

METHOD AND MACHINE FOR DECORATING 2-PIECE CANS

FIELD OF INVENTION

5 The present invention relates broadly to a method and machine for decorating 2-piece cans, to a printing plate for transferring ink during decoration of cans, and to a decorated can.

BACKGROUND

10 In the production of containers for fluid such as beverages, commonly referred to as cans, the ability to decorate the cans is an important aspect of the overall production process.

 For 2-piece cans, which consists of an integrally formed main body and bottom end, to be completed with a separate top end after filling, the printing is onto
15 the cylindrical main body, typically done utilising rotating printing plates. The rotating printing plates transfer (transfer point 1) images to a blanket segment, for printing onto the rotating main body (transfer point 2). The printing plates are prepared from colour separated printing films in which halftone dots are used to print continuous tone images. Currently, two-piece can printing utilises a screening
20 technique (to create half tone dots) referred to as AM screening, in which the different densities are achieved by varying the size of the dots, with the number of the dots fixed according to the printing resolution. Typical printing resolutions on two-piece cans are in the range between 65 to 150 lpi.

 One problem associated with AM screening is that in the printing from the
25 plate to the can, dot gains typically occur due to the nature of the printing media and machinery. As a result, reproduction of printing in e.g. the highlight tonal area from 1 to 10% and the shadow tonal areas from 90% to 100% dot printing has been unsatisfactory, and to the applicant's knowledge, unachievable in the 1 to 3% (cannot be captured on the plate) and beyond 72 to 75 % (become solid on the
30 plate) range.

 In at least preferred embodiments, a method and system for decorating 2-piece cans are provided which are suitable for reproducing half-tone dots in the highlight areas below from about 3% to 10% and the shadow areas from 90% to 100%

SUMMARY

In accordance with a first aspect of the present invention there is provided a method of decorating 2-piece cans. The method comprises the steps
5 of utilising a printing plate in transferring ink to cylindrical main bodies of the respective cans, and structuring half-tone dots on the printing plate such that for at least a portion of a tonal range in the decoration a dot size is kept constant while a number of dots per unit area is varied to achieve different tonal values.

The dot size may be kept constant while the number of dots per unit area
10 is varied in a highlight region and in a shadow region of the tonal range. The highlight region may be from about 1 to 10% tonal range. The shadow region may be from about 90 to 99% tonal range.

The method may further comprise the step of structuring the dots such that in a mid-tone range the number of dots per unit area is kept constant while
15 the size of the dots is varied to achieve different tonal values. The mid-tone range may be from about 10 to 90% tonal range.

The step of utilising the printing plate to transfer ink to the cans may comprise utilising the printing plate to transfer ink to one or more blankets, and subsequently transferring ink from the blankets to the cans.

The method may further comprise the step of obtaining a calibration
20 curve for the transfers of the half-tone dots onto the printing plate and onto the cans, and the method further comprises the step of preparing the printing plate such that the tonal values in the plate are based on desired tonal values in the decoration and taking into account the calibration curve.

In accordance with a second aspect of the present invention there is provided a printing plate for transferring ink during decoration of 2-piece cans, wherein half-tone dots on the printing plate are structured such that for at least a
25 portion of a tonal range in the decoration a dot size is kept constant while a number of dots per unit area is varied to achieve different tonal values.

The dot size may be kept constant while the number of dots per unit area
30 is varied in a highlight region and in a shadow region of the tonal range. The highlight region may be from about 1 to 10% tonal range. The shadow region may be from about 90 to 99% tonal range.

The dots may further be structured such that in a mid-tone range the
35 number of dots per unit area is kept constant while the size of the dots is varied

to achieve different tonal values. The mid-tone range may be from about 10 to 90% tonal range.

The printing plate may transfer ink to one or more blankets, for subsequent transfer of ink from the blankets to the cans.

5 The dots may further be structured based on a calibration curve for transfers of the half-tone dots onto the printing plate and onto the cans, wherein the dots are structured based on desired tonal values in the decoration and taking into account the calibration curve.

10 In accordance with a third aspect of the present invention, there is provided a machine for decorating 2-piece cans, the machine comprising one or more printing plates of the second aspect.

15 In accordance with a fourth aspect of the present invention, there is provided a decorated 2-piece cans, wherein half-tone dots printed on the can are structured such that for at least a portion of a tonal range in the decoration a dot size is kept constant while a number of dots per unit area is varied to achieve different tonal values.

20 In accordance with a fifth aspect of the present invention, there is provided a decorated 2-piece cans, wherein the decoration is based on halftone dots, and wherein the printed decoration comprises detail in a tonal range below about 3% and above about 72%.

The printed decoration may comprise detail in a tonal range below about 1% and above about 75%.

BRIEF DESCRIPTION OF THE DRAWINGS

25 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 shows a schematic side view of a can decoration machine embodying the present invention.

30 Figure 2 shows a toning range divided into separate sub-ranges, for use in can decoration embodying the present invention.

Figure 3A) to C) show schematic drawings illustrating a can decoration system and process embodying the present invention.

35 Figure 4 is a flow chart illustrating a two-piece can decoration process embodying the present invention.

DETAILED DESCRIPTION

Figure 1 shows a schematic side view of a machine 100 for decorating 2-piece cans. A plurality of un-decorated cans (i.e. integral body wall and bottom end) (e.g. 102) are rotatably mounted on mandrels (e.g. 103) on a mandrel wheel 104. The cans (e.g. 102) are loaded and unloaded from the mandrel wheel 104 utilising an air-assist infeed track 106 and a disc transfer wheel 108 respectively. The disc transfer wheel 108 comprises, in the example embodiment, 24 suction heads (not shown) for removal of the printed cans from the mandrel wheel 104.

The machine 100 further comprises a number of inker units, in the example embodiment six-inker units 110 to 115. Each inker unit 110 to 115 provides printing of one colour component, and it will be appreciated by a person skilled in the art how a colour decoration can be build up through successive printing of the individual colour components.

Ink from the respective inker units 110 to 115 is provided onto respective plate cylinders (e.g. 120). Each of the plate cylinders (e.g. 120) has a flexible printing plate (e.g. 122) mounted to it. Each of the plates (e.g. 122) comprises a developed half-tone dot array for the respective colour components of the decoration to be printed onto the cans.

In operation, the plate cylinders (e.g. 120), the blanket wheel 119, the mandrel wheel 104 and the disc transfer wheel 108 are rotated continuously. Thus, in a first transfer step, ink from the respective inker units 110 to 115 is transferred from the plate cylinders (e.g. 120) onto the blankets (e.g. 117) on the blanket wheel 119. In the example embodiment, 12 blankets (e.g. 117) are mounted on the blanket wheel 119.

In a second transfer step, ink is transferred from the blankets (e.g. 117) onto the surfaces of the cans (e.g. 102). Each can (e.g. 102) rotates on their respective mandrels (not shown) on which they are mounted.

An applicator roll 128 applies a protective varnish to the printed cans, before the cans are unloaded from the mandrel wheel 104 utilising the suction heads (not shown) mounted on the disc transfer wheel 106. The cans are then transferred to a pin chain for down-line drying (not shown).

Figure 2 shows a toning scale 300 for use in decorating two-piece cans in an embodiment of the present invention. The tonal range from 0 to 100% has

been divided into three sections: A first section 302 from 0% to 10%, a mid-section 304 from 10% to 90%, and a third section 306 from 90% to 100%. The sections 302 and 306 will be referred to herein as highlight and shadow regions respectively.

5 In the highlight region 302 from 0 to 10% in the example embodiment, the size of the half-tone dots is maintained constant while the number of dots per unit area is varied to achieve different tonal values. This screening technique is referred to hereinafter as FM screening. In the mid-range 304, the
10 density of the dots is maintained constant while the size of the dots is varied, to achieve different tonal values as in conventional AM screening for decorating cans. Finally, in the shadow region 306, FM screening is again utilised.

 The use of FM screening in the highlight and shadow regions can enhance the reproducibility of decoration detail in decoration of 2-piece cans utilising half-tone dot printing plates.

15 Figure 3A) to C) show schematic drawings illustrating a system 401 having different stages for a decoration process for two-piece cans. At a first stage 400 (shown in Figure 3A), a film 402 is produced utilising a production machine 404 on which the desired decoration image is selected/input and processed as an array of half-tone dots for example, including e.g. a 10% tonal
20 value for a particular detail of the image. One film 402 is produced for each of the individual colours utilised.

 In a second stage 406 illustrated in Figure 3B), one of the films 402 is used to expose and develop a flexible printing plate 408, utilising an exposure source 410 and suitable materials incorporated in or on the printing plate 408. It
25 has been recognised that a transfer function applies to the transfer from the film 402 to the developed printing plate 408. This is caused by gains or losses in the transferred dot size. For one particular detail, the transferred half-tone dot density on the printing plate 408 may now correspond to $10\% \pm X$ tonal value.

 At the final stage 412, illustrated in Figure 3C), the plate 408 is mounted
30 on one of the plate cylinders 414, for printing onto a blanket (not shown) and onto the can 417. Again, a transfer function applies during this process, such that a particular detail on the can 417 may now have a half-tone dot density corresponding to $10\% \pm X \pm Y$ tonal value. This is in contrast to the initially input value of 10% in the original design of the decoration image at stage 400.

In an embodiment of the present invention, in addition to utilising a combination of FM and AM screening in different tonal ranges, as described above with reference to Figure 3, an initial calibration processing is conducted to account for the different transfer functions during the decoration of cans. To
5 obtain the calibration curve, a particular value, e.g. 10%, is initially selected for a detail at the design stage 400, and the resulting tonal value on the can 417 is determined after stage 412. Maximum and minimum readings are taken out of a number of samples, and based on those readings, a calibration value is determined. For example, 10% in the original design may result in 5% tonal
10 value on the can 417. This information is then fed back into stage 400 of the process as indicated by feedback loop 418 in Figure 3.

The person skilled in the art will appreciate that thus an improved reproduction capability and quality can be achieved in the embodiment. Effectively, in the example embodiment the tonal range printable on the can 417
15 has been increased compared to existing can-decoration processes. That is, where existing processes may have been able to e.g. achieve only a tonal range from about 3% to about 75%, in the example embodiment that range can be broadened to substantially extend from about 0% to 100%.

Figure 4 is a flow chart 300 illustrating a process in another embodiment
20 of the present invention. At step 302, a decoration image is chosen/design. At step 304, half-tone dots are structured such that in at least a portion of a tonal range in the decoration image a dot size is kept constant while a number of dots per unit area is varied to achieve different tonal values.

At step 306, the decoration image is printed onto the cans.

25 Embodiments of the present invention can provide one or more of the following observable improved results in different areas:

Tone Jump

In existing 2-piece can decoration processes, a major obstacle was faced in the printing in the highlight area from 1 to 10%. Typically, printing plates could not
30 hold/reproduce the dots in the 1 to 3% area. This resulted in tone jump and harsh lines in very critical print areas.

By keeping the dot size constant and only changing the number of dots, FM screening clusters the dots in the highlight areas in the example embodiment. Once the dots are clustered, the dots are exposed onto the plate, without the problem of
35 having to transfer prohibitively small dot sizes. Thus, in the example embodiment

problems associated with tone jump can be overcome, and highlight details can be captured on the cans.

Shadow Details

Improved printing capability in the shadow areas can be provided. Since the
5 dot size remains constant in the shadow area, dot gain also remains constant. In
prior art AM screening, as the dot size increases, in theory the percentage of dot
gain increases as well. As a result, shadow details can be seen more clearly, for
example in the >80% toning range. In prior art AM screening, the relevant dots
would typically be solid in that range, due to the increased dot gain.

Resolution

2-piece cans printing utilising existing AM screening typically uses screen
lines ranging from 85 to 100 lpi. At this resolution, the half tone generally appears to
be very grainy, since the entire range of dot sizes must be accommodated.
Typically, the lower screen lines are used mainly because of the plate exposure and
15 dot gains/losses caused by the various pressure settings between ink rollers - plate
cylinder - blanket - mandrels. As there are various dot sizes in AM screening, the
dot gain and losses are difficult to maintain, in particular in the highlight and shadow
areas.

In the example embodiment, only one dot size needs to be controlled at any
20 resolution in the shadow and highlight areas. As the dot size remains the same in
those regions, the gain and losses are even as well. Furthermore, utilising the
calibration processing and keeping the machine settings constant, it was found that
dots e.g. in 2-3% toning areas can now be reproduced, which, has not been
reproducible with existing AM screening.

25 In the foregoing manner, a method and system for decorating 2-piece cans
and a decorated 2-piece cans 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.

30 For example, it will be appreciated that in different embodiments, the ranges
in which FM screening is used can be different from the ones shown for the example
embodiments (see Figure 3).

Furthermore, it will be appreciated that the overall decoration may also
include areas/colours which are printed utilising continuous-tone techniques.

CLAIMS

1. A method of decorating 2-piece cans comprising the steps of:
 - utilising a printing plate in transferring ink to cylindrical main bodies of the respective cans, and
- 5 - structuring half-tone dots on the printing plate such that for at least a portion of a tonal range in the decoration a dot size is kept constant while a number of dots per unit area is varied to achieve different tonal values.
2. The method as claimed in claim 1, wherein the dot size is kept constant while the number of dots per unit area is varied in a highlight region
- 10 and in a shadow region of the tonal range.
3. The method as claimed in claim 2, wherein the highlight region is from about 1 to 10% tonal range.
4. The method as claimed in claims 2 or 3, wherein the shadow region is from about 90 to 99% tonal range.
- 15 5. The method as claimed in any one of the preceding claims, further comprising the step of structuring the dots such that in a mid-tone range the number of dots per unit area is kept constant while the size of the dots is varied to achieve different tonal values.
6. The method as claimed in claim 5, wherein the mid-tone range is
- 20 from about 10 to 90% tonal range.
7. The method as claimed in any one of the preceding claims, wherein the step of utilising the printing plate to transfer ink to the cans comprises utilising the printing plate to transfer ink to one or more blankets, and subsequently transferring ink from the blankets to the cans.
- 25 8. The method as claimed in any one of the preceding claims, further comprising the steps of obtaining a calibration curve for transfers of the half-tone dots onto the printing plate and onto the cans, and preparing the printing plate such that the tonal values in the plate are based on desired tonal values in the decoration and taking into account the calibration curve.
- 30 9. A printing plate for transferring ink during decoration of 2-piece cans, wherein half-tone dots on the printing plate are structured such that for at least a portion of a tonal range in the decoration a dot size is kept constant while a number of dots per unit area is varied to achieve different tonal values.

10. The printing plate as claimed in claim 9, wherein the dot size is kept constant while the number of dots per unit area is varied in a highlight region and in a shadow region of the tonal range.

11. The printing plate as claimed in claim 10, wherein the highlight
5 region is from about 1 to 10% tonal range.

12. The printing plate as claimed in claims 10 or 11, wherein the shadow region is from about 90 to 99% tonal range.

13. The printing plate as claimed in any one of claims 10 to 12, wherein the dots are further structured such that in a mid-tone range the number
10 of dots per unit area is kept constant while the size of the dots is varied to achieve different tonal values.

14. The printing plate as claimed in claim 13, wherein the mid-tone range is from about 10 to 90% tonal range.

15. The printing plate as claimed in any one of claims 9 to 14, wherein
15 the printing plate transfers ink to one or more blankets, for subsequent transfer of ink from the blankets to the cans.

16. The printing plate as claimed in any one of claims 9 to 15, wherein the dots are further structured based on a calibration curve for transfers of the half-tone dots onto the printing plate and onto the cans, and the dots are
20 structured based on desired tonal values in the decoration and taking into account the calibration curve.

17. A machine for decorating 2-piece cans, the machine comprising one or more printing plates as claimed in any one of claims 9 to 16.

18. A decorated 2-piece cans, wherein half-tone dots printed on the
25 can are structured such that for at least a portion of a tonal range in the decoration a dot size is kept constant while a number of dots per unit area is varied to achieve different tonal values.

19. A decorated 2-piece cans, wherein the decoration is based on halftone dots, and wherein the printed decoration comprises detail in a tonal
30 range below about 3% and above about 72%.

20. The decorated can as claimed in claim 19, wherein the printed decoration comprises detail in a tonal range below about 1% and above about 75%.

21. A method of decorating 2-piece cans, substantially as herein describe with reference to the accompanying drawings.

22. A printing plate for transferring ink during decoration of 2-piece cans, substantially as herein describe with reference to the accompanying drawings.

23. A machine for decorating two-piece cans, substantially as herein
5 describe with reference to the accompanying drawings.

24. A decorated 2-piece cans, substantially as herein describe with reference to the accompanying drawings.