METHOD AND APPARATUS FOR DOUBLE SEAMING

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This invention relates to can closing equipment and more particularly it relates to a method and apparatus for forming a double seam joint between can ends and can bodies.

In the field of can closing by seaming a can end to a can body, the term "double seaming" is used to denote a two-step closing operation in which a "first" step forms a partial seam by bending the end skirt and the body flange into engagement, and a "second" step forms the finished seam by flattening the partial seam into a tightly formed end seam.

Generally, it is the practice in the canning industry to fill the cans at a filling machine and to introduce the filled cans into the double seaming apparatus, to prevent spillage of the fluid contents of the filled cans. It is preferable to feed the filled cans linearly, i.e., in a straight line, into the seaming apparatus and to then register an end with each can prior to the seaming operations. In the double seamer, a plurality of rotatable support pads are equally radially spaced from a vertical shaft which defines the central axis of the machine. As each filled can and its associated end enters the double seamer, they are placed upon a spring loaded driving support pad and clamped down by a driving clutch. As the double seamer operates, all of the clamped cans and ends are revolved about the central axis of the machine, and simultaneously each can and end is rotated or spun about its own axis by the driving clutch. As used herein, the term "revolving" connotes rotary movement of a can about the central vertical axis of the double seamer, and the term "rotation" connotes rotary movement of a can about its own vertical axis.

During revolution, two seaming devices come into contact with each can to effect the first and second seaming operations. Each seaming device engages the can end skirt and the can body flange and the rotation of the can and end while in engagement between the seaming device causes the seam to be effected. When both the first and the second seaming operations are completed, the can end has been joined to the can body by a double seam, and the closed can is subsequently discharged from the double seamer. The seaming device can be of two general types; either the stationary type known as a "seaming roll" and typified by U.S. Patent No. 1,104,751, issued to F. Wegner, or the rotary type known as a "seaming roller" and typified by U.S. Patent No. 1,398,018, issued to H. G. Hill.

In the past, most double seamers have employed seaming rollers to perform each of the two seaming operations. In order to move such seaming rollers into engagement with the cans to be seamed, it has been necessary to utilize complicated camming arrangements, as illustrated in U.S. Patent No. 1,183,654 issued to L. C. Krummel, or pivotally mounted rollers with operating fingers, as illustrated in U.S. Patent No. 1,474,173, issued to H. T. Small. While such seaming rollers form excellent double seams, the apparatus needed to operate the seaming rollers often unduly complicates the double seamer machine and impedes the high speed operation of the machine. Accordingly, in recent years, designers of double seamers have sought to replace the complicated seaming rollers. Recent patents such as U.S. Patent No. 2,727,481, issued to E. Laxo and U.S. Patent No. 2,975,740, issued to C. J. Smith et al., illustrate and describe the use of two seaming rails, one for performing each seaming operation.

While there can be no question that the use of seaming rails in lieu of seaming rollers provides a far simpler construction of the double seamer machine, it has been found that the double seam produced by a twin rail double seamer are not folded tightly enough and are far more susceptible to failure. In the first place, it is necessary for each can to rotate about its own axis at least once plus some small amount of overlap during engagement with each of the seaming devices, and since modern double seamers perform both seaming operations within one revolution of the double seamer machine or 360°, the angle subtended by each seaming rail must necessarily be somewhat less than one half a revolution or 180°. Since all seaming must take place along a rail extending over an arc of less than 180°, the number of times a can may rotate about its own axis is necessarily limited, but yet must be at least one complete rotation plus an overlap. The previously mentioned Smith et al. Patent 2,975,740, for example, discloses that 3/4 can rotations take place while in engagement with each seaming rail. In actual practice, it has been found that the double seam produced by such a minimal number of rotations is not folded tightly enough and is susceptible to leakage. Furthermore, and far more serious a problem, rail type seamers cause the metal at the end seam to be cold worked. Since the seaming rail is stationary and the can rotates with respect to it, the metal at the seam area of the can is caused to "flow" ahead of the seaming operation. Actually this "flow" takes the form of metal at the end seam being folded over upon itself in a microscopic fashion and although such folding is hardly visible to the naked eye, it still structurally weakens the metal of the end seam. Moreover, when such folding occurs during engagement with the first seaming rail, subsequent engagement with the second seaming rail tends to aggravate and accentuate the problem by increasing the folding.

It is therefore an object of the present invention to overcome the problems and difficulties encountered in prior art double seamers.

Another object of this invention is to provide an improved method of double seaming a can end onto a can body.

Another object of this invention is to provide a double seaming method which forms effective, tightly sealed end seams without folding over or otherwise adversely working the metal at the end seams.

Another object of this invention is to provide an improved double seamer for seaming cans onto can bodies.

Another object of this invention is to provide a high capacity, fully automatic apparatus of simplified construction which will satisfactorily seal cans onto bodies without folding over or otherwise adversely working the metal at the end seams.

Another object of this invention is to provide a double seaming method and apparatus wherein a set of seaming rollers and their associated operating mechanisms can be eliminated during one seaming operation.

Another object of this invention is to provide a double seaming method and apparatus wherein the foregoing objects can be carried out during a single revolution of the machine.

Another object of this invention is to provide a double seamer which utilizes an improved form of seaming roller,

Numerous other objects, advantages, and features will be apparent as it is better understood from the following description which, taken in connection with the ac-
comprising drawings, discloses a preferred embodiment thereof.

The foregoing objects are attained by providing a double seamer wherein the first seaming operation is performed by a seaming roll and the second seaming operation is performed by a seaming roller. Can bodies are automatically introduced into the double seamer and deposited upon support pads radially stationed around the central axis of the machine. Can ends are also automatically introduced into the machine when associated can bodies are present, and these ends are registered with the can bodies and held thereon by driving chucks located above the support pads. As the double seamer operates, it revolves the cans about its central axis and simultaneously, each driving chuck and support pad rotates a can and its associated end about its own axis. As the revolution and rotation are occurring, each can contacts a seaming roll designed to occupy less than one quadrant (i.e., less than 90 degrees of the 360 degrees which are traversed in one complete revolution of the double seamer). The contact between the seaming roll and the rotating can causes a partial seam to be effected. As each partially seamed can is revolved beyond the seaming roll, a cam-operated seaming roller pivots into engagement with it, and the contact between the seaming roller and the rotating can causes a finished seam to be effected. Subsequently, the double seamed can is ejected from the machine. The entire foregoing operation, from introduction of an opened end can body to ejection of that can body with an end double seamed thereto, takes place in less than 360 degrees or one complete revolution of the double seamer.

Referring to the drawings:

FIGURE 1 is a plan view of a double seamer in accordance with the present invention;

FIG. 2 is a front elevational view of the double seamer illustrated in FIG. 1;

FIG. 3 is a sectional view taken along line 3—3 of FIG. 1;

FIG. 4 is a sectional view taken along line 4—4 of FIG. 3;

FIG. 5 is a sectional view taken along line 5—5 of FIG. 3;

FIG. 6 is a fragmentary sectional view illustrating a can before the double seaming operation occurs;

FIG. 7 is a fragmentary sectional view illustrating a can undergoing the first seaming operation;

FIG. 8 is a fragmentary sectional view illustrating a can undergoing the second seaming operation;

FIG. 9 is a sectional view of the can end feeding mechanism taken along line 9—9 of FIG. 1 and showing the mechanism in a feed position;

FIG. 10 is a sectional view of the can end feeding mechanism, similar to FIG. 9, but showing the mechanism in a no-feed position;

FIG. 11 is a plan view of the can end feeding mechanism taken along line 11—11 of FIG. 10;

FIG. 12 is a sectional view taken along line 12—12 of FIG. 3;

FIG. 13 is a perspective view of a seaming roller in accordance with the present invention;

FIG. 14 is a fragmentary transverse sectional view of the seaming roller of FIG. 13 mounted within its associated bearings; and

FIG. 15 is an end view of a no can-no cover detector device taken along line 15—15 of FIG. 2.

As a preferred or exemplary form of the present invention, FIGS. 1 and 2 illustrate a double seamer apparatus in accordance with the present invention and generally designated 30. The apparatus has a main frame and base assembly 32, a cover or upper assembly generally designated 34, a can feeding assembly generally designated 36, a cover feeding assembly generally designated 38, and a can ejecting assembly generally designated 40. The apparatus is operated by a main driving motor (not shown) which operates main drive gears 42, 44 which in turn operate the double seamer shaft and sleeve gearing 46, 48 as seen generally in FIG. 1 and in greater detail in FIG. 3.

An auxiliary gear drive unit 50, as illustrated generally in FIGS. 1 and 2, is used to drive a feed chain to introduce cans into the double seamer, as will be presently described. The gear drive 50 is driven by a gear 52 which is in turn driven by the transfer turret gear 54. The transfer turret gear 54 itself is operated by the gear 58 which also operates the ejection turret gear 60. The gear 54 also operates a cover feed turret gear 56.

In order to understand the present invention more fully, its general operation will now be described and its component parts will be described in greater detail hereinafter. As can be seen from FIGS. 1, 2 and 4, a plurality of cans 62 are fed into the machine 30 by the can feeding assembly 38 which includes a chain feed 64 with projecting fingers 66 extending between each feeding can 62 and toward an opposed guide rail 67. The chain feed 64 is operated by the gear drive 50, as previously described. As the fingers feed the cans 62 linearly into the machine, the cover feeding assembly 38 feeds can ends or closures 68 to mate with the cans. As shown in FIG. 4, the ends 68 are fed between guide rails 70 and a cover feed turret 72 which in turn operates feed pins 74 spaced about its periphery. An end 68 is engaged between each pair of feed pins 74 and is fed into a pocket 76 of a transfer turret 78 which continues carrying the end between the guide rails 70 and finally locates it over an infeed can 62. The cover feed turret 72 and the transfer turret 78 are operated respectively by gears 56 and 54.

As an infeeding can 62 and an infeeding end 68 come into superposed alignment, the can feeds into a pocket 80 on the periphery of a central turret 82 and simultaneously a chuck unit, to be described presently, is operated to drive the end into the can end to spin or rotate the can about its own axis while it synchronously revolves about the main shaft 86 of the machine 30. As the central turret 82 revolves, the can is fed past a seaming roll 88 which engages the rotating and revolving can and end and performs the first seaming operation. A cam rail 90 is provided outside the seaming roll 88 in the direction of revolution, and both the seaming roll and can rail are affixed to the upper assembly 34. Movable seaming rollers, as will be later described, are operated by the cam rail 90 to engage the revolving can and end to effect the second seaming operation and to thus provide a tightly double seamed can. Simultaneously, the double seamed cans are fed into the can ejecting assembly 40 which includes an ejecting turret 92 with peripheral pockets 94. The ejecting assembly also includes an arcuate rail portion 96 with a terminal finger portion 98. The ejecting turret 92 is driven by the gear 60 in opposition to the direction of the central turret 82 with the result that, as the double seamed cans reach the finger portion 98, they are transferred out of the pockets 80 of the central turret 82 and into the pockets 94 of the ejecting turret 92 which in turn moves the cans around the arcuate rail portion 96 and ejects them between guide rails 100.

The seaming roller assembly which performs the second seaming operation is generally designated 102 and is illustrated in FIG. 13 wherein it can be seen that the assembly is comprised of a body portion and a shaft portion. The body portion includes three interconnected stepped portions 104, 106 and 108. The stepped portions 104, 106 and 108 are formed respectively within the stepped portions 104 and 108. A roller 114, hereinafter denoted the lower roller, is rotatably mounted within the slot 110 at one end of the stepped portion 104. At the other end of the stepped portion 104, a seaming roller 116 can be rotatably mounted. The seaming roller 116 is pivot illustrated in the assembly of FIG. 13, since it is not a fixed part thereof, but rather, it can be interchanged as desired since the size of the seaming roller employed may be varied to accom-
modate cans of varying diameter. A roller 118, herein-after denoted the intermediate roller, is rotatably mounted centrally within the slot 112. The stepped portion 106 is provided with a central aperture through which the shaft portion of assembly 102 extends. As can be seen in FIG. 13 and also in FIG. 14, the shaft portion includes a shaft 129, locked to the body portion by a locking bolt 130 and a sleeve 124 surrounding the shaft, said sleeve commencing slightly above the stepped portion 106 and terminating upward into a wing 126, which is shown turned 90° counterclockwise from its actual position, for ease of illustration. A roller 128, herein denoted the upper roller, is rotatably mounted on the intermediate roller side of the wing 126. The axis of the upper roller 128 is normal to the axes of the intermediate and lower rollers, 118 and 114, respectively.

Referring now to FIG. 3 for a more detailed description of the apparatus of the present invention, it will be seen the main drive shaft 86 of the machine is provided at its lower end with a driving gear 46 and is journaled at its upper end within a bearing chamber 139 formed in the upper assembly 34. A gear 132 is keyed to the shaft 86 near its middle portion and an identical gear 135 is keyed to the shaft near its upper portion, the purpose of these gears to be described shortly. Surrounding the shaft 86 at its lower end is a sleeve 134 to which the sleeve drive gear 48 is keyed. It will be noted that the shaft and sleeve drive gears 46 and 48 are operated respectively by the main drive gears 42 and 44 which are affixed to a shaft 136 which is operatively connected to the main driving motor (not shown). It will also be noted that the shaft drive gear 46 is slightly smaller than the sleeve drive gear 48 so that, in operation, the shaft will rotate faster than the sleeve, thus ensuring that the driving chucks and support pads which are operated by the shaft will rotate more times than the central turret 82 which is operated by the sleeve, thereby effectuating a more firm and more effective double seam. A shaft to sleeve ratio of 1.25:1 is preferable. However, the size of the gears 46 and 48 can be varied to provide different ratios and to accommodate different can sizes.

A drive gear 59 is keyed to the sleeve 134 adjacent the gear 48 and is surrounded by a bearing 140 extending from the machine frame 32. The drive gear 59 will be discussed in greater detail hereinafter in connection with the cover feeding assembly 38. After the gear 134 passes through an opening in the frame 32, the central turret 82 is keyed to the sleeve 134 for rotation therewith. The central turret 82 is manufactured as a two-part item, with a cavity 142 being formed between the upper part 82a and the lower part 82b, the gear 132 being located within the cavity. When the infeeding cans 62 are received in the pockets 80 of the central turret 82, they are deposited upon support pads 144, one of which is located beneath each pocket 80. Each support pad 144 has a depending stem 146 which extends downward and partially into the cavity 142. A pad driving pinion 148 is attached to the lower end of each stem 146 and each of these pinions 148 mates with the gear 132. Each support pad 144 is spring biased upward by means of spring 150 acting against the pinion 148 or the stem 146, or both. A bias adjustment means 152 can be used to vary the amount of spring bias exerted on the support pads. In operation, rotation of the sleeve 134 causes the support pads 144 and their associated mechanism to revolve about the central axis of the machine, as defined by the vertical axis of the shaft 86. Simultaneously, rotation of the shaft 86 causes the gear 132 to drive the pinions 148 to spin or rotate each support pad 144 about its own axis, as defined by the vertical axis of the stem 146. The mating relation between the gear 132 and the pinions 148 can be seen in greater detail in FIG. 4.

Located above each pocket 80 of the central turret 82, as can be seen from FIG. 3, is a driving chuck 154 to which an upwardly extending stem 156 is affixed. The stem 156 passes through a chuck bearing 158 and at the upper end of the stem, a chuck driving pinion 160 is attached. Each of the chuck driving pinions 160 mates with the gear 138. Each of the chuck bearings 158 is keyed at 162 to the central turret 82, as can be seen in FIG. 5 and also in FIG. 5. It will be obvious that rotation of the gear 138 causes the pinions 160 to rotate or spin around their own axes and to thus rotate or drive the chucks 154.

However, it will be noted from FIG. 4 that the chucks 154 are reciprocable and are not in their lowered or can engaging position throughout the entire machine 30. Rather, the chucks 154 lower at the point where a can 62 enters a pocket 89 of the central turret 82. At this same point, the transfer turret 78 has located an end 68 over the can 62. Lowering of the chuck 154 drives the end 68 into the can 62 as may be seen in FIG. 6. When the can and end reach the ejecting assembly 40, the chuck 154 is raised. This selective reciprocating or raising and lowering of the chucks 154 will be accomplished by a cam rail arrangement as shown in FIG. 3. This arrangement includes an upper cam rail 164 formed on a depending portion 166 of the top 168 of the upper assembly 34. An upper extension 170 of each of the bearings 158 is provided with a pair of cam follower rollers 172 and 174 which respectively engage the upper and lower surfaces of the upper cam rail 164. When the upper cam rail 164 raises the upper extension 170 to the position shown in dashed lines on the left of FIG. 3, the chuck 154 is raised out of engagement with the can and end in the turret pocket 80. FIG. 12 further illustrates the engagement of the cam follower rollers 172 and 174 and the upper cam rail 164.

The seaming roller assemblies 102 are mounted within the machine 30 by means of bearings affixed to the central turret 82. One such bearing 176 surrounds each seaming roller sleeve 124 and another such bearing 178 surrounds the seaming roller shaft 120, as can be seen in FIG. 3 and in FIG. 14. It will be apparent from an examination of FIGS. 3 and 4 that the seaming roller assemblies 102 must be reciprocably mounted so that they may be raised for passage over the seaming rail 88 in the central turret 82 rotates. To permit such reciprocation, the seaming roller sleeves 124 and the shaft 120 must be reciprocable respectively within the bearing sleeves 176 and 178. To accomplish such reciprocation, a cammed groove 180 is provided beneath an annular shoulder 182 of the upper assembly 34. The upper roller 128 of the seaming roller assembly rides within the cammed groove 180 and the seaming roller wing 126 rides along the inner face 184 of the cammed groove, as can be seen in FIGS. 3 and 12. The low position of the cammed groove 180 is shown at the left of FIG. 3 whereat it can be seen that the seaming roller 116 is engaging the double seam 186 of a can. The high position of the cammed groove is shown at the right of FIG. 3 wherein it can be seen that the seaming roller 116 is elevated above the seaming rail 88 which is engaging the can double seam.

To complete the description of the components housed within the upper assembly 34, it can be seen from FIG. 3 that the upper assembly has a depending skirt 188 which has mounted on its lower end the seaming rail 88 and the cam rail 90. A portion of the cam rail 90 is spring biased at 190, as can be seen on the left of FIG. 3 and in FIG. 4, and the purpose of this spring bias will be described presently. Also, an intermediate cam rail 192 is provided depending from the cammed groove 180 and mating with the intermediate roller 118 for operation of the seaming roller 116 in a manner as will be presently described.

With the foregoing components and their explanation in mind, it will now be possible to explain the operation of the double seamer, as the time a can enters the
pocket 80 of the central turret 82 until it is ejected into a pocket 94 of the ejecting turret 92 with a double seam 86 being formed thereon. As the can 62 enters the pocket 89 and an end 68 becomes aligned over it, the chuck 154 descends by virtue of the upper cam rail 164, to drive the end into the can, as shown in FIG. 6, and to lock the can and end between the chuck 154 and the support pad 144, as shown in FIG. 3. The main motor shaft 136 operates gearing 42, 44, 46, 48 to rotate the main machine shaft 86 and its surrounding sleeve 134.

Since the central turret 82 is attached to the sleeve 134, it also rotates and thus causes the can and end to be revolved about the central axis of the machine. Simultaneously, it gears 138 and 132, which are attached to the shaft 86, are rotating and respectively causing the pinions 160 and 148 to rotate, thus causing the can and end assembly to spin or rotate about its own axis. As was previously described, the shaft gear 46 is slightly smaller than the sleeve gear 48 thus causing the shaft 86 to rotate faster than the sleeve 134 and thereby creating a condition wherein the can and end assembly rotates faster than it revolves.

As the can and end is synchronously rotating and revolving, it is fed past the arcuate seating rail 88 as can be seen in FIGS. 3 and 7. As the can 62 and end 68 move past the seating rail, a partial double seam 186 is produced by the pressure and relative movement between the seam and the rail 88. As was described in the introduction, the length of the seating rail 88 is kept to a minimum to avoid “flow” of the metal in the seam area and it is preferred that the length of the seating rail be such that it occupies less than one quadrant (i.e., less than 90 degrees of the 360 degrees which are traversed in one complete revolution of the double seamer 30). But while the rail length must be less than 90 degrees, its actual length is determined by the circumference of the cans 62.

When the can and end move beyond the seating rail 88, a seating roller assembly 102 is pivoted into position to effect the second seating operation, as shown in FIGS. 3, 5 and 8. The seating roller assembly 102 has been raised over the seating rail 88 by means of the cammed groove 188, as previously described, and as the assembly passes beyond the seating rail, the cammed groove 188 lowers the assembly and a raised portion 194 on the can rail 90 engages the lower roller 114 to pivot the seating roller assembly 102 inward so the seating roller 116 engages the partially formed double seam 186. The pressure and the relative movement between the seating roller 116 and the rotating and revolving can produces a tightly folded finished double seam 186, as can be seen in FIG. 8. The rail 90 is spring biased at 190 to assure a tight engagement between the roller and the seam. The intermediate can rail 92 extends only partially around the machine 30, as can be seen in FIG. 5, and when the intermediate roller 118 comes into engagement with the can rail 92, the seating roller assembly 102 is pivoted outward and out of engagement with the double seam. When the seating roller has been pivoted out of engagement and has been raised, the double seamed can is transferred from the central turret 82 to the ejecting turret 92 and subsequently out of the machine.

Referring now to the details of the cover or end feeding assembly 38, FIG. 9 shows the cover feed turret drive gear 56 being operated by the gear 54, which in turn is driven by the cover feed drive gear 58 which is keyed to the machine sleeve 134 and thus driven by the sleeve gear 48. An internal gear 196 is affixed to the upper surface of the gear 56 and is simultaneously rotate therewith. A pinion 198 is driven by the internal gear 196 to rotate a shaft 200 having another pinion 202 at its upper end.

Other pinion 208 which rotates a cover feeding separator device 210 by means of a shaft 212. The separator device has a knife blade 214 which separates the lowermost end 68 from a stack of ends resting in a slanted stack guide 216. Beneath the knife blade 214 is a spiral slot 218 is provided for radially feeding the separated lowermost end 68 downward onto the guide rails 70 wherein it is engaged by a pin 74 on the feeding turret 72 to thus start feeding into the machine 30. The spiral slot 218 and its function is described in greater detail in U.S. Patent No. 2,750,919, issued to 226.

In order to assure proper functioning of the apparatus, it is necessary to interconnect the can feeding assembly 36 and the cover feeding assembly 38 so that if no can is present for one particular pocket, no cover will be fed to that pocket. This arrangement is illustrated in FIGS. 2A, 10, 11 and 15, and 16, and is known as a no-can-no-cover detector device. As can be seen in FIGS. 1 and 15, a rail 220 is normally forced outward beneath the guide rail 67 by cans 62. This rail, however, is normally biased inward by means of tension springs 222 acting on a crank 224 at the end of the rail 220. A link 226 is connected to the rail 220 and a rod 228 is connected to the link 226. The rod 228 is connected through a bell crank 230 to a control rod 232 which controls the feed of the covers 68, as can be seen in FIGS. 9 and 10. A cam follower 234 is attached to the end of the control rod 232 and is adapted to move a cammed groove 236 in the separator device 210 to or ride upon a cammed rail portion 238 at the outside edge of the groove 236. Due to the tension of the spiral spring, the rail 220 is normally biased inward into the path of the infeding cans 62. When a can 62 is present, it resists the bias of the cammed groove 236 in the separator device 210.

For simplicity of identification, this may be referred to as the "can present" position. When no can 62 is present, the rail 220 is free to move inward and consequently the link 226, rod 228, and crank 230 disconnect to move the control rod 232 to the position shown in FIG. 9 wherein the cam follower 234 on the end of the control rod rides upon the cammed rail portion 238. For simplicity of identification, this may be referred to as the "can absent" position.

A slide 240 surrounds the control rod 232 and is provided at its upper end with a pin 242 having a beveled area 243. When the control rod 232 is in the "can present" position of FIG. 9, the cam follower 234 rides upon the cammed rail portion 238 and thus causes the slide 240 to move upward at the high spot of the cammed rail. When the control 232 is in the "can absent" position of FIG. 10, the cam follower 234 rides within the groove 236 and the slide 240 is not raised. To permit the slide 240 to be raised by the cammed rail 236, the control rod 232 is specially connected to the bell crank 230 in such a manner that the rod 240 is free to rise and lower, yet is also free to be moved in and out by the crank. This special connection can best be seen in FIG. 11 and it takes the form of a spool 244 with a central groove 245 mounted on the outer end of the control rod and a pair of pins 246 offset from a rod 248 affixed to the bell crank 230. Thus, when the bell crank 230 rotates the rod 246, the pin 246 being located within the groove 245 tend to push upon the spool 244, thereby sliding the control rod 232 through the slide 240. When the cammed rail portion 238 acts upon the follower 234 to raise the slide 240 and control rod 232, the spool 244 can rise without moving either the pin 246 or the rod 248 and bell crank 230 connected to the pins.

As can be seen from FIG. 11, a pair of scissor jaws 250 and 252 are mounted above the cover feeding separator device 210. The scissor jaw 250 has a rearwardly extending finger 254 and a forwardly extending finger 256;
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similarly, the scissor jaw 252 has a rearwardly extending finger 258 and a forwardly extending finger 260. A pair of opposed spring-biased jaws 262 act on the rearwardly extending fingers to force them toward one another, but the slide pin 242 extends between the fingers to prevent them from closing completely. The forwardly extending fingers 256, 260 serve to mount respectively depending elements 264, 266 which taper inward at their lower end to support the lowermost cover 68 beneath its edges. When no can 62 is present, the cover feeding device 38 assumes the "can absent" position shown in FIGS. 10 and 11 and the cam follower 236 enters the groove 234, thus preventing the slide pin from rising. Accordingly, the pin 242 does not rise and the scissor jaws are not forced further open and therefore the depending elements 264, 266 stay in the position illustrated in FIG. 11 and no end 68 is released. If, however, a can 62 is present, the device assumes the "can present" position of FIG. 9 with the cam follower 236 riding upon the cammed rail portion 238. At the high spot of the cammed rail portion, the slide 240 and the attached pin 242 are raised upward and the beveled pin portion 243 causes the rearwardly extending fingers 254 and 256 to open or spread further apart. This opening of the scissor jaws causes the depending elements 264, 266 to move out from beneath the edges of the end 68 to thus allow the end to drop onto the guide rails 70 to be fed into the machine. The outward position of the depending elements 264, 266 is shown in dashed lines in FIG. 11.

It should be understood that the double seamer of the present invention is adaptable for use with cans of varying diameters and heights. As previously described, the seaming rollers 116 can be selectively changed to compensate for cans of various diameters. Also, the seaming roller 86 can be replaced to accommodate cans of varying diameter, or alternatively, the seaming roller 86 can be adjustable mounted to the upper assembly skirt 188 to allow it to be moved inward or outward in accordance with the can diameter. To allow the apparatus to accept cans of varying height, the entire upper assembly 34 is mounted on three spaced posts 270 as shown in FIGS. 1, 2 and 4. These posts are adjustable to enable the entire upper assembly to be raised and/or lowered to a height which will accommodate the height of the can being seamed.

The thickness or tightness of the double seam being produced may also be adjusted. The spring 190 which biases the cam rail 99 is integrally connected between the cam rail 99 and a screw adjustment means 272, 274, as shown in FIGS. 1, 2 and 4. Since the spring 190 acts against the rail 90 to urge the seaming roller 116 into engagement with the end seam, the harder the spring pushes, the tighter the end seam will be folded, and by varying the position of the screw 272, the push of the spring can accordingly be selectively varied. Additionally, it is within the scope of the present invention to form the lower step 104 of the seaming roller body portion as an articulated, rather than integral, piece. If the step 104 is articulated, that end which pivotally mounts the lower roller 114 can be moved relatively to that end which pivotally mounts the seaming roller 116 to thus vary the distance between the lower roller 114 and the seaming roller 116. This variation in distance is another way in which the seam thickness in the second operation can be adjusted. The first operation seam thickness is controlled by adjusting the screws which mount the seaming rail 88. The sets "end," "crown," and "closure" are used interchangeably herein to describe the element 68 which is to be double seamed to a can 62.

It is thought that the invention and many of its attendant features will be understood from the foregoing description and it will be apparent that various changes may be made in the construction and arrangement of parts and that changes may be made in the steps of the method described and in their order of accomplishment without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

We claim:

1. In the manufacture of containers wherein a flanged closure and a flanged container are clamped together in partial assembly between a container support and a chuck in said closure so that their flanges are in close contact, and the thus partially assembled container and closure are rotated on their common axis while being moved in a predetermined path along which said closure is double-seamed to said container, the process comprising the steps of:

pressing a seaming rail into engagement with said flanges of the container and its closure, to produce a partial double seam therebetween, during slightly more than one rotation of the partially assembled container and closure about their common axis thereby preventing folding of the cold worked material;

pressing a seaming roller into engagement with said partial double seam between said rotating container and closure during the remainder of their progress along said predetermined path;

2. A method of double seaming a closure to a container, comprising:

feeding a flanged closure into partial assembly with the open end of a flanged container on a support pad;

pressing and retaining said closure and container into close partial assembly between said support pad and a chuck applied to said end to hold the outwardly extending flanges of the container and closure in close contact;

rotating said partially assembled container and closure about their common axis while thus held between said pad and chuck;

removing said container with its closure completely double-seamed thereto, from said circular path.

3. A method of double seaming a closure to a container comprising the steps of:

feeding a flanged closure into partial assembly with the open end of a flanged container;

clamping said closure and container into close partial assembly to hold the outwardly extending flanges of the container and closure in close contact;

rotating said partially assembled container and closure about their axis while thus clamped together;

removing said rotating container and closure in a circular path around a fixed center through less than 360°;

pressing a seaming rail into engagement with said flanges of the container and closure to produce a partial double seam therebetween during less than 90 degrees of the initial portion of said circular path;

rolling said partial double seam into a completed double seam during the remainder of the movement of said rotating container and closure along said circular path; and

removing said container with its closure completely double-seamed thereto, from said circular path.

4. In an apparatus for sealing a cover to a container along a sealing area adjacent the juncture between said container and cover, the combination comprising:
means for temporarily clamping a cover onto a container;
means for rotating the clamped container and cover around their common axis;
means for revolving said rotating container and cover in a circular path through less than 360°;
stationary sealing means adjacent about one quadrant of said circular path of said sealing area between said rotating container and cover for partially sealing said area;
movable sealing means revolvable with said rotating container and cover along a circular path adjacent said revolving and rotating sealing area of the container and cover, and movable into engagement with the partially sealed sealing area to complete the sealing of said area during the remainder of the progress of said container and body along their circular path.

5. The apparatus for sealing a cover to a container as set forth in claim 4, wherein said stationary sealing means intercepts the normal circular path of said movable sealing means, and said movable sealing means is vertically reciprocable from said normal path; and means are provided for vertically reciprocating said movable sealing means out of its normal path to avoid interference with said stationary sealing means and back to its normal path to complete said sealing operation.

6. Apparatus for double seaming a cover to a container body comprising:
a rotatable turret member having at least one peripheral pocket therein;
means for introducing a flanged container body into said peripheral pocket;
means for feeding a flanged cover into superposed alignment with said container body;
means rotatable with said turret and disposed adjacent said pocket for clamping said container body and said cover together into partial assembly within said pocket, with the opposing surfaces of said flanges in close contact;
means rotatable with said turret and disposed adjacent axis and thus causing said clamped body and cover to revolve in a circular path about the turret axis; means associated with said turret rotating means for rotating said clamped body and cover about their common axis within said pocket while they simultaneously revolve about the turret axis;
stationary sealing means for engaging the flanges of said rotating and revolving clamped body and cover for forming a partial double seam therebetween;
retractable sealing means for engaging said partial double seam to form a completed double seam;
actuating means for selectively oscillating said pivotal sealing means into and out of said sealing engagement with said flanges; and
rejection means for discharging the double seamed container and cover out of said turret pocket.

7. Apparatus as defined in claim 6 wherein the means for clamping said container body and cover together comprises a rotatable spring-biased support pad beneath said pocket for supporting said container body and a rotatable reciprocable driving chuck above said pocket for holding said cover in contact with said container body.
8. Apparatus as defined in claim 6 wherein said stationary sealing means is an arcuate sealing rail disposed along a portion of said circular path of the container body and cover at a height corresponding to that of the flanges of the clamped container body and cover.
9. Apparatus as defined in claim 8 wherein the portion of said circular path along which said rail extends is no greater than one quadrant.
10. Apparatus as defined in claim 6 wherein said pivotal sealing means includes a seaming roller assembly having a seaming roller engageable with said flanges and at least one cam follower; and wherein the actuating means for selectively oscillating the pivotal sealing means includes at least one cam rail upon which said cam follower rides.
11. Apparatus as defined in claim 10 wherein said sealing rail intercepts the normal path of said sealing roller assembly, and said assembly is also mounted for vertical reciprocation; and wherein means are provided for vertically reciprocating said assembly out of its normal path to avoid interception by said arcuate sealing rail, and back to its normal path after it has passed said rail.
12. In an apparatus for double seaming a can end to a can body, the combination comprising:
clamping means for temporarily holding a flanged can end and flanged can body together in partial assembly;
means for rotating said assembly about its axis and simultaneously moving said rotating assembly in a circular path;
a stationary arcuate sealing rail extending alongside said circular path for about one quarter of its length, said rail having a groove therein adapted to engage and interlock the outwardly extending flanges of said can end and can body to form a partial double seam;
a pivotal sealing roller movable in a circular path adjacent to and together with said clamping means, said roller having a sealing groove therein adapted to engage the partial double seam and form it into a completed double seam;
means for moving said sealing roller along its circular path; and
actuating means for selectively pivoting said sealing roller into and out of its sealing engagement with said can end and body.
13. In a double seamer having a stationary seaming device for performing a first seaming operation and a movable seaming device for performing a second seaming operation, wherein the stationary seaming device intercepts the normal path of said movable sealing device, the combination comprising:
a body portion of said movable sealing device movable normally along an arcuate path, and around its vertical axis, and also vertically along its axis; a sealing roll mounted on said body portion;
means for moving said body portion along said arcuate path;
means for moving said body portion around its vertical axis to move said sealing roll into its second seaming operation; and
means for moving said body portion vertically from its normal arcuate path before reaching said intercepting stationary seaming device to clear said device, and for returning said body portion to its normal path after it has passed said device.
14. A movable seaming device as defined in claim 13 but further characterized by said body portion being comprised of three interconnected stepped portions defining a lower, an intermediate, and an upper step, with a cam roller being mounted on each of the lower and upper steps, and by the provision of cam means for engaging said rollers to move said body portion around its vertical axis.
15. A movable seaming device as defined in claim 14 wherein a wing portion extends upwardly from said intermediate step and a roller is rotatably mounted on said wing portion; and wherein said means for moving the body portion vertically includes a cam for engaging and effecting vertical movement of said roller.
16. In a single revolution double seaming machine which assembles a can end to a can body by forming a double seam created by interlocking the can end peripheral skirt with the can body peripheral flange during less than a single revolution of the machine, improved double seam forming means comprising:
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a stationary arcuate seaming rail occupying less than one quarter of the distance travelled during a single revolution of the machine;
said seaming rail including a central inner groove adapted to engage and interfold the can end peripheral skirt and the can body peripheral flanges to form a partial double seam; and
a selectively pivotable seaming roller adapted to be pivoted into and out of engagement with said partial double seam, said pivoting occurring in less than the remaining three-quarters of a single revolution;
said seaming roller including a continuous central groove adapted to surround said partial double seam and apply pressure to flatten said partial double seam into a finished double seam.

17. Apparatus for securing a can cover to a can body comprising:
body feeding means for introducing a can body linearly into said apparatus;
said body feeding means including a chain drive with extending finger portions projecting outward between alternate can bodies to move said bodies along a linear track;
a central shaft extending through said apparatus substantially normally to said linear track and defining the central axis of said apparatus;
a main apparatus frame;
an upper assembly extending above said main apparatus frame;
said central shaft extending through said main apparatus frame and into said upper assembly;
a central sleeve surrounding said central shaft for a portion of its length;
a central turret affixed to said central sleeve and having a plurality of spaced peripheral pockets;
a support pad adjustably mounted within the base of each central turret pocket;
driving means affixed to said central shaft and rotatable therewith for rotating said support pads;
said body feeding means being operable to feed a can body into each central turret pocket and onto the support pad beneath that pocket;
cover feeding means for selectively feeding a can cover from a source thereof to a position above each can body when said can body becomes deposited upon a support pad;
said cover feeding means including a cover feeding turret which moves a cover between guide rails and a transfer turret which removes the cover from the cover feeding turret and continues moving said cover between the guide rails until it reaches a point of aligned superposition over a can body supported in a central turret pocket;
can body sensing means for sensing whether a can body is being fed into a particular central turret pocket;
said can body sensing means being interconnected with said cover feeding means to assure that a cover will only be fed to a container pocket if a can body is being fed to that pocket;
a plurality of driving chucks rotatably and reciprocably mounted within said central turret, one of said chucks being located above each peripheral pocket;
can means attached to said upper assembly and co-acting with said driving chucks for selectively reciprocating them between a lower and an upper position;
each of said driving chucks forcing a can cover into engagement with the can body beneath it when said chuck moves to its lower position;
said driving chuck and said support pad acting as clamping means for clamping together a can body and cover;
additional driving means affixed to said central shaft and rotatable therewith for rotating said driving chucks;
shaft gearing means for rotating said central shaft;
sleeve gearing means for rotating said central sleeve;
said central shaft rotation causing said driving means and said additional driving means to rotate and to thus rotate the support pads and the driving chucks thereby causing each clamped can body and cover to rotate about its own axis within each turret pocket;
said central sleeve rotation causing said central turret to rotate about the central axis of the apparatus and thus causing each rotating clamped can body and cover to synchronously revolve about said central axis;
an arcuate stationary seaming rail affixed to said upper assembly and partially surrounding said central turret and extending into the peripheral pockets thereof at a height corresponding to the interface of the can bodies and can covers clamped within said pockets;
said seaming rail having a central groove wherein which interlocks said can bodies and said can covers to form a partial double seam;
a plurality of elevatable and pivotable seaming roller assemblies affixed to said central turret with one of said assemblies being adjacent each peripheral pocket;
each of said seaming roller assemblies having a rotatable seaming roller mounted thereon and adapted to engage a previously formed partial seam to convert it into a finished flattened end seam;
each of said seaming roller assemblies also including a lower, an intermediate, said an upper cam follower roller;
a lower cam rail affixed to said upper assembly and engageable with said lower cam follower rollers to selectively pivot each seaming roller assembly into a seam engaging position;
an upper cam rail affixed to said upper assembly and engageable with said upper cam follower rollers to selectively elevate said seaming roller assemblies to lift them over said stationary seaming rail;
an intermediate cam rail affixed to said upper cam rail and engageable with said intermediate cam follower rollers to selectively pivot each seaming roller assembly out of said engaging position; and
ejecting means for removing a can body and its attached cover from its central turret pocket once a finished double seam has been formed;
said ejecting means including a rotatable ejection turret having peripheral pockets therein and an arcuate rail member for transferring a seamed can and cover from a central turret pocket into an ejection turret pocket and subsequently out of said apparatus.

18. Apparatus as defined in claim 17 wherein said shaft gearing means operates at a greater speed than said sleeve gearing means thus causing said central shaft and its attachments to rotate faster than said central sleeve and its attachments.

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