United States Patent [19]

Zurick

[11] **3,817,209**

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[54] **GRAVURE COATING**

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[52] **U.S. Cl.** **118/258,** 101/170

[51] **Int. Cl.** **B05c 1/08**

[58] **Field of Search**... 118/211, 212, 50 C, DIG. 15, 118/244, 258–262; 101/127, 129, 113, 114

[56] **References Cited**

UNITED STATES PATENTS

2,638,050 5/1953 King 118/DIG. 15

Primary Examiner—Morris Kaplan

Attorney, Agent, or Firm—Ryder, McAulay, Fields, Fisher & Goldstein

[57] **ABSTRACT**

A variable gravure pattern is employed on a gravure cylinder used in the overlapping coating of a cylindrical body, such as a so-called tin can, with paint or shellac. The overlapping coating provides a substantially uniform coat because of the variable gravure pattern while avoiding the pronounced line of demarcation at the start of the coat and at the end of the coat which occurs when there is a double thickness of coating in an overlap area.

8 Claims, 8 Drawing Figures

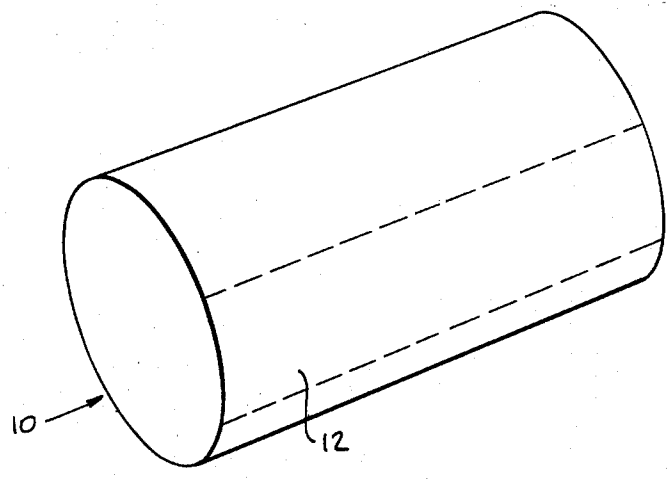


Fig. 1.

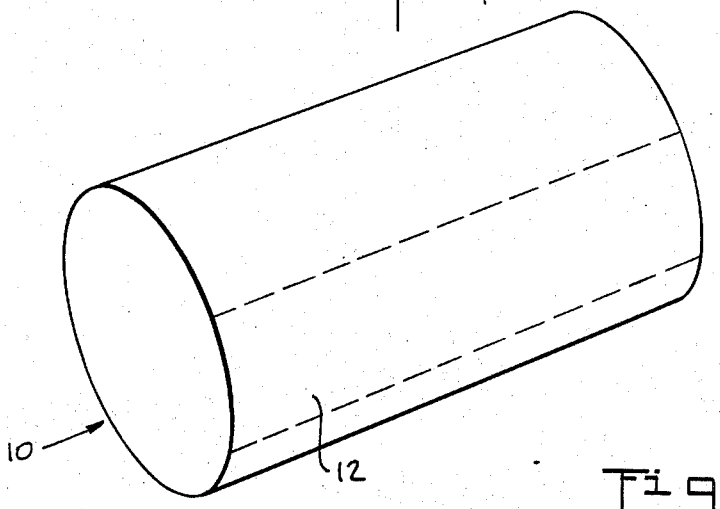


Fig. 4.

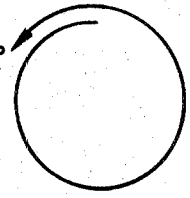


Fig. 2.

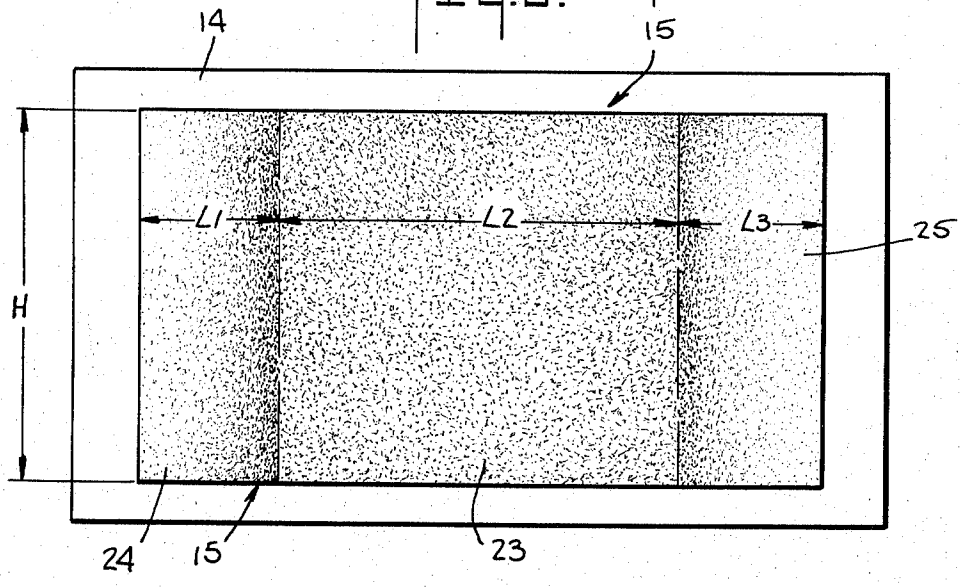


Fig. 3.

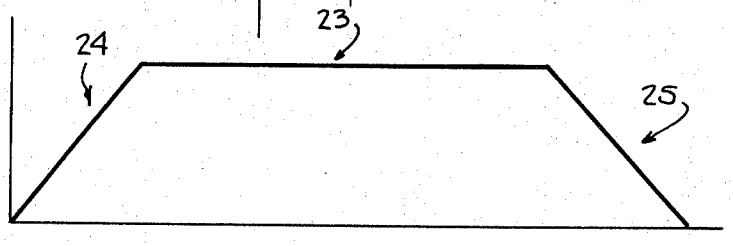


Fig. 5.

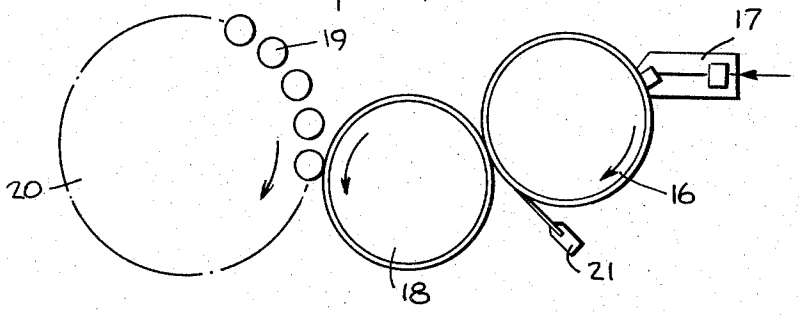


Fig. 6.

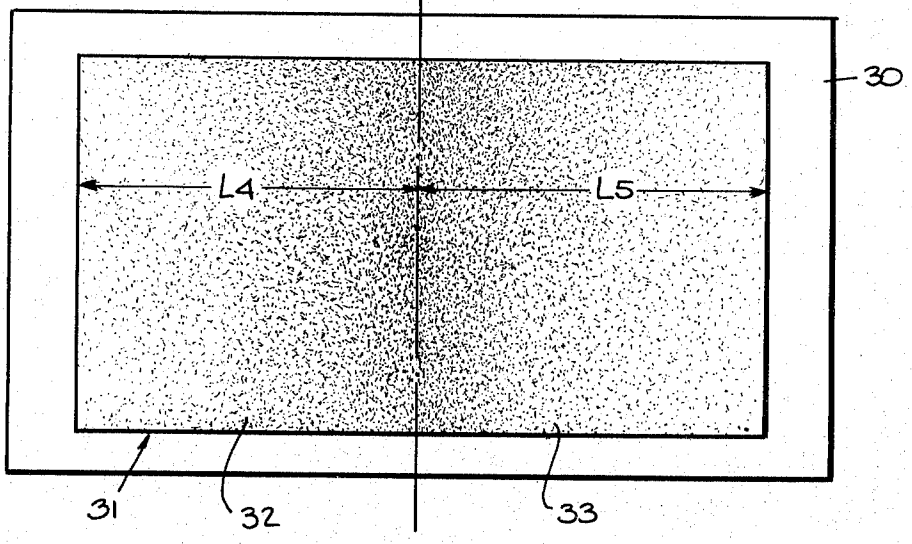
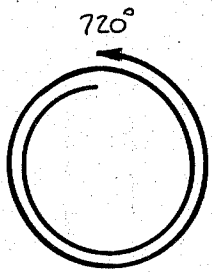


Fig. 8.



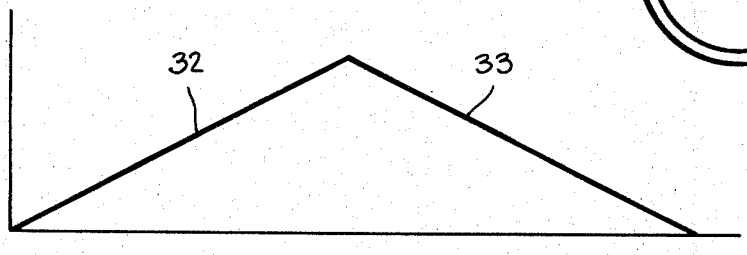


Fig. 7.

GRAVURE COATING

This invention relates in general to a gravure printing technique for applying a substantially continuous coat to an article and more particularly to such a technique as is applied to cylindrical, or other continuous surface, devices such as an aluminum or steel can.

BACKGROUND OF THE INVENTION

Cans of widely varying sizes are used as containers for a wide variety of consumer and other goods. These cans have a continuous surface which in the case of the more usual can is a cylindrical surface. This surface is commonly used as an aid in the sale of the product contained therein. In many circumstances, not only is a legend and decorative motif printed on the cylindrical surface by one of the known type of can printers (such as that disclosed in the Hartmeister U.S. Pat. No. 3,261,281 or that disclosed in the Zurick U.S. Pat. No. 3,356,019) but also, prior to the printing, a paint basecoat is applied and, after the printing, a shellac overcoat is applied. The basecoat is preferably a uniform solid color, often white, on top of which the legend and decorative motifs are printed. The overcoat is usually a shellac-type of finish applied evenly and in a form that is as transparent as possible. The overcoat is to protect the printing from damage during shipping and handling prior to selling.

It is known to apply the base on the sheet metal before it is turned into a can. It is also known to apply the base on the formed cylindrical can body particularly where fabrication and minimum use of base paint, it is preferable to apply the base to the formed cylindrical body. From the point of view of obtaining an even coat, it is preferable to apply the paint to the flat sheet metal.

Typically, when a base is applied to a formed cylindrical body, the applicator roll or other applicator device is caused to transverse the circumference of the body approximately two and one-third times. The basic reason for this is to minimize the visual impact of the overlap zone.

It would save time and paint to apply the base coat by making a single 360° transverse around the circumference of the can. But if such is done, then the juncture or overlap area becomes visually pronounced. Some small amount of overlap is necessary in order to make sure that the entire cylindrical can body is coated. If the coating is primarily a single thickness, then the overlap zone has a double thickness and the result will be a visually distinctive zone. For example, when the basecoat is a white paint, this overlap zone will appear to be a much whiter white than will the rest of the can.

From the point of view of efficient use of paint and efficient use of machine applicator time it is desirable to apply a single basecoat.

However, from the point of view of visual impact on the purchaser, it is necessary to apply at least two coats and then an overlap.

Similar problems arise in connection with the application of the shellac overcoat.

Accordingly, it is a major purpose of this invention to provide a coating technique that can be applied to the formed continuous surface with only limited overlap and yet provide a substantially uniform, continuous coating on that surface.

It is another purpose of this invention to provide the above result in a high-speed machine.

For purposes of this invention, the terms "can body" and "can" are used to represent hollow, preformed containers including but not limited to cylindrical bodies.

BRIEF DESCRIPTION OF THE INVENTION

In brief, this invention employs a gravure printing technique employing a gravure cylinder having a unique design. A transfer roll transfers the coating material from the gravure cylinder to the can body. The gravure pattern etched in the cylinder face for each can area has three zones. Assume a rectangular configuration for the area within which the cell pattern of the gravure pattern resides. These three zones are a center band and first and second side bands. In one embodiment, the center band constitutes about 60 percent of the area and the side bands each constitutes about 20 percent of the area. The center band is between the two side bands and has a cell pattern that provides a predetermined maximum coverage of the corresponding portion of the can that is coated from the center band of the gravure pattern. This center band covers approximately three-fourths of the circumference of the can. The other one-fourth of the circumference of the can is covered a first time by the first side band and then is covered a second time by the second side band.

During coating the first and second side bands provide overlapping coats. The pattern of the cells in the side bands is such that each side band provides continuously decreasing coverage from the predetermined maximum coverage at the portion of each side band immediately adjacent to the center band and decreasing at an even rate out to the outer ends of each of the two side bands.

Thus, during coating, the two side bands which provide overlapping coating complement each other to provide a coat that is equal in density to the coat provided by the center band.

BREIF DESCRIPTIONS OF THE DRAWINGS

FIG. **1** illustrates a cylindrical can body on which the coating zones are schematically indicated.

FIG. **2** is a face view of a first embodiment of the gravure cylinder of this invention showing the gravure pattern.

FIG. **3** is a graphical representation of the artwork density used as the basis for generating the FIG. **2** gravure pattern.

FIG. **4** illustrates the amount of coating overlap on the can body that is generated by the FIG. **2** gravure pattern.

FIG. **5** is a simplified schematic of a can coating system employing the gravure principle of this invention.

FIG. **6** is a face view for a second embodiment of the gravure pattern of this invention.

FIG. **7** is a graphical representation of the artwork density used as the basis for generating the FIG. **6** gravure pattern.

FIG. **8** illustrates the amount of coating overlap in the can body that is generated by the FIG. **6** gravure pattern.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The can body **10** shown in FIG. **1** is coated by a blanket cylinder in such a fashion that the bulk of the circumference of the can body **10** is coated once while the zone **12**, shown between dotted lines, is coated twice. This zone **12** is the overlap area. With reference to the gravure cylinder **14**, this overlap area corresponds to the portion of the can which is printed from the two side zones **24** and **25** of the gravure pattern **15**.

As shown in FIG. **2**, a gravure cylinder **14** has a gravure area **15** within which area there is distributed a pattern of small cells for carrying the paint of shellac or other coating material. In FIG. **2**, the gravure pattern **15** is shown flat for convenience of illustration. There will normally be a plurality of separate gravure patterns **15** around the circumference of the gravure cylinder **14**. As shown in FIG. **5**, a reservoir **17** dispensing paint (or other coating material) applies the coating material to the gravure cylinder **14**. The gravure cylinder is in rotating contact with transfer cylinder **18**, which in turn carries the coating material around to be applied to the outer surface of can bodies **19**. The cans **19** are carried on a continuously moving carrier. The relationship and structure of blanket **18**, cans **19** and carrier **20** can be that described in said U.S. Pat. No. 3,356,019. The doctor blade **21** positioned prior to contact between gravure cylinder **14** and blanket cylinder **18** assures that each cell on the surface of each gravure pattern area **14** is filled with coating material and that excess coating material is wiped off. Thus the doctor blade **21** aids in assuming a repeatable application of coating material. The reservoir **17** can be any type that provides a continuous source of coating material to the surface of the gravure patterns on the gravure cylinder **14**. A device such as that which is known as ink rails can be employed.

The gravure pattern **15** has three zones, a center zone **23** and side zones **24** and **25**. The height H of these three zones is at least equal to the height of the cylindrical object **19** that is to be coated. The combined length (L1 plus L2) of the first side zone **24** and the center zone **23** equals the circumference of the cylindrical object **19** to be coated. The length L3 of the second side zone **25** is equal to the length L1 of the first side zone **24**. In coating, this provides an overlap of the side zones **24** and **25**. The cell pattern on the center zone **23** is that dictated by the density of coat it is desired to apply to the cylindrical surface **10**. The cell pattern in each side zone **24, 25** varies along the length of each side zone. The cell pattern in each side zone ranges from a maximum coating material carrying density where continuous with the center zone **23** to a minimum at locations most distant from the center zone **23**.

In one practical embodiment, coating material density variation is provided by variation in cell diameter, the number of cells per unit area being held constant. In that embodiment, cell diameter decreases substantially linearly with distance out from the center zone **23**.

The graph of FIG. **3** illustrates the amount of coating material applied by the cells of the gravure pattern **15** as a function of length along the gravure pattern **15**. As shown in FIG. **3**, the amount of coating material applied by the size zone **24** increases going from left to right until it reaches the center zone **23** at which a maximum predetermined density is applied. This maximum predetermined density is applied throughout the center zone **23**. At the side zone **24** the density applied decreases continuously going from left to right.

Thus it can be seen that when the two side zones **24** and **25** are overlapped on a cylindrical surface, the result will be that the two triangular distributions for the size zones will add to provide an effective constant density substantially equal to that provided by the center zone **23**.

In one practical embodiment, the continuous variation of density applied by the side zones **24** and **25** is provided by a change in the diameter of the cells. In theory, the number of cells per unit area and the cell depth could also be varied in order to provide this variation in ink carrying capacity but the usual gravure techniques affect primarily cell diameter. In any case, the result desired is achieved through a normal gravure plate generation from artwork that is shaded (as represented in FIG. **3**) to provide a continuously increasing shading from left to right in the zone **24**, a continuous maximum shading throughout the zone **23** and a continuously decreasing shading from left to right throughout the zone **25**.

In an operating system, a gravure cylinder **14** (see FIG. **5**) contains a number of separate gravure patterns **15** spaced around the circumference of the cylinder. Coating material is applied to the cells in these gravure patterns by known techniques not shown in detail herein. Pressure contact between the patterns on the gravure cylinder **14** and the blanket cylinder **18** causes the material carried by the cells in the gravure pattern **15** to be transferred to the blanket cylinder **18** as the gravure and blanket cylinders rotate in contact.

The coating material is then carried by the blanket cylinder **18** to the individual cans **10**, which are held on a carrier mechanism **20**. The blanket cylinder **18** and carrier mechanism **20** are in such registry that the can body **10** contacts the blanket cylinder just prior to the pattern on the blanket and so that they part contact just prior to the end of the pattern on the blanket. Such a registration mechanism is desirable in order to prevent the material that has been applied to the cylindrical body **10** from being transferred back to the blanket **18**.

However, although some degree of registration is thus required, highly precise registration is not required under this invention because a slight deviation in the overlap of the pattern provided by the two side zones **24** and **25** will result only in a slight and unnoticeable variation in coating density over the area where registration is less than perfect. The reason for this can be readily seen by imagining that the two triangles representing the triangular coating density applied through the two side zones **24** and **25** do not overlap perfectly to form a rectangular net result. Slight deviation from perfect overlap will simply mean that a very small increment representing the lower corner of the triangle will be either missing or unnecessarily added. The result is an effectively even paint basecoat or shellac overcoat.

FIG. **4** represents the number of degrees of coating application in one embodiment, approximately that which would be applied by the gravure pattern of FIG. **2**. Specifically, an overlap of 72° and thus a convolution of 432° is illustrated.

A second embodiment of the invention is illustrated in FIG. **6**, in which a gravure cylinder **30** has a gravure area **31** and is comprised of two side zones, a first side zone **32** and a second side zone **33**. This FIG. **6** embodiment has no central zone. The cell pattern of each of the two side zones **32, 33** is arranged to provide a maximum amount of coating material at the center of the gravure area **31** where the two side zones are next to one another and to provide a decreasing amount of coating material to either direction of the center line.

As illustrated graphically in FIG. **7**, the two side zones **32, 33** provide a linear decrease of coating material from the center line outward and thus provide two triangular patterns of coating material. The length L4 of side zone **32** is equal to length L5 of side zone **33**. However, each side zone has a length equal to the circumference of the can to be coated. Specifically, the length L4 is equal to the circumference of the can which is to be coated by the gravure area **31** and the length L5 also equals the circumferece of the can to be coated. Accordingly, as indicated in FIG. **8**, this FIG. **6** embodiment has a full 360° of coating coverage overlap and thus requires a convolution of applied coating of 720°.

Although this invention has been described with application to a particular embodiment, there are modifications in the embodiment described that could be made while remaining within the scope of the inventive concept.

For example, the invention is described in connection with application to the coating of a cylindrical container body. However, this invention could be adapted to be employed for a coating of tapered bodies such as the small tublike containers in which spreads such as margarine are frequently contained for sale. In such an embodiment, the configuration of the gravure pattern would have a corresponding taper, as is known in this art. The basic concept of two zones at the ends of the gravure pattern which provides overlapping printing on the container with an appropriate substantially continuous and gradual change in the extent of the coverage throughout these side zones would still apply. The surface involved would have to be a continuous surface since the coverage carried by one of the two side zones will overlap with the coverage provided by the other of the two side zones. More specifically, in all presently contemplated embodiments, the continuous surface involved is generated as a surface of revolution about an axis.

While the embodiments herein disclosed describe a gravure pattern with a substantially identical gradation in each side zone, it will be understood that this gradation need not be necessarily equal or even complementing to obtain improved coating results in the overlap area.

What is claimed is:

1. In a gravure printing machine for coating continuous surfaces, the improvement comprising:

a cylindrical gravure surface having a gravure pattern, said pattern having first and second side zones,

the cells in each of said side zones varying in capacity to apply coating material according to a predetermined pattern as a function of circumferential distance along the gravure surface in the direction in which the gravure surface is successively applied to the surface being coated,

the positioning of said side zones along the circumference of said cylinder together with the width of said side zones being related to the circumferential distance around the surface to be coated such that the portion of the surface being coated by said first side zone will also be coated by said second side zone,

said pattern in first side zone being complementary in density to said pattern in said second side zone whereby to provide substantially uniform overall coating density.

2. The gravure printing improvement of claim **1** further comprising:

said gravure pattern having a central zone, said side zones being positioned on either side of said central zone,

the cell pattern in said central zone providing a uniform coating density on the surface to be coated equal to said uniform overall coating density provided by the overlapping of said side zones.

3. The gravure printing improvement of claim **1** wherein:

said pattern in each of said side zones is a substantially linear variation in cell capacity to apply coating material, said variation being from a maximum at the ends of said side zones closest to one another to a minimum at the ends of said side zones most removed from one another.

4. The gravure printing improvement of claim **2** wherein:

said pattern in each of said side zones is a substantially linear variation in cell capacity to apply coating material, said variation being from a maximum at the ends of said side zones closest to one another to a minimum at the ends of said side zones most removed from one another.

5. The gravure printing improvement of claim **1** wherein:

said first and second side zones are of substantially equal circumferential width.

6. The gravure printing improvement of claim **2** wherein:

said first and second side zones are of substantially equal circumferential width.

7. The gravure printing improvement of claim **3** wherein:

said first and second side zones are of substantially equal circumferential width.

8. The gravure printing improvement of claim **4** wherein:

said first and second side zones are of substantially equal circumferential width.

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