This invention relates to a can end seamer and method of end seaming. More particularly, it relates to a can end seamer of the type known as a double seamer wherein applies can ends or covers to can bodies and forms a double seam joint between the ends and the bodies.

Can end seaming operations must, in most cases, be carried out at high speed. Where food or the like intended for human or animal consumption is canned, the can ends must be airtight. Therefore, the machines employed to close cans must be capable of operating at high speed, yet with great dependability.

These considerations and problems apply with special force to double seamers because the seaming operation is more complex, being divided into two steps or operations known in the art as the “first operation” and the “second operation.” In the first operation the curl of the can end and the flange of the can body are partially bent and formed to engage one another. In the second operation the partially formed seam is flattened to form a flat, tight seam.

At the present time a great majority of can end seamers are roll type seamers wherein an assembled can body and can end are clamped between a lower pad and a seaming chuck; are rotated from an entry point to an exit point or a discharge point; and, during transit from the entry point to the discharge, are caused to spin. Meanwhile, during the first seaming operation a first operation seaming roll is moved by suitable means such as a cam into engagement with the can end curl and can body flange. It is the pressure of the seaming roll and the curling of the can end and can body which bring about the seam formation to form a first operation seam. This procedure (i.e., contact with a seaming roll and spinning of the can end and can body) is repeated during the second seaming operation.

It is prevailing practice, and it is deemed to be a necessary practice to spin each assembled can end and can body many times during each seaming operation. Thus it is common practice to spin an assembled can end and can body about 18 to 30 revolutions during each seaming operation.

It has been considered necessary to spin can ends and can bodies many times during each spinning operation in order to obtain a good seam.

We have found to the contrary, namely, that good seams can be formed by spinning each can end and can body not greatly in excess of one revolution during each seaming operation, and we have further discovered that there are certain marked disadvantages in previous practice in this regard which are eliminated or greatly lessened by our practice of spinning each can end and can body not greatly in excess of one revolution during each seaming operation.

Thus, we have found that the multiple spinning of prior practice causes work hardening of the metal of the end seam, thereby causing deterioration of the metal. This deterioration is especially pronounced in the case of tin lined cans. As a result of such deterioration the end seams become discolored, even black on standing. This discoloration meets with considerable resistance and has led to the practice of applying a lacquer to both sides of can ends.

We avoid or greatly reduce such work hardening, metal deterioration and discoloration, and we eliminate the necessity of lacquering can ends as a means of preventing blackening of end seams by greatly reducing the number of revolutions through which each can end and can body spin during each seaming operation. We find that a good seam results notwithstanding contrary views of others skilled in the art.

We may accomplish our object in this regard by means of conventional roll type seamers by using them to spin each can end and can body through, for example, one revolution per seaming operation plus a reasonable overlap, e.g., a 50% overlap. Thus, the span between the inlet and discharge positions may be shortened or the design of the rotating parts may be such as to spin each can end and can body 1½ revolutions during each seaming operation. For example in one type of roll type double seamer, first and second operation seaming rolls are employed for each seaming head and, during each cycle of operation, a first operation can acts on the first operation roll or rolls of each seaming head to contact the same with the can body flange and can end curl held by that particular head; then a second operation can acts on the second operation roll or rolls to contact the same with such flange and curl. In accordance with the present invention the dwell time of these cans would be modified to cause seaming contact during each seaming operation for a period of about 1½ can revolutions for the largest size of can, rather than about 18 revolutions as presently practiced.

However, we prefer to employ the principles of a bar type seamer such as shown in Kruse U.S. Patent No. 1,313,998, granted August 26, 1919 entitled, “Machine For Seaming Heads or Ends on Cans.” In this type of machine the seaming element which accomplishes the function of the seaming rolls of present-day conventional roll type seamers is a stationary seaming bar. Moreover, the preferred type of bar seamer for use in connection with the present invention is that described and claimed in Laxo U.S. Patent No. 2,727,481, granted December 2, 1955, entitled “Can End Seamer,” hereinafter referred to as the Laxo patent.

The end seamer of the Laxo patent embodies certain novel and very advantageous features, among which may be mentioned the following: Instead of employing seaming rolls which are moved by cams into and out of engagement with can bodies and can ends, the seamer of the Laxo patent employs a stationary seaming bar. Meanwhile the seaming chucks and the assembled can bodies and can ends spin about their individual axes and travel along the seaming bar.

In the seamer of the Laxo patent, if double seaming is to be effected, the seaming bar is constructed in two sections for the first and second seaming operations, respectively.

The machine of the Laxo patent is especially well adapted for purposes of the present invention. In past practice with this machine it has been customary and has been deemed preferable to employ a first operation seaming bar having a length equal to about 2½ times the circumference of the largest can body to be seamed. Thus, in a machine intended for cans ranging from No. 202 to No. 404 in size, a first operation seaming bar would be employed which is about 33%" long (i.e., 3.14 x 4.25 x 2.5). A seaming bar of this length would spin or revolve each No. 404 can body and can end about 2½ times and it would spin each No. 202 can body...
body and can end about 5 times. A second operation seaming bar of the same length would also be employed which would, therefore, revolve each No. 404 can end and can body 2½ times and each No. 202 can end and can body 5 times. Each of the seaming bars of the Laxo patent, as previously designed, would have a long entry taper. Thus, assuming a circular bar with the seaming groove on the concave side of the bar, the bar would be sprung in a forward direction by the internal pressure of its length so as to depart from a true circular shape. By way of specific example, a 34" bar intended as the first operation bar for a seamer for No. 202 to 404 cans would be mounted in a frame ring, then biased outwardly from the seaming bar axis of the machine, for a length of about 13¼" commencing at its leading or entry end. Therefore, an assembled No. 404 can end and can body entering the bar would be subjected to gradually increasing seaming pressure for one complete revolution. At the end of this taper the arc of the bar would be circular and the seaming pressure would remain virtually constant. Similar considerations would apply to the second operation bar.

It may be said that prior practice with the machine of the Laxo patent has been a great improvement over past and present practice with roll type seamers because, among other things, can bodies can be rotated and passed through much fewer revolutions per seaming operation; i.e., about 2½ to 5 as compared to 18 to 30. Nevertheless, it has previously been deemed important in the machine of the Laxo patent to apply a gradually increasing seaming pressure throughout at least on revolution during each seaming operation.

We have found, on the contrary, that the seaming bar of the Laxo patent may be greatly shortened to a length not greatly in excess of the circumference of the can size intended to be seamed. For example, in a machine intended for cans ranging from No. 202 to No. 404 in size, each bar would have a total length of about 13¼" plus a reasonable overlap, or a total of about 20". This contrasts with previous practice in which the bar would be about 34" long. In this connection we provide a tapered entry end for the first operation bar which is very short in length, e.g., about one inch for a bar intended for No. 202 to No. 404 cans. This short taper acts to supply a very rapidly increasing seaming pressure to each can end and can body as it commences the first seaming operation. The remainder of the first operation seaming bar has no taper and, if it is a circular bar, it has a constant radius. The second operation seaming bar need not have any entry taper. It is, however, preferred that the entry end of the second operation bar be chamfered to permit extraction of a can at the end of the first seaming operation for inspection of the first operation seam.

The improvements thus described with reference to the machine of the Laxo patent have several advantages. Thus less work hardening and metal deterioration is caused (although the machine of the Laxo patent is itself a great improvement in this respect over conventional roll type seamers) and smaller seaming bars may be employed. Small bars permit smaller machines and involve less machining of parts and less wear of seaming chucks, etc.

Another feature of the machine of the Laxo patent which has given some reason for improvement has been the spring means employed to urge the seaming spindles and chucks toward the seaming bars. Springs have been employed for this purpose which urge the seaming spindle and chuck radially outwardly toward the seaming bars. These springs maintain the chucks in operative relation to the seaming bars at all times during the seaming operation or operations, yet they retract or flex when required by extra metal thickness, e.g., at the juncture of an end seam and side seam. This problem is, in general, very effectively solved by the construction of the Laxo machine, but at high speeds inertia becomes a limiting factor in the ability of the springs to perform their intended function.

Among the objects of the present invention are, therefore, the following: To provide improved can end seaming machines, particularly for double seam formation. To provide can end seamers which can end bodies will be subjected to increasing seaming pressure during mating engagement. To avoid work hardening, metal deterioration, and/or discoloration of end seams of cans. To shorten the seaming bar of, and generally to improve upon, the bar type of end seamer.

To provide improved mounting for seaming chucks in bar type seamers.

These and other objects of the invention will be apparent from the ensuing description and the appended claims.

One form of the invention is illustrated by way of example in the accompanying drawings, in which:

Figure 1 is a view partly in side elevation and partly in section of the machine of the present invention.

Figure 2 is a vertical midsection taken through one of the seaming chuck assemblies illustrating the manner in which the bar is imparted to the seaming chuck in a manner to minimize inertia and other disadvantages of yielding chucks.

Figure 3 is a view similar to that of Figure 2 but showing the chuck assembly at a different stage of operation.

Figure 4 is a top plan view of the first and second operation seaming bars employed in the machine of the present invention for a double seaming operation, such figure illustrating the manner in which the bars are designed to reduce the number of revolutions required for each assembled can body and can cover and to reduce the lengths of the seaming bars.

Figure 5 is a section taken along the line 5—5 of Figure 4, such view also showing the seaming bars mounted on the frame of the machine.

Figure 6 is a section taken along the line 6—6 of Figure 2, showing the detent ring of the chuck assembly in top plan.

Figure 7 is a fragmentary top plan view of the first operation seaming bar showing the entry end thereof.

Figure 8 is a section taken along the line 8—8 of Figure 7, such view also showing the seaming bar mounted on the frame of the machine.

Referring now to the drawings and more particularly to Figure 1, the machine of the invention is generally designated by the reference numeral 10. It comprises a main stationary frame 11 within which is journaled a central, hollow shaft 12 which supports a lower assembly 13 and an upper assembly 14. The lower assembly 13 comprises a skirt or spider 15 which is integral with the shaft 12 and which carries a plurality of lifter pads 16 each of which is rotatably mounted in the spider 15 so as to be free to spin about its own axis as it rotates about the axis of the shaft 12. Each lifter pad 16 is supported by a shaft 16a which is nonrotatable relatively to the spider 15 but is slideable in a vertical direction relatively to the spider. Journalled in the lower end of each of the shafts 16a is a cam follower roller 17 which rolls on a lifter cam 18. As is well known in the cam making art, it is the function of the cam 18 to act on the cam rollers 17 and the shafts 16a to raise and lower the lifter pads 16. Thus when a can body 26 of which is shown at 19 in Figure 1) with a can cover superimposed thereon is delivered to and seated upon a lifter pad 16, the latter will be in its lowered position and will clear its respective seaming chuck and the seaming bar. Then, as the spider 15 and the lifter pad 16 continue to rotate, the cam 18 lifts the shaft 16a, the lifter pad 16 and the assembled can body and can end so as to engage the seaming chuck.
The upper assembly 14 comprises a skirt or spider 21 which is adjustable vertically by a nut 22 threaded to a screw 23. By rotating the screw 23 the height of the upper assembly 14 is adjusted for a particular can height. The spider 21 is formed along its outer edge or periphery with sleeves 25 each of which receives a chuck assembly generally designated by the reference numeral 26.

Referring now more particularly to Figure 2, one of the seaming chuck assemblies 26 is there shown. It comprises a spindle 27 which is formed with an axial passage 28 to receive a knockout rod 29 to the lower end of which is threaded a knuckle head 30 formed with a nut 31 to receive a wrench. At its upper end a steel ball 32 is provided which is seated in a socket 33 formed in a nut 34 threaded to the upper end of the knockout rod 29. An expansion spring 35 is provided which is compressed within the axial passage 28 between a shoulder 40 on the knockout rod 29 and a shoulder 41 on the seaming spindle 27. It will be apparent that the spring 35 will normally maintain the knockout rod 29 in its up position illustrated in Figure 2. A knockout cam (not shown) is provided for acting on the steel ball 32 to force the knockout rod 29 to the down position which is illustrated in Figure 3. In this attitude is applied to the can body from the seaming chuck at the conclusion of the seaming operation.

The seaming spindle 27 is journaled in upper bearings 42 and lower bearings 43. The lower bearings 43 are held in place by a nut 44 threaded to the spindle and a lock washer 46. The upper bearing 42 is upon a ring 47 fixed to the spindle 27 and beneath the ring 47 there is provided a guard member or shield 48 which is supported by a spacer 48A and which receives a mating guard member or shield 49. The purpose of the shieldings 48 and 49 is to prevent lubricant, condensed steam and the like from reaching the spindle to form objectionable character from leaking downwardly along the spindle to the chuck, thence into the cans as they are being closed. A drive sprocket 50 is provided which is driven by a chain 51 which is fixed to the frame of the machine. The sprocket 50 is rotatably mounted on the spindle 27 by means of suitable bearings (not shown) so that the spindle is free to rotate relatively to the sprocket, except that a driving connection is provided between the sprocket 50 and the spindle 27 in the form of an overrunning clutch (not shown). The overrunning clutch connection may be that described and claimed in Laxo and West Patent Application Serial No. 311,774, filed February 15, 1954, entitled "Double Seamer," or it may be any other suitable type of overrunning clutch. The purpose of such overrunning clutch is to allow the spindle 27 to rotate freely by reason of frictional engagement of the seaming chuck with a can body, can end and seaming bar, but to drive the spindle whenever the seaming chuck tends to slip or skid. A sealing member is provided at 60 having outwardly projecting annular ribs 61 which mesh with grooves 62 formed in the sleeve 25.

The seaming chuck proper is indicated by the reference numeral 75. It is formed with a recessed face 76 and a downwardly and outwardly projecting rim 77 to fit a can cover or can end, to clamp the same to a can body and to hold the assembled can end in can body flange in operative engagement with a seaming bar. The chuck 75 is bolted by shoulder screws 78 to a holder element 79 having a function described hereinafter. It will be seen that the chuck 75 is a change part which can be easily and speedily changed for cans of different size and for replacement of worn chucks.

The screws 78 extend through bushings 80 which are located in passages 81 formed in a central ring 82. The detent and the nut having cooperative shoulders 84 and 85, respectively. The nut 83 is threaded to the head 46 of the spindle 27. The detent ring 82 is formed with detent sockets 90. The holder element 79 is tapped at 91 to receive the screws 78. As will be seen from an inspection of Figure 6, there are three pairs of detent sockets 90 which are arranged symmetrically. The spring holder 79 is formed with an equal number of passages 93 which are in registry with the detent sockets 90. A spring 94 is disposed within each passage 93 and is compressed between the spindle head 46 and a steel ball 95 which is seated in the respective socket 90.

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It will be observed that the detent ring 82 is fitted snugly to the spindle head 46 and to the nut 83. Therefore, the detent ring 82 has no central radial play either in a vertical plane or in a horizontal plane. However, there is substantial play in a horizontal plane between the spring holder 79 on the one hand and the detent ring 82 and spindle head 46 on the other hand. There is also a substantial play between the bushings 80 and the detent ring 82. It will, therefore, be apparent that a small but substantial lateral shifting of the chuck 75 is made possible.

However, the chuck 75 is normally held in exactly centered position, i.e., exactly coaxial to the spindle 27, by the detent sockets 90, steel balls 95 and springs 94. It will be apparent that if a lateral force of sufficient magnitude is applied to the chuck 75, for example, from left to right as viewed in Figure 2, the chuck will shift laterally and the steel balls 95 will "pop" out of their sockets 90. In so doing the balls 95 will compress the springs 94. However, instantaneously when the disturbing force is relieved the springs 94 will act to restore the steel balls 92 to their detent sockets 90 and to restore the chuck 75 to its normal, coaxial position.

It is an important advantage of this construction and mode of operation that a shiftable chuck is employed, i.e., shiftable in a lateral plane toward and from a seaming bar; that the chuck is normally held in a precisely centered position by resilient means which yields to allow shifting of the chuck in response to metal thickness interposed between the chuck and the seaming bar; and that the seaming spindle itself is not shifted. This construction overcomes the disadvantages noted above.

The chuck 75 and spring holder 79 are light, and since they are the only parts that shift, there is very little inertia opposing the springs 94, both when the chuck is deflected and when it returns. Thus inertia does not have a detrimental effect on high speed performance of the machine.

Referring now to Figures 4, 5, 7 and 8, two seaming bars 100 and 101 are shown which are intended for the first seaming operation and the second seaming operation, respectively. These bars are of substantially identical design except as noted hereinafter.

Referring more particularly to Figures 5 and 8, it will be seen that the first operation seaming bar 100 is formed with a seaming groove 102 which receives an assembled can body flange 104 and can cover curl 105a for the purpose of forming an end seam. The seaming bar 100 is also formed with a groove 103 having a mounting purpose explained hereinafter.

A clamp member 114 is shown bored to a mounting ring 114, such mounting ring being formed with a transverse passage 115 to receive a bolt 116, the inner end of which, i.e., to the left as viewed in Figure 5, has a head 107 formed with a tongue 108 intended to fit within the groove 103 in the seaming bar. A pair of nuts 119 is provided to act over the threads 118 to the end of the bolt 116. The mounting ring 104 is formed with another transverse passage 118 which receives a set screw 115 which is provided with a lock nut 116.

It will be seen that there are several such adjustment assemblies, each such adjusting assembly being generally designated by the reference numeral 117. These adjusting assemblies are employed in the following manner: The seaming bars 100 and 101 are seated as illustrated between the clamp member 114 and the mounting ring 104. To move the seaming bar inwardly, i.e., to the left.
as viewed in Figure 5, the nuts 109 on the bolt 106 are loosened and the set screw 115 is screwed inwardly. As will be seen, the set screw 115 bears against the rear of the seaming bar. Accordingly such manipulations will push the seaming bar inwardly, or to the left as viewed in Figure 5. When suitable adjustment has been made, the nuts 109 are also tightened, thereby clamping the seaming bar in adjusted position.

If it is desired to move the seaming bar outwardly, or to the right as viewed in Figure 5, the nut 116 will be loosened, likewise the outer nut 109 and set screw 115 rotated outwardly. Then the inner nut 109 will be rotated so as to draw the bolt 106 outwardly or to the right thereby moving the seaming bar outwardly to the predetermined position of set screw 115. When suitable adjustment has been made the nuts 109 and 116 are tightened, thereby clamping the bar in adjusted position.

In accordance with preferred practice in the past, in connection with the machine of the Laxo patent, the seaming bars 106 and 101 would be sprung, as by means of the bolts 106 to give the entry portion of each bar an eccentricity in an outward direction, to the end that a gradually increasing seaming pressure is applied to each assembled can end and can body. However, in accordance with the present invention such practice is followed. Thus in the case of a circular seaming bar 106, the groove segment 162 at 100 and 101, the bar will have a true circular arc along its entire length and it will not be sprung or biased. Moreover, the length of each bar will be sufficient only to revolve the largest size of can end and can body (i.e., the largest size for which the machine is designed) not greatly in excess of one revolution, e.g., 1½ revolutions. That is, each of the bars 100 and 101 intended for cans of, say, No. 404 size maximum will have a length of about 1½ x 4½ x 3.14 = 20 inches. By way of contrast, previous thinking and practice would employ bars each of which would have a length of 2½ x 4½ x 3.14 = about 34 inches.

It will be understood that bars of noncircular shape, e.g., wavy, sinusoidal bars for rectangular or oval cans, and straight line bars may also be employed; e.g., the sinusoidal bars shown in Figure 1 of the Laxo patent. In all such cases the principles of our invention are applicable, i.e., a bar length of about 1.5 times the bar circumference may be employed. It may, however, be preferred to increase the length of the sinusoidal bar because of difficulty in handling at corners.

The seaming bars 100 and 101 are maintained as true arcs of circles or, in other words, each is maintained throughout substantially its entire length at the same distance from the chuck axis. Therefore a constant seaming pressure is applied throughout substantially the entire seaming operation. Nevertheless, it is preferred to start the first seaming operation at a lesser pressure and to increase this pressure rapidly. This object is preferably accomplished by the means now to be described.

Referring now more particularly to Figures 7 and 8, the entry end A of the first seaming bar 100 is modified in accordance with the present invention to eliminate a lengthy entry taper, to avoid a gradual increase of seaming pressure and to increase the seaming pressure very rapidly. A very short entry section of the bar 100 is indicated generally by the reference numeral 125. It will be seen that the overhang 126 of the bar 100 has the same radius generally along the entry section 125, elsewhere along the bar, but that the groove segment 102a is recessed much further than the main groove 102; and the groove segment 102a commences with a rounded end portion 127 and then slopes along a straight diagonal line to the transition point 129 with the main portion of the groove 102. The entry section 125 of the bar may have a length of only about one inch for a 20 inch bar intended for No. 404 cans maximum. This contrasts with an entry section of about 13.5-in machines built heretofore.

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