffice, therefore, to merely add that one of the important steps of the method is the use of a split ring curling iron and the gradual contraction of the curling iron as it enters the cup, such gradual contraction being an oblique movement which is the resultant of a radial and longitudinal movement of the curling iron relatively to the cup, so that the curling iron is caused to follow the taper of the cup wall.

From the foregoing, it is apparent that I have provided a novel apparatus and a novel method for curling a rim bead on a paper container or the like, the invention being especially desirable for use in connection with a container having a wide angled taper in the walls. It will further be apparent that the rim bead is provided by virtue of a substantially complete, uninterrupted contact of the curling iron with the edge of the container, so that a tightly rolled and smooth rim bead will be provided. The apparatus is readily adaptable for use either within or without a cup making machine, and it will be noted that the curling iron may rotate relatively to the cup being worked upon, the cup may rotate relatively to the curling iron, or both may rotate

relatively to each other, the apparatus being readily adaptable for the accomplishment of any of these purposes without varying the main principles of the invention.

It will, of course, be understood that numerous details of construction may be varied through a wide range without departing from the principles of this invention, and it is therefore not the purpose to limit the patent granted hereon otherwise than is necessitated by the scope of the appended claims.

I claim as my invention:

1. In apparatus for curling the edge portion of a container, a container holder, a supporting member, means carried by said member for disposition inside a container to clamp the container against said holder, a curling iron in the nature of a split ring carried by said member for contacting and rolling the edge portion of the container upon relative axial movement between said holder and said member, a cam element carried by said member, spreader elements also carried by said member and engaged with the curling iron, said spreader elements being positioned to follow said cam element, and resilient means tending to urge said spreader elements to expand said curling iron, said spreader elements following said cam element to contract said curling iron upon relative movement towards each other between the holder and supporting member to form a curled rim bead on the container.

2. In apparatus of the character described, a container holder in which a container may seat, a supporting shaft, a main clamping element carried by the shaft for entering the container and clamping it against the holder, an auxiliary clamp carried by and spring-urged away from the main clamping element to insure separation of the container and main clamping element after a curling operation on the edge portion of a container, a cam member on said shaft, spring means tending to maintain the main clamping element and said cam member separated, an outer shell carried by said shaft, spreader elements carried by said shell and movable radially relatively thereto, spring means urging said cam into engagement with said spreader elements in a manner to hold said elements in outermost position, and a single-piece split-ring curling iron carried by said spreader elements, said shaft being slidably associated with said main clamping elements and said outer shell to insure a firm holding of the cup and cause said spreader elements to follow the cam and move inwardly to contract said curling iron against the action of said spring means when acting on the edge portion of a container.

3. In curling apparatus of the character described, a shaft, a container forming mandrel on said shaft, a container holder engageable around a container on said mandrel, a pulley rotatable and slidable with respect to said shaft, a cam element adjacent the hub of said pulley and rotatable relatively to said shaft, a bearing between the cam element and the mandrel to permit relative rotation of the cam element, spring means urging the cam element and pulley hub apart longitudinally of the shaft, spreader elements pivoted to ride the surface of the cam element, means maintaining contact between the spreader elements and cam element, and a split ring curling iron carried by said spreader elements and expansible and contractable as the

spreader elements ride the surface of the cam element.

4. In a curling apparatus of the character described, a holder in which a container may be seated, a shaft, an inside container clamp carried by the shaft, a cam member on said shaft, a spider on said shaft, spreaders arranged to ride the cam surface of the cam member, links pivoted both to the spider legs and the spreaders to support and permit radial movement of the spreaders, resilient means urging the spreaders to ride the cam member to outermost position, a split-ring curling iron carried by the spreaders, and bearing means associated with said inside clamp to permit relative rotation between the inside clamp and the shaft and other structure carried thereby, said spreaders being forced to follow said cam member against the action of said resilient means and contract said curling iron during a curling operation on the container.

5. In a curling apparatus of the character described, a holder in which a container may be seated, a shaft, an inside container clamp, a cam member on the shaft, bearing means between the cam member and inside clamp to permit relative rotation therebetween, a supporting member, a plurality of spreader elements carried by the supporting member in a manner to permit only relative radial sliding movement of the spreader elements, means on said spreader elements to ride said cam member, spring means between the spreader elements and shaft urging the spreader elements against the cam member and therealong to outermost position, means to limit the movement of said spreader elements, and a split-ring curling iron carried by said spreader elements and contractable as said elements ride said cam member against the action of said spring means when the container and curling iron are forcibly brought together.

6. Apparatus for curling the edge portion of a container, including a single-piece split-ring curling iron for engagement with the container and which is variable in size in keeping with variations in size of the container wall.

7. Apparatus for curling the edge portion of a container, including a single-piece split-ring curling iron for engagement with the container, and supporting means arranged to carry said curling iron and progressively contract the iron during its curling action on the container.

8. Apparatus for curling the edge portion of a container, including a single piece expansible and contractable curling iron of such size as to establish substantially uniform and complete contact entirely around the edge of the container.

9. Apparatus for curling the edge portion of a container, including a single piece expansible and contractable curling iron of such size as to establish substantially uniform and complete contact entirely around the edge of the container, and mechanism arranged to carry and control the expansion and contraction of the curling iron during operation.

10. Apparatus for curling the edge portion of a container having a tapering wall, including an integral expansible and contractable curling iron of such size as to establish substantially uniform and complete contact entirely around the edge of the container.

11. Apparatus for curling the edge portion of a container having a tapering wall, including an integral expansible and contractable curling iron for engagement with the edge of the container and relative travel along the container wall during the curling operation, and supporting means carrying said curling iron and arranged to progressively contract the curling iron in keeping with the taper of the container wall during the curling operation.

12. In apparatus for curling the edge portion of a container, an expansible and contractable curling iron in the nature of a single-piece split ring having a groove therein, one wall of the groove being disposed at the same angle as the container wall and the remainder being complementary to the desired shape of the resultant curled portion of the container.

13. In apparatus for curling the edge of a container, supporting means, a clamp carried by the supporting means for entering and engaging the inside wall of the container, curling means carried by said supporting means, and bearing means associated with said supporting means to permit relative rotation between the clamp and curling means.

14. In apparatus for curling the edge portion of a container having a tapering wall, including a holder for a container, supporting means, said holder and means being arranged for relative axial movement, an expansible and contractable curling iron in the form of a single-piece split ring carried by said supporting means, spreader elements engaged with said curling iron to control its expansion and contraction, and cam means carried by said supporting means and in engagement with said spreader elements in a manner to cause progressive contraction of the curling iron in keeping with the taper of the container wall during the curling operation.

15. In combination with apparatus for curling the edge portion of a container having a tapering wall, an expansible and contractable curling member in the form of an integral split ring.

16. The method of curling the edge portion of a container having a tapering wall, including the step of applying pressure substantially uniformly and completely around the edge portion of the container and of sufficient degree to curl said edge portion, and progressively contracting the area of pressure application in keeping with the taper of the container wall while establishing relative rotation between the applied pressure and the edge portion of the container.

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