

SYSTEM, METHOD, AND APPARATUS FOR FORMING CONTAINERS

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This invention relates, in general, to forming the bodies of two-piece containers from flat metal stock and relates, in particular, to a system, certain unique apparatus within the system and to a method for operating the system wherein positive sidewall thickness control can be maintained while eliminating mechanical liftout and transfer and avoiding flange lock-out while producing improved bottom profile construction.

It has long been known that two-piece containers are preferable, for many reasons, in the food and beverage industry. It has also been long known that these containers can be formed from flat pieces of metal, or sheets, by various processes such as drawing, ironing, etc.

Generally speaking, the known apparatus for forming the body of a two-piece container by drawing and redrawing includes a series of apparatus such as a sheet feeder a cupper; a draw-redraw press having a trim station; mechanical means for lifting the caps out of the die and then transferring the cups and containers from one station to another; and various auxiliary devices such as flangers, bead-ers, testers, etc. This apparatus is usually arranged in a "line" so that the material passes from station to station for successive operations.

While such a system is essentially effective for the purposes for which it is designed, it is subject to some disadvantages.

5 One is that the means of transfer from one station to another which is generally employed is mechanical in nature involving apparatus of various designs, all of which have, in common, the feature of reaching into the press, grasping the container, and moving it from one station to the next. The difficulty is the relatively
10 high maintenance cost with mechanical transfer apparatus of this type which is also subject to frequent breakdowns.

A second disadvantage of this type of transfer apparatus is that it is relatively slow. In other words,
15 the overall speed of operation of the press, and of the container production line as a whole, is limited to the speed with which the transfer mechanism can operate.

A third disadvantage is that mechanical, hydraulically or pneumatically operated liftout means are
20 required to move the container out of the die into position for transfer. Here again the maintenance problem is significant as is the relative speed of operation.

Accordingly, the present invention is directed to a
25 system, a method, and apparatus for eliminating the transfer and liftout mechanism and improving the overall function of the container line.

5 The present invention, as noted, relates to a method, a system, and an apparatus. Many of the system components and method steps are known in the art. It is believed, however, that the unique arrangement of the apparatus in the present system is new in the art as is some of the apparatus.

10 As far as the apparatus is concerned, it is believed that provision of a draw-redraw press, which also performs the bottom profile operation, is new. Heretofore, in the prior art, the raw material was cut and then fed through a draw-redraw press where, in a double action press, the first redraw was performed following which the container was mechanically transferred to the tooling for performing the second redraw operation.

15 It has been found, however, that by providing both the draw and the redraw tooling in the same press and by providing for "through the die" operation, the first redraw can be performed and the container, with no flange on it, can be passed completely through the die onto a conveyor, from which it is moved to an accumulator/divider table where it is stored until it is returned to the press for operation of the second or redraw operation. In this way, the mechanical liftout and transfer of the prior art is eliminated and the only limitation on
20 the speed of operation is the speed of the press.

In this way also, it has been found that the difficulties with breakdowns of the conventional mechanical

liftout and transfer are eliminated and maintenance costs are considerably reduced.

It is also a factor in the present system that the trimmer station is removed from the redraw die since the container is formed without a top flange, thereby
5 eliminating the necessity for that step as well.

Finally, the concept of profiling the bottom in the second redraw station is believed to be new, particularly with regard to bottom profiling.

10 Accordingly then, production of an improved system, apparatus, and method for forming two-piece container bodies of the type above described becomes the principal object of this invention with other objects thereof becoming more apparent upon a reading of the following
15 brief specification considered and interpreted in view of the accompanying drawings.

OF THE DRAWINGS:

20 FIGURE 1 is a plan view of the improved system.

FIGURE 2 is an elevational view taken along the line 2-2 of FIGURE 1.

FIGURE 3 is an elevational view taken along the line 3-3 of FIGURE 1.

25 FIGURE 4 is a partial, elevational view showing the apparatus for making the first draw.

FIGURE 5 is an elevational view, partially in section, showing the apparatus for making the second draw or redraw.

5 FIGURE 6 is a partial plan view of the die set for the draw and redraw operations.

FIGURE 7 is a partially schematic, elevational view of the die set and press for making the draw and redraw.

FIGURE 8 is an elevational view of the draw-redraw press illustrating the first draw operation.

10 FIGURE 9 is an elevational view of the draw-redraw press illustrating the redraw operation.

15 This invention relates to an improved, highly efficient, low maintenance system for producing bodies for two-piece containers. It also relates to certain unique and novel apparatus which forms a part of the system and to a method of operating the system and apparatus.

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SYSTEM

25 The overall system is generally illustrated in FIGURES 1 through 3 of the drawings. Therefore, the overall system, which involves a novel combination of known and novel apparatus, and particularly the arrangement of that apparatus, will be described with reference being had, primarily, to those figures of the drawings.

Accordingly, and referring to FIGURES 1 and 3, it will be noted that the system is arranged so that the metal stock enters the apparatus from the left side of the drawing figures and is first passed through a Dexter feeder 10 of a type which is well known in the art. Pre-cut sheets are loaded into the Dexter feeder 10 in known fashion and the Dexter is either mechanically or electronically connected to the cupper which will be subsequently described. In this regard, it should be noted that the form in which the stock is delivered to the overall system is not overly critical and it could be supplied as either sheet or coil stock.

Still referring to FIGURES 1 and 3 of the drawings, it will be noted that the Dexter feeder 10 is connected, by means of a conveyor 11, to a waxer or lubricator 20. The means for moving the sheets from the Dexter feeder 10 to the waxer 20 are known in the art and form no particular part of this invention, other than as integral components of the unique overall system arrangement.

From the waxer or lubricator 20, the material is then passed to a sheet feeder 30, an example of which is shown in Bulso et al U.S. Patent 3,980,297. This apparatus will accurately feed the sheets, one at a time, into the cupper 40. The cupper 40 comprises a reciprocating press having tooling that is capable of blanking each sheet into discs and cupping the raw material from sheet form so as to really constitute the first step of a

series of steps which transform the container from a flat piece of metal into a finished, cylindrical container body.

From the cupper 40, the material passes onto the
5 conveyors 41 and 42. The conveyor 41 is a scrap ejector which transfers the blank scrap produced in cupper 40 to a scrap receptacle 41a. The conveyor 42 is really a combination doubling box elevator so that the cups are moved out of the cupper 40, up the trackwork of a
10 vertical elevator, and then across a horizontal conveyor to the next station (see FIGURE 3). Transfer mechanism of this general type is well known in the art and is not illustrated herein in great detail.

From the conveyor 42, the cups pass to the
15 accumulator/divider tables which are generally indicated by the numeral 50 and include upper and lower tables 51 and 52. The cups are first received on lower table 52 and it will be understood that the tables 51 and 52 serve as an orientation point prior to delivery of the cups to
20 the draw-redraw press 60. In other words, the tables serve as a mass line flow link between cupper 40 and press 60 and allow press 60 to cycle using accumulated cups even when cupper 40 is momentarily deactivated. Also, the tables serve as a point for inspection and
25 rejection of defective cups.

After such inspection has taken place and once sufficient cups C are accumulated, the lower table 52

divides the cups into lanes and gravity feeds the cups, by means of the conveyor 53, into the double acting draw-redraw press 60. This press, which is illustrated in FIGURES 4 through 9 of the drawings, will be described in greater detail below. Suffice it to say here, however, that the draw-redraw press 60 carries die sets capable of successively drawing and redrawing the cups to the desired dimensions.

It will be understood, however, that this is a "through the die" type operation and therefore the cups first pass into the draw-redraw press 60 from the lower table 52 and are directed to the die sets which perform the draw operation. After they have been drawn, they are then passed on through the die and onto the conveyor 55 and back to the upper table 51.

Table 51 performs functions similar to table 52, i.e., inspection, removal of defective pieces, orientation, and accumulation. It also should be noted that during this time the container is out of the press and cooling down, which enhances further operations.

From the table 51, the containers are then gravity fed back into the press 60 on conveyor 54 so as to permit the redraw die set to operate on them. As noted, the detail of this operation and the apparatus necessary to its performance will be described more specifically below.

For purposes of reviewing the general system, however, it is sufficient to note that after the just mentioned redraw operation, the drawn and redrawn containers will exit from the redraw press 60 to the conveyor 56 (see FIGURE 1).

Referring again to FIGURES 1 and 2 of the drawings in particular, it will be noted that the doubling box conveyor 55, which is similar to conveyor 42, essentially interconnects the apparatus just described with a second conveyor 56 which leads to a second series of apparatus usually arranged in parallel relationship with the first.

Thus, it will be seen that the conveyor 56 communicates between the press 60 and infeed conveyors 71 of the trimmers 70. These are rotary trimmers which can be of any conventional construction or design. Accordingly, as the drawn and redrawn containers are fed into the trimmers 70 by means of the infeed conveyors 71, they are then appropriately trimmed as required. It will be noted, however, that the trimming operation occurs outside the press 60 in this system. This provides improved quality and lower machine maintenance and also avoids flange lock out or wrinkles and thus results in fewer rejected containers.

The containers then pass out of the trimmers 70 onto discharge conveyors 72 and 73. This is essentially another elevator-conveyor combination of the type already referred to with regard to the conveyors 41, 42, and 55,56.

The trimmed containers then pass, by means of the elevator-conveyor 73, into the spin flanger 80, at which time a flange is formed on the upper edge of each container. Once the flanging operation has been completed, the containers are passed onto the elevator-conveyor 81 which in turn passes them onto the bead-ers 90. Once the beading operation has been completed, the containers are moved to the elevator-conveyor 82, which essentially is a discharge elevator, and then moved to a conveyor arrangement 100 which feeds into an air tester 110 and ultimately to a palletizer.

In this fashion, a container is completely formed in the unique system starting with the blank stock at the Dexter feeder 10 and finishing with the formed container exiting at the air tester 110.

APPARATUS

With regard to some of the specific apparatus employed in carrying out the invention, attention is directed to FIGURES 4 through 9 of the drawings. While the system is believed to be unique in its arrangement of components, some of the apparatus employed is also considered novel.

Referring next then to FIGURE 4, it will be noted that this essentially illustrates the die set capable of performing the first redraw of the container in the draw-

redraw press 60. The press will normally be of the double acting type, an example of which is shown in Ridgeway U.S. Patent 3,902,347. The specific tooling carried by the press is generally indicated by the numeral 200 and includes the die 201 and retainer ring 202 which is secured to the bottom bolster of the press by a plurality of screws 202a. This is a female die and is intended to cooperate with a punch 205 carried by the inner punch holder of the press. The outer punch holder of the press also carries a pressure sleeve 203 for hold down purposes. The riser 204 and punch 205, which is secured to the lower end of the riser by the screw 205b, are, as noted, carried by the inner punch holder.

An upper cylinder 206 and lower cylinder 207 are located in the outer punch holder to receive pistons 208 and 209 which act on the pressure sleeve 203 under pneumatic or hydraulic pressure for hold down purposes. Essentially the pressure sleeve descends as the press descends and engages the bottom of the cup to hold it in place while the punch 205, which is carried by the inner punch holder and passes through the pressure sleeve, is forced downward to form the container or, in other words, to perform the first redraw or draw of the container.

It will also be noted that the die 201 has a through bore 201a therein. In this fashion, once the draw has taken place and when the punch 205 is being retracted with the inner punch holder, the pressure sleeve 203 is

-12-

also retracted. The punch 205 is formed with a through central bore 205a which leads to a communicating bore 204a in riser 204 which, in turn, communicates with a source of air. Also, punch 205 tapers slightly toward its lower end. These two features allow the container C
5 to be removed from the punch and deposited onto conveyor 54 which leads back to the upper accumulator table 51 where the containers are accumulated and retained, as described above, until such time as they are returned to the press 60 for the second redraw.

10 Reference to FIGURE 8 of the drawings illustrates the manner in which the conveyor system cooperates with the press 60 and lower table 52. It will be seen how the cups C move on conveyor 53 into the press 60 in the direction of arrow 53a so that they can be drawn by
15 tooling 200 and then pass "through the die" onto conveyor 54 for transportation to upper table 51 in the direction of arrow 54a for accumulation and retention prior to further operations. This "through the die" arrangement eliminates the mechanical liftout and transfer means
20 common to the prior art.

Attention is now directed to FIGURE 5 of the drawings wherein the tooling for performing the second redraw is illustrated and generally indicated by the numeral 300.

25 This tooling, of course, is carried in the same press 60 and the particular relative physical arrangement

of the tooling of FIGURES 4 and 5 within the press will be described subsequently.

For present purposes, however, and specifically referring to the second redraw tooling illustrated in
5 FIGURE 5, it will be noted that again a die 301 is employed and is held onto the bottom bolster of the press by the die ring 302 and a plurality of screws 302a.

The inner punch holder of the press 60 carries a riser 304 and a punch 305. A pressure sleeve 303 is
10 carried on the outer punch holder.

The redraw operation is accomplished somewhat similarly to the draw or "first redraw" operation. Thus, the pressure sleeve 303 is operated on by pistons 308 and 309, which are carried in the upper and lower cylinders
15 306 and 307 of the outer punch holder. The sleeve 303 descends to engage the bottom of the drawn container C and hold it in place so that the riser and punch, which descend with the inner punch holder, can perform the redraw operation.

Reference to FIGURE 9 of the drawings illustrates the cooperation of the conveyor system and upper table 51 with the press. As noted, the drawn containers pass out of the press onto conveyor 54 and thus to upper table 51. After the inspection, orientation and accumulation
20 functions are performed and the containers are fed back into press 60 by conveyor 55 in the direction of arrow 55a whereupon the redraw takes place as just described.

The containers are then moved onto conveyor 56 and out of the press.

It ought to be noted, however, that a still further operation is performed in a unique fashion at the second
5 redraw station.

Specifically, the bottom of the container C is profiled by a reverse draw accomplished by utilization of profile pad 310 and pressure pad 311. The container is held between punch 305 and pad 311. It will be noted
10 that punch 305 has a concave bottom so that the container is held between the periphery of punch 305 and the pad 311.

As the punch 305, which has just redrawn the container C continues its descent with the inner punch
15 holder, it picks up pad 311 for holding purposes. Pad 311 works as a pressure sleeve similar to sleeve 303 and is controlled by pistons 314 and 315 operating within cylinder 313.

The container thus held is forced onto the top of
20 the profile pad 312 which is fixed on riser 312a.

In this way, the container is reverse drawn and the metal flows about the radius of pad 311.

After the bottom is profiled, the inner punch holder lifts off and container C is stripped from punch 305 by
25 air passing through bore 305a in the punch and 304a in the riser although mechanical strippers 315 can be provided for insurance if desired.

In order to move the redrawn container onto exit conveyor 56, a "blow out" apparatus is employed. Referring to FIGURE 9 it will be seen that a nozzle 400 which is connected by a suitable conduit 401 leading to a source of pressurized air (not shown). This air, when applied in the direction of arrow 400a will blow the containers onto conveyor 56 whereupon they can be removed from press 60 for further operations. Only one nozzle 400 is illustrated although one would be associated with each set of redraw tooling 300. Here again, mechanical liftout and transfer with its attendant disadvantages is avoided.

The present invention also includes a further feature which enhances its efficiency and reliability. Thus, particular attention should be given to FIGURES 6 and 7 of the drawings which illustrate the arrangement of the first redraw and second redraw die sets within the press 60.

It will be noted that an even number of die sets are contained in the press. Half of these will be tooling 200, capable of performing the first redraw and passing the redrawn container C on to the conveyor 54 and out of the press.

The remaining half will contain the apparatus necessary to perform the second redraw as indicated by the numeral 300 in FIGURE 5. This tooling 300, of course, will receive the redrawn containers when they

pass back into the press. It is important, however, to note that at all times the press will have a balanced load. In other words, assuming an initial start up operation, the cups from the cupper 40 will only be
5 passed into the press in sufficient number and in a sufficient spacing and direction to occupy each of the tooling sets 200 for the first redraw. The second redraw tooling 300 will be empty and will not perform any function. Due to the symmetrical arrangement of the
10 tooling 200 and 300, the press will, in fact, have a balanced load at that time. Thus, the tooling is arranged so that there are an equal number of first and second redraw tooling (200 and 300) stations spaced and located from front to rear and from side to side.

15 Once a full complement of containers have been subjected to the first redraw and removed from the press, a second quantity of cups will enter the press and the draw operation repeated. On the next sequence, however, a quantity of containers which have been subjected to the
20 first redraw will also enter the press and will occupy each of the tooling sets 300. In this fashion again, due to the number of the forming stations and their symmetrical arrangement, the press 60 again will have a balanced load with all stations 200 and 300 full.

25 The accumulator/divider table 51 insures that no drawn containers will be returned to the press for the second redraw until there are a sufficient number of

acceptable containers to occupy all of the second redraw stations 300. In this way, the press will either run with a full complement at all of the stations 200 and 300, or will run only with either stations 200 or 300 full. Again, the balancing of the loading of the press is uniquely assured with this system and such balancing is important to the operation of a high speed, high efficiency press.

It is also believed unique and should be noted that it is not generally known in the art to take containers into a press, perform an operation on them, take them out of the press, and then return them to the same press for a second operation.

It should be noted that in describing the system, the apparatus 10, 20, 30, 40, 50, and 60 is illustrated and described as being disposed in parallel relationship with apparatus 70, 80, 90, and 100. These lines could also be arranged in end to end relationship if desired or necessitated by the dimensions or configuration of the building in which they are installed.



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CLAIMS:

1. A system for forming containers from flat metal stock, comprising: first means for blanking and cupping the stock into individual cups; second means, connected to said first means, for drawing and redrawing the cups and including a first inspection and accumulating station, means for transferring the cups from said first inspection and accumulating station to a press for drawing, a second inspection and accumulating station for receiving the drawn cups, and means for transferring the drawn cups from said second inspection and accumulating station to the press for redrawing; third means, connected to said second means, for trimming the redrawn cups; fourth means, connected to said third means, for flanging the redrawn cups; and fifth means, connected to said fourth means, for beading the flanged and redrawn cups.

2. The system of Claim 1 wherein said first inspection and accumulating station includes an accumulator/divider table, a first conveyor interconnecting said first means and said table, and a second conveyor interconnecting said table and said second means; and said second inspection and accumulating station includes an accumulator/divider table, a first conveyor interconnecting said second means and said table



-19-

for transfer of drawn cups; and a second conveyor inter-
connecting said table and said second means for return of
said drawn cups to said second means.

5 3. The system of Claim 1 wherein a sheet feeder is
disposed before said first means and an air tester and
palletizer are disposed after said fifth means.

10 4. Apparatus for drawing and redrawing containers
in a system for forming containers from flat metal stock,
comprising: a reciprocal press; at least one set of draw
tooling carried by said press; means for removing drawn
containers from said press; at least one set of redraw
15 tooling carried by said press; means for reinserting the
drawn containers into the said press for redrawing; and
means for removing redrawn containers from the press.

20 5. The apparatus of Claim 5 wherein said redraw
tooling includes tooling for profiling the bottom of the
redrawn container.

25 6. The apparatus of Claim 5 wherein equal numbers
of sets of said draw and redraw tooling are carried by
said press and arranged in alternating, symmetrical
fashion.



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-20-

7. The apparatus of Claim 5 wherein a first accumulator/divider table is disposed adjacent said press for providing a source of cups for said draw tooling; a second accumulator/divider table is disposed adjacent said press for providing a source of drawn containers for said redraw tooling; and said second accumulator/divider table is connected to said means for removing drawn containers from said press and with said means for reinserting drawn containers into said press for redrawing.

8. The apparatus of Claim 5 wherein said draw tooling includes a draw punch; a draw die; pressure means for holding the container during drawing thereof; and said draw die having a through passage whereby the drawn container may be passed through the die and onto the means for removing the drawn containers from the press.

9. The apparatus of Claim 8 wherein said means for removing drawn containers from the press includes a conveyor disposed beneath each set of draw tooling.

10. The apparatus of Claim 5 wherein said redraw tooling includes: a redraw punch; a redraw die; pressure means for holding the container during redrawing thereof; and air pressure means for moving the redrawn container from the redraw tooling to said means for removing redrawn containers from the press.



11. A method of forming containers from flat metal stock comprising the steps of blanking and cupping the stock into individual cups, accumulating the cups at a first inspection station, transferring the cups to a drawing and redrawing press, drawing the cups, accumulating the drawn cups at a second inspection station, transferring the cups to said drawing and redrawing press, redrawing the cups, trimming the redrawn cups, flanging the redrawn cups and beading the flanged and redrawn cups.

12. The method of Claim 11, wherein the cups are bottom profiled during the redrawing step.

13. The method of Claim 12 wherein said drawn cup is removed from the press to an accumulator/divider table for orientation and inspection prior to being reinserted into the press.

14. The method of Claim 12 wherein equal numbers of cups and drawn containers are inserted into the press at any given time for drawing and redrawing.

15. The system for forming containers substantially as hereinbefore described with reference to the accompanying drawings.

16. The apparatus for forming containers substan-



-22-

tially as hereinbefore described with reference to the accompanying drawings.

17. The method for forming container bodies
5 substantially as hereinbefore described with reference
to the accompanying drawings.

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