

## PROCESS AND SYSTEM FOR MANUFACTURING PRINTED CAN ENDS

### FIELD OF INVENTION

5           The present invention relates broadly to a process for manufacturing printed can ends, to a production system for manufacturing printed can ends, and to printed can ends.

### BACKGROUND

10           In the production of containers for fluids such as beverages, commonly referred to as cans, the ability to print information onto the cans is an important aspect of the overall production process.

          For two-piece cans, the top cap is referred to as an end, and includes the drinking spout and pull-tab for opening the same. Similarly, for three-piece  
15       cans, the top end bottom caps are referred to as ends, wherein the bottom cap typically does not include any further structural features, unlike the top cap.

          In current processes for the production of can ends, the material for the ends is initially provided in planar sheet form, and the printing is done on the planar sheets, typically utilising different forms of ink printing. After the printing  
20       process, typically the ink is oven cured. The ink may be covered with a protective lacquer, and oven cured again. The sheets containing the printing for many individual ends are then cut and fed into a shell press for forming shells. Finally, the printed shells are fed into a conversion press for attaching pull-tabs to the printed shells and for forming the complete, printed can ends.

25           The feature of this production process of requiring the material for the ends in planar sheet form makes production of printed can ends a somewhat cumbersome and cost and time inefficient process. In at least preferred embodiments of the present invention, a novel production process for manufacturing printed can ends is provided which circumvents the requirement  
30       of providing the material in planar sheet form for the production of printed can ends.

**SUMMARY**

In accordance with a first aspect of the present invention, there is provided a process for manufacturing printed can ends, the process comprising the steps of coil-feeding a shell material for the printed ends into a shell press to form shells, printing information on the shells utilising a laser-marking device and feeding the printed shells into a conversion press for attaching pull-tabs to the printed shells and for forming the can ends.

The step of printing the information on the shells may comprise utilising one or more laser-marking beams, wherein each laser-marking beam is utilised to successively mark a plurality of shells located in different marking positions under the respective laser-marking beams.

The step of printing the information on the shells may comprise utilising one or more conveyor belts for delivering the shells into the marking positions under the respective laser-marking beams.

The conveyor belts may approach one or more laser heads, from which the respective laser-marking beams originate, from opposite sides, and the method further comprises utilising an unloading unit disposed at the marking positions for unloading the printed shells.

The unloading unit may comprise suction pipes for unloading of the printed shells from the marking positions.

In accordance with a second aspect of the present invention, there is provided a production system for manufacturing printed can ends, the system comprising a coil-fed shell press for forming shells for the can ends, a laser-marking device for printing information on the shells, and a conversion press for attaching pull-tabs to the printed shells for forming the can ends.

The laser-marking device may comprise one or more laser-marking beams, wherein each laser-marking beam successively marks a plurality of shells located in different marking positions under the respective laser-marking beams.

The system may comprise one or more conveyor belts delivering the shells into the marking positions under the respective laser-marking beams.

The conveyor belts may approach one or more laser heads of the laser-marking device from opposite sides, and the system further comprises an unloading unit disposed at the marking positions for unloading the printed shells.

The unloading unit may comprise suction pipes for unloading of the printed shells from the marking positions.

The system may be implemented at a single location.

5 The system may be implemented as a substantially continuous production line at the single location.

10 In accordance with a third aspect of the present invention, there is provided a can end comprising a peripheral cover hook, a chuck wall depended from the interior of the cover hook and outwardly concave angular reinforcing bead extending radially inwards from the chuck wall, and a central panel supported by an inner portion of the reinforcing bead, wherein the chuck wall is inclined to an axis perpendicular to the exterior of the central panel at an angle between about 20° and about 60°, and the concave cross-sectional radius of the reinforcing bead is less than about 0.75 mm, and wherein a top surface of the can end has printed information thereon.

15 The top surface of the can end may have the printed information laser-marked thereon.

#### BRIEF DESCRIPTION OF THE DRAWINGS

20 Embodiments of the invention will be better understood and readily apparent to one of ordinary skill in the art from the following written description, by way of example only, and in conjunction with the drawings, in which:

Figure 1 is a schematic drawing of a production system embodying the present invention.

25 Figure 2 is a schematic drawing of a laser-marking device for use in the production system of Figure 1.

Figure 3 shows a cross-sectional view of a can end embodying the present invention.

Figure 4 shows a flow-chart of a process embodying the present invention.

30 Figure 5 is a schematic drawing illustrating marking positions for shells in another laser-marking device for use in the production system of Figure 1.

Figure 6 is a chart illustrating a production sequence of the laser-marking device of Figure 5.

## DETAILED DESCRIPTION

The preferred embodiment described provides a process and system for manufacturing printed can ends which circumvent the need to provide the material for the ends in planar sheet form.

5        Figure 1 shows a schematic drawing of the different stages in a production system 100 for manufacturing printed can ends, embodying the present invention. The system 100 comprises a coil-fed shell press 102 for forming individual shells e.g. 104 from sheet material 106 which is un-spooled from a coil 108.

10        In the next stage of the system 100, the shells e.g. 104 are fed into a laser-marking device 110 for printing information thereon.

         In a final stage of the system 100, the printed shells e.g. 112 are fed into a conversion press 114. A material strip 116 for the forming of pull-tabs is also fed into the conversion press 114. Printed can ends e.g. 118 are dispensed  
15        from the conversion press 114 and including pull-tabs (not shown) for opening the drinking spout (not shown).

         During the processing in the conversion press 114, the drinking spout is formed on the printed shells e.g. 112 utilising a scoring action. The pull-tabs from the materials strip 116 and the formed drinking spout on the printed shells  
20        are typically joined together through a rivet (not shown) formed on the printed shell during one of a number of progressive processing stages in the conversion press 114. The feeding of the printed shells e.g. 112 and to the materials strip 116 containing the tab stock is in a direction perpendicular to each other. A person skilled in the art will appreciate that the finished printed can ends e.g.  
25        118 are thus made through a combination of forming, punching, and scoring actions within the conversion press 114.

         Details of a suitable laser-marking device for use in the production system 100 in one embodiment of the invention will now be described with reference to Figure 2. Figure 2 shows a drawing of a laser-marking device 200  
30        comprising two double conveyor belt carriers 202, 204, which meet underneath a laser head assembly 206. The conveyor belts of each carrier (e.g. 202) are separated by channel guides (e.g. 208, 210, 212) for conveying respective pairs of shells e.g. 214 and 216 towards the laser head assembly 206.

         The shells e.g. 214, 216 are loaded onto the carriers (e.g. 202) from a  
35        shell cartridge assembly 218, in which two columns 220, 222 of stacked shells

are loaded. During operation, respective end portions 224, 226 underneath the columns 220 and 222 are incrementally moved upward. Top ones of the shells in the respective columns 220, 222 are loaded onto the conveyor belts of the respective carriers (e.g. 202) utilising pairs of rotatable arms (e.g. 228, 230) fitted  
5 with vacuum suction cups (e.g. 232, 234).

Underneath the carriers 202, 204 and at a marking position of the shells, in which they are exposed to respective laser-marking beams (e.g. 236) of the laser head assembly 206, suction pipes (e.g. 238) are provided. One pipe is provided for each marking position, i.e. a total of four in the example  
10 embodiment. Each suction pipe (e.g. 238) extends downward and subsequently outward away from the laser head assembly 206, for collection of the printed shells at respective ends (e.g. 240) utilising suitable collection containers or cartridges (not shown).

The laser-marking device 200 further comprises a computer station 242  
15 for computer control operation of the various elements of the laser-marking device, providing standard user interface capabilities.

Figure 5 is a schematic drawing illustrating marking positions for shells in another laser-marking device 500 for use in the production system of Figure 1. The device 500 comprises a laser body 501 with two laser heads 502, 504.  
20 Each laser head 502, 504 produces one laser beam in this embodiment. Four conveyor belts approach the laser heads 502, 504 from opposite sides, i.e. a total of eight conveyor belts (e.g. 506, 508) is used.

Under each laser head 502, 504, four shells (e.g. 510) are located in marking positions. For each laser head 502, 504, the laser beam successively  
25 marks four shells as indicated by numerals 1 to 4 in Figure 5. Furthermore, during the marking of the shells labeled 1 and 2, new shells are provided as shells labeled 3 and 4. Similarly, during the marking of the shells labeled 3 and 4, new shells are provided as shells labeled 1 and 2. The printed shells are removed utilising suction pipes (not shown) underneath the marking positions.

Figure 6 is a chart illustrating a production sequence 600 of the laser-marking device of Figure 5. Each sequence in an example embodiment covers a time period of 0.3 seconds. In the first two sequences 602, 604, the shells labeled 1 and 2 in Figure 5 are marked by the respective laser heads 502, 504 (see Figure 5). In the same sequences 602, 604, the conveyors (e.g. 506)  
35 provide the shells labeled 3 and 4 in Figure 5 into their marking positions.

During the next two sequences 606, 608, the shells labeled 3 and 4 in Figure 5 are marked by the respective laser heads 502, 504 (see Figure 5). In the same sequences 606, 608, the conveyors (e.g. 508) provide new shells labeled 1 and 2 in Figure 5 into their marking positions. This production pattern is repeated continuously throughout the production process.

Returning now to Fig. 1, it will be appreciated by a person skilled in the art that the production system 100 can be implemented in a substantially continuous production-line at one location utilising e.g. suitable cartridge devices between the different stages. This provides a cost and time efficient manufacturing process.

The person skilled in the art will appreciate that the production system 100 of the example embodiment described above with reference to Figures 1 and 2 can be used to produce printed can ends of a large variety of styles, including conventional Ring-pull, Stay-On-Tab (SOT) or Large-Opening-End (LOE) ends. In the following, it will further be described that the system 100 can be used to produce a particular type of printed can ends.

Because the production system 100 utilises a coil-fed shell press 102, it is particularly useful for the production of printed can ends of the type shown in Fig. 3. Fig. 3 shows a cross sectional view of a can end 300 comprising a peripheral cover hook 302, a chuck wall 304 extending axially and inwardly from the interior of the peripheral cover hook 302, an outwardly concave reinforcing or anti-peaking bead 306 extending radially inwards from the chuck wall 304, and a central panel 308 supported on an inner panel wall 310. The panel wall 310 is substantially upright allowing for metal springback after pressing. The chuck wall 304 is inclined to an axis perpendicular to the exterior of the central panel 308 at an angle between  $20^{\circ}$  and  $60^{\circ}$ , preferably between  $40^{\circ}$  and  $45^{\circ}$ . Typically, the cross sectional radius of the anti-peaking bead 306 is about 0.5 mm.

Preferably, the anti-peaking bead 306 is parallel sided, however, the outer wall 312 may be inclined to a line perpendicular to the central panel 308 at an angle between  $-15^{\circ}$  to  $+15^{\circ}$ , and the height of the outer wall 312 may be up to 2.5 mm.

The can end 300 is preferably made from a laminate of sheet metal and polymeric coating. Preferably, the laminate comprises an aluminium magnesium alloy sheet such as 5182, or aluminium manganese alloy such as

3004 with a layer of polyester film on one side. A polypropylene film may be used on the "outer" side if desired.

Can ends of the type of can end 300 shown in Fig. 3 can provide for superior characteristics in the closure of cans such as two piece cans, while still  
5 permitting stacking of filled cans on top of one another. One such characteristic is that can ends of the type of can end 300 can be made from a thinner gauge material, e.g. 0.254 mm, as opposed to conventional ends, e.g. 0.27 mm for ends of the same diameter.

It has been recognised by the applicant that the incorporation of a coil-  
10 fed shell press into a production process embodying the present invention can enable the production of printed can ends of a superior type such as can end 300 shown in Fig. 3, which could previously not be achieved in processes which involve shell presses for pressing of the printed shells from cut planar sheets. To the inventors' knowledge, there is currently no die-set developed for forming  
15 can ends of the type of can end 300 from planar sheet-fed presses. Reasons for this include the problems associated with feeding thin-gauge planar material printed sheets for cutting and shell forming in sheet-fed presses.

Thus, the present invention can provide for the manufacture of superior can ends such as can end 300 with printed information on a top surface thereof,  
20 for example on the top surface of the central panel 308, and/or of the chuck wall 304.

In the example embodiment, an additional aspect of the printed can ends such as can end 300 is the feature that the printed information is provided through a laser-marking process, as opposed to an ink-based process. This can  
25 provide a number of additional advantages, including:

- a) Eliminate problems associated with scuffing of ink-printed characters during the conversion press processing.
- b) Eliminating or at least reducing the likelihood of fraudulent or accidental removal of the printed information.
- 30 c) Eliminate concerns associated with the potential for the ink-based print to come into contact with the contents prior to or during consumption. At this stage, to the inventors' knowledge, there is no known ink that is of food grade, thus health or safety concerns may arise with ink-printed can ends.

Figure 4 shows a flowchart 400 summarising the steps in a process for manufacturing printed can ends of the example embodiment. It comprises the step of coil-feeding a shell material for the printed ends into a shell press to form shells (step 402), printing information on the shells utilising a laser-marking device (step 404) and feeding the printed shells into a conversion press for attaching pull-tabs to the printed shells and for forming the can ends (step 406).

In at least preferred embodiments, the present invention can provide a number of advantages, including:

- a) Replacing contact ink press printed shell with laser-marked shells before tab attachment.
- b) Eliminating planar sheet printing step from the process.
- c) Process can be applied on plain or coated shells.
- d) Potential to perform high volume laser-marked shells production up to about ten million per month.
- e) Utilising double headed laser and multi-conveyor belts design to achieve high volume production.
- f) Laser-marking settings/parameters for laser engraving onto coated and non-coated shells can be chosen to achieve highly complex characters and clarity, enabling for example different languages such as English, Chinese, Malay, Thai or Vietnamese characters to be printed.
- g) Attaining consistent quality of container ends with shell presses of the type normally used for non-characterised shells, thus providing flexible and seamless implementation.

In the foregoing manner, a process and system for manufacturing printed can ends and printed can ends are disclosed. Only several embodiments are described. However, it will be apparent to one skilled in the art in view of this disclosure that numerous changes and/or modifications may be made without departing from the scope of the invention.

**CLAIMS**

1. A process for manufacturing printed can ends, the process comprising the steps of

- coil-feeding a shell material for the printed ends into a shell press to  
5 form shells,
- printing information on the shells utilising a laser-marking device and
- feeding the printed shells into a conversion press for attaching pull-tabs  
to the printed shells and for forming the can ends.

2. The process as claimed in claim 1, wherein the step of printing the  
10 information on the shells comprises utilising one or more laser-marking beams,  
wherein each laser-marking beam is utilised to successively mark a plurality of  
shells located in different marking positions under the respective laser-marking  
beams.

3. The process as claimed in claim 2, wherein the step of printing the  
15 information on the shells comprises utilising one or more conveyor belts for  
delivering the shells into the marking positions under the respective laser-  
marking beams.

4. The process as claimed in claim 3, wherein the conveyor belts  
approach one or more laser heads, from which the respective laser-marking  
20 beams originate, from opposite sides, and the method further comprises utilising  
an unloading unit disposed at the marking positions for unloading the printed  
shells.

5. The process as claimed in claim 4, wherein the unloading unit  
comprises suction pipes for unloading of the printed shells from the marking  
25 positions.

6. A production system for manufacturing printed can ends, the  
system comprising

- a coil-fed shell press for forming shells for the can ends,
- a laser-marking device for printing information on the shells, and
- 30 - a conversion press for attaching pull-tabs to the printed shells for  
forming the can ends.

7. The system as claimed in claim 6, wherein the laser-marking  
device comprises one or more laser-marking beams, wherein each laser-marking  
beam successively marks a plurality of shells located in different marking positions  
35 under the respective laser-marking beams.

8. The system as claimed in claim 7, wherein the system comprises one or more conveyor belts delivering the shells into the marking positions under the respective laser-marking beams.

5 9. The system as claimed in claim 8, wherein the conveyor belts approach one or more laser heads of the laser-marking device from opposite sides, and the system further comprises an unloading unit disposed at the marking positions for unloading the printed shells.

10 10. The system as claimed in claim 9, wherein the unloading unit comprises suction pipes for unloading of the printed shells from the marking positions.

11. The system as claimed in any one of claims 6 to 10, wherein the system is implemented at a single location.

12. The system as claimed in claim 11, wherein the system is implemented as a substantially continuous production line at the single location.

15 13. A can end comprising  
- a peripheral cover hook,  
- a chuck wall depended from the interior of the cover hook and outwardly concave angular reinforcing bead extending radially inwards from the chuck wall, and  
20 - a central panel supported by an inner portion of the reinforcing bead, wherein the chuck wall is inclined to an axis perpendicular to the exterior of the central panel at an angle between about 20° and about 60°, and the concave cross-sectional radius of the reinforcing bead is less than about 0.75 mm, and

25 wherein a top surface of the can end has printed information thereon.

14. The can end as claimed in claim 13, wherein the top surface of the can end has the printed information laser-marked thereon.

15. A process for manufacturing printed can ends, substantially as herein described with reference to the accompanying drawings.

30 16. A production system for manufacturing printed can ends, substantially as herein described with reference to the accompanying drawings.

17. A can end substantially as herein described with reference to the accompanying drawings.

**PROCESS AND SYSTEM FOR MANUFACTURING PRINTED CAN ENDS****ABSTRACT**

5 A process for manufacturing printed can ends, the process comprising the steps of coil-feeding a shell material for the printed ends into a shell press to form shells (step 402), printing information on the shells utilising a laser-marking device (step 404) and feeding the printed shells into a conversion press for attaching pull tabs to the printed shells and for forming the can ends (step 406).

10 **FIG. 4**