United States Patent [19]

Ray

[11] **3,863,374**

[45] **Feb. 4, 1975**

[54] **LABELED SIDE-SEAMED CAN BODY**

[75] Inventor: **Lowell Elmo Ray**, Elgin, Ill.

[73] Assignee: **American Can Company**, Greenwich, Conn.

[22] Filed: **June 26, 1973**

[21] Appl. No.: **373,768**

[52] **U.S. Cl.** **40/306**, 40/135

[51] **Int. Cl.** **G09f 3/10**

[58] **Field of Search** ..... 220/9, 63; 40/135, 125 A, 40/2 R, 2.2, 306, 310, 312

[56] **References Cited**

UNITED STATES PATENTS

706,635	8/1902	Booth	40/306
2,825,159	3/1958	Schor	40/306
2,855,707	10/1958	Schor	40/306
2,982,040	5/1961	Keller	40/306
3,110,554	11/1963	Yazumi	40/306

Primary Examiner—Robert W. Michell

Assistant Examiner—Wenceslao J. Contreras

Attorney, Agent, or Firm—Robert P. Auber; Paul R. Audet; George P. Ziehmer

[57] **ABSTRACT**

A side-seamed cylindrical metal can body having a non-stretchable, water-resistant, wrinkle-free, opaque paper-based film label substantially 100% bonded thereto is provided wherein the label hides the side seam.

27 Claims, 5 Drawing Figures

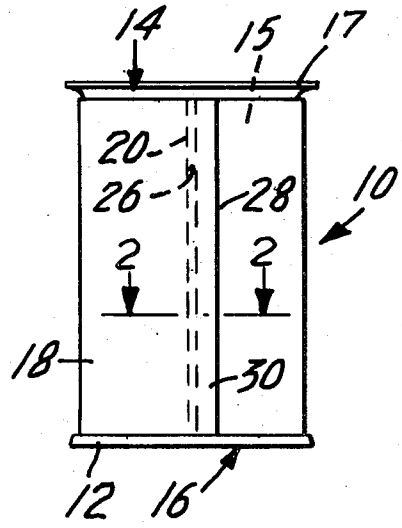


FIG. 1

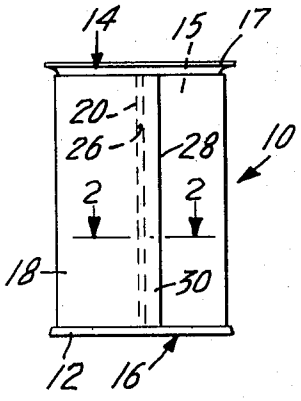


FIG. 2

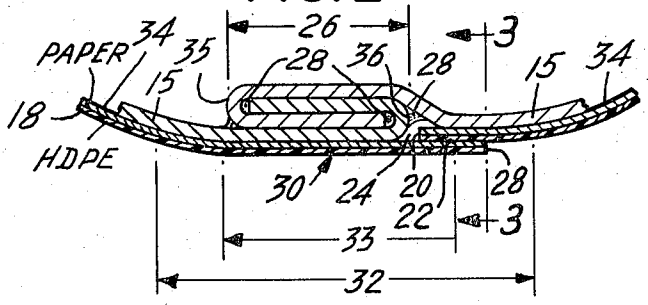


FIG. 4

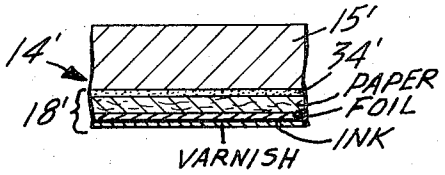


FIG. 3

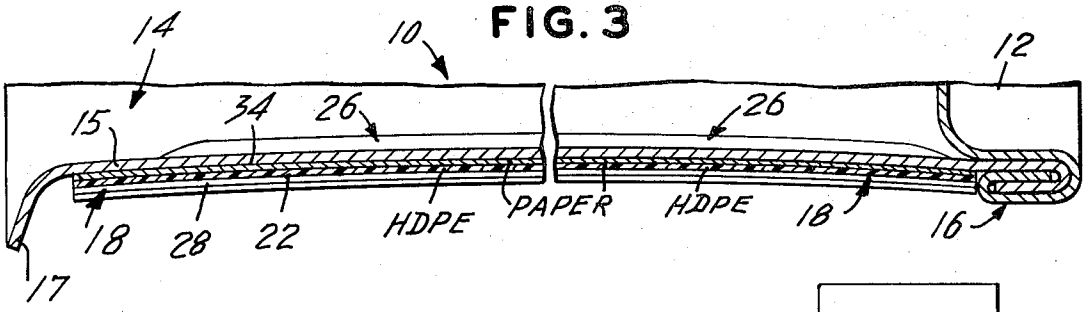
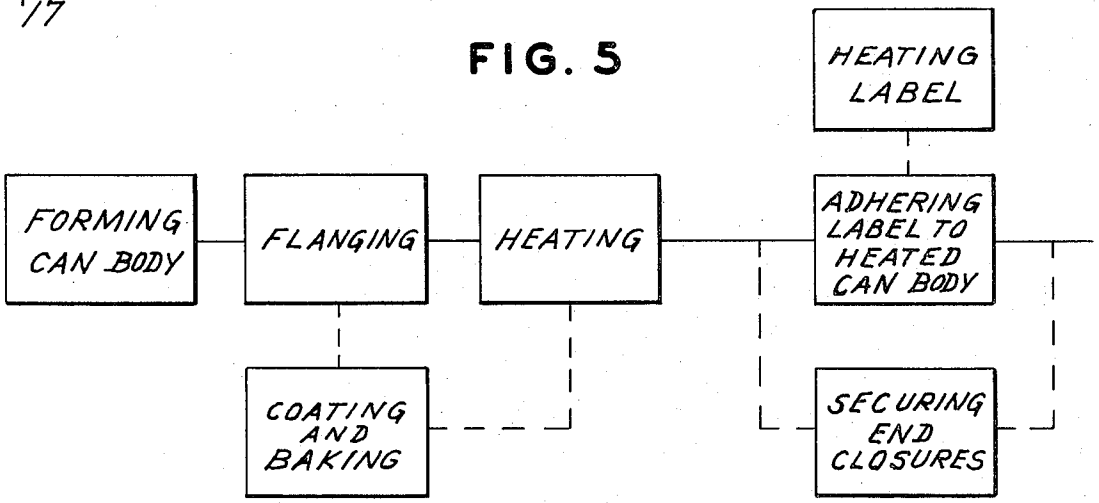


FIG. 5



LABELED SIDE-SEAMED CAN BODY

BACKGROUND OF THE INVENTION

This invention relates to metal can bodies and has particular reference to side-seamed metal can bodies having paper-based wrinkle-free labels substantially 100% bonded thereto.

Presently, most side-seamed containers, for example soldered, threepiece aerosol cans, are decorated by lithographing tinplate body stock prior to cutting it into individual body blanks for subsequent formation and soldering into cylindrical can bodies.

Conventional lithographic processes include cutting the metal into sheets, applying at least an inside coating to these sheets and baking. The precoated sheets are then printed with metal litho inks, using offset lithography. Such inks are transferred by an offset process to the exterior of the tinplate sheet. Only one or two colors can be applied per pass of a sheet through such offset lithography equipment, so that, for instance, a five color label would require three to five passes through the lithography equipment and its attached sheet-baking oven. The final step in the process is the application of a varnish on top of the ink to protect it from scuffing and to provide the can with satisfactory mobility for subsequent handling. The decorated sheets are then slit into individual body blanks, with care being taken to do the slitting in precise register with the placement of the lithography on the sheet, and this lithography, in turn, in register with the coating outline on the inside of the sheet. With soldered cans, it is also necessary to cut back the lithography from the edges of the body blank which are to be formed into a lock and lap type seam, in order that they will not interfere with the soldering operation. Thus, when the can has been formed into a body, despite the interfolding of the edges of the body blank there is still approximately three-quarters of an inch of bare, unlithographed metal showing at the side seam area of the container which destroys the continuity of the lithography and makes the appearance of the container less than completely satisfactory. An additional problem stems from what is referred to in the art as the side seam bow, which is a direct result of the process wherein, due to the application of heat and compressive forces during mechanical forming, the ends of the flat metal sheet which are joined to form the side seam are flattened and distorted, resulting in a further unappealing aspect at the side seam. In addition, excess solder is not always completely wiped from the side seam, and the rough, irregular appearance of the excess material also contributes to unsightliness. If the solder wiping pressure is too great, all of the tin can be removed from parts of the side seam, and an unsightly dark appearance will occur.

There are other basic disadvantages of conventional metal lithographic processes that relate to the appearance and performance of the container. First, offset lithography is limited to screens of a relatively low number of lines, whereas rotogravure printing, used on film labels, can produce finer screen work. Second, in printing individual sheets at relatively high speeds and applying colors one or two at a time, it is difficult to maintain consistent depth or shading of colors or registration between colors so that spoilage increases with the number of colors or trips through the printer. These problems become so severe that six and seven color metal litho designs are virtually unknown in commercial metal containers. The many handling steps of the metal sheets through many printing presses and wicket ovens tend to bend, dent, or damage the edges of the sheets and further make the can-making process more difficult. Finally, the thin coat of varnish applied over the litho ink is so thin that it is often subject to scratching and damage in both the can-making operation and subsequent handling. In spite of the disadvantages expressed above, in general, metal lithography has become well accepted in the trade, because it is more resistant to damage than its less commonly used alternative, which is application of a loose, spot-adhered paper label to the can after it has been packed.

The disadvantages of such conventional, loosely adhered paper labels are obvious. Such labels are easily torn or damaged, are generally hygroscopic, permit easy corrosion of the metal bodies of the containers, and can only be applied after the cans have been filled and subjected to sterilization, pasteurization, can warming and other wet processes, since such treatments usually serve to remove or impair the appearance of any label applied prior to such steps.

The film labeling system involved in this invention provides better aesthetics, a greater variety of substrates and decorative effects than can be achieved through conventional metal lithograhy, and presents substantial advantages in the quality of printing. First, there is a choice of printing methods, which include rotogravure and flexographic methods in addition to offset printing. The system involves printing continuous webs of paper-based films instead of individual sheets of metal, which allows the achievement of higher speeds, multiple color application and better registration. A paper and film printing rotogravure line, web fed, for instance, would consist of six or seven color decks, followed by a varnish deck, with drying facilities between each deck in the line. Thus, a seven color label could be printed and varnished in a single pass through such a line.

A major advantage of film labeling over metal lithograhy is that it allows a choice between several different printing methods, depending on the size of the job and the quality and number of colors desired. Rotogravure printing allows the use of finer screens and maintains closer color tolerances, that is, less color variation from image to image, and this technique is highly suitable for long runs. Flexographic printing does not allow fine screen work but is ideal for short runs. Offset lithography falls somewhat between these extremes.

Today, one of the most important advantages for a film labeling system is the fact that the film label material can be printed in a central location with minimum problems of air pollution from the use of solvents. At the can-making location, the printed film labels are received in large rolls, and there are no solvent fumes emitted from the entire decorating operation at the can-making plant. This can be contrasted with the need for fume incinerators or other solvent disposal means in connection with the use of metal decorating inks and varnishes at each individual metal can plant for conventional lithography.

The labels themselves can have varnish or plastic film on top of the ink for better scuff resistance, and label changing becomes a much simpler operation wherein it is possible to change one roll of preprinted stock for another in a few minutes without substantially interrupting the production flow in the can line. Label

changes are particularly important with carbonated beverage containers, where there are many different flavors, and also many aerosol product lines.

In view of the above, it is an overall object of this invention to provide a film labeling system for decorating side-seamed metal can bodies that retains the advantages of film labeling, and that is an effective alternative to conventional lithography, including its advantages but not its disadvantages.

In the art of decorating can bodies, the side seam area has presented major problems. One is the unsightliness of the side seams of lithographically decorated cans due to their aforementioned exposed bare metal and grey strip of wiped solder.

Efforts to overcome this problem include applying predecorated film labels with adhesive over their entire back surface to the can bodies. This has not heretofore been satisfactory because wrinkles appear in the label adjacent to the side seam. Such wrinkles not only are unsightly, but they allow moisture to collect in air pockets under the label. This aggravates the unsightliness, for example, by discoloring the label and causing it to lift off of the can body. This problem is, of course, acute with paper based labels. Attempts to make the labels water-resistant by forming them of non-stretchable thermoplastic and other such water-resistant materials have not been successful, since the wrinkles still occur at the side seam, adhesion there is poor, and lift-off still occurs. Non-stretchable films are desirable, since they are dimensionally stable under tensions of web printing and registration cutoff operations. Such films are also easier to handle through the steps of feeding, positioning to registered printed indicia, and positioning for cutting prior to bonding the label to the can body wall. Cutting is also easier with non-stretchable film.

In the bonding of non-stretchable film labels having adhesive over their entire back surfaces, it has now been discovered that the problem of wrinkling at the side seam is mainly due to irregular physical characteristics of the side seam area. It is not cylindrical like the rest of the can body wall because, for example, it is circumferentially flattened and is inwardly bowed as it extends axially from top to bottom ends of the can body wall. The significance of the bow, flat and other irregularities such as projections of solder, welding flash and side seam cement was not previously recognized. Conventionally, when a film label is applied to the can body, its leading edge is usually applied to a non-side-seamed wall portion of the can. As the label is progressively wrapped around and eventually adheringly anchored to the axially straight cylindrical can body wall at the axial edge of the side seam, the label, being axially anchored at the edge of the side seam, cannot stretch and conform to the side seam's axially bowed, and circumferentially flattened contour. Usually, only the top and bottom edges of the label are adhered to the top and bottom portions of the can body wall, which are least bowed. The more axially central portions of the label cannot stretch radially inward to sufficiently contact and be permanently adhered to the most aggravated portions of the side seam bow. Labels made with fairly stiff thermoplastic materials desirable for scuff resistance, such as polyethylene terephthalate and vinylidene chloride polymer-coated cellophanes and other stiff labels such as those containing paper and/or foil, tend to spring back when forced radially inward to the contour of the side seam bow. Such labels are difficult to adhere to the contours of side seam bows, especially in high speed can manufacturing lines. Resulting poor adhesion, wrinkles, air pockets, etc., at the side seam precluded application of such labels to can bodies, for example, to cans of pressurized products such as aerosol, beer and carbonated beverages, until after such cans were filled and immersed in water baths.

Heretofore, the only known method of applying a wrap-around, non-stretchable label to a cylindrical side-seamed can body in a wrinkle-free manner, was to employ a non-adhesive-backed label. The leading edge of this label was spot-adhered to the can body wall and the main body of the label was wrapped tightly thereabout, especially around the circumferentially slightly larger top and bottom ends thereof. The trailing edge was spot-adhered, and because the main body of the label was not adhered at all and did not conform to the contours of the can body wall, especially its bow, water could easily flow under the label and cause it to soften, pucker and otherwise render it unsightly and unmanageable. Thus, there has been no known commercial or other instance wherein a side-seamed can body could be labeled before it was subjected to water baths such as exacting aerosol water bath tests of 160° F for 5 minutes, pasteurization baths of 140° F for 20 minutes, or pre-sterilized beer and soft drink can warming baths of 90°F for 5 minutes.

It has been found that the aforementioned problems are overcome and side-seamed can bodies with paper-based labels substantially 100% bonded thereto, water-resistant, and wrinkle-free adjacent their side seam areas, can be provided when the leading edge of the label is placed within the side seam area, bow or flattened surface area, and the trailing edge is lapped thereover with the overlapped portions of the label being within the side seam area of the can body wall.

Accordingly, it is a primary object of this invention to provide a side-seamed metal can body having a wrinkle-free, water-resistant, paper-based film label substantially 100% bonded thereto.

Another primary object of this invention is to provide a labeled side-seamed metal can body wherein the paper-based label is wrinkle-free at the side seam area.

Another primary object of this invention is to provide the aforementioned labeled can body wherein the label is opaque and hides the side seam area.

Another object of this invention is to provide the aforementioned labeled can body wherein the label hides the irregular physical characteristics at the side seam area.

Another object of this invention is to provide a side-seamed can body having a non-stretchable water-resistant, wrinkle-free side-seam-hiding paper-based film label substantially 100% bonded thereto.

Another object of this invention is to provide a side-seamed metal can body having a non-stretchable water-resistant wrinkle-free side-seam-hiding paper-based film label substantially 100% bonded thereto, wherein the labeled can body has the ability to withstand a water bath test of 160° F for 5 minutes.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side view of an embodiment of a labeled metal can body of this invention.

FIG. 2 is an enlarged section taken substantially along line 2—2 of FIG. 1.

FIG. 3 is an enlarged fragmentary section taken through a length of can body wall substantially along line 3—3 of FIG. 2.

FIG. 4 is an enlarged fragmentary section as would be taken through the wall of another embodiment of the can body of this invention.

FIG. 5 is a schematic view showing a method of forming the labeled metal can body of this invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawing in detail, FIG. 1 is a labeled, empty, open-ended, cylindrical, side-seamed, flanged metal can body, generally designated **10**, having end closure **12** secured to the bottom of can body **14**, as by a conventional double seam **16** (FIG. 3), having a flange **17** at the upper open end, and having film label, generally designated **18**, adhered to substantially the entire circumference of can body wall **15**. Film label **18** has a leading edge **20** positioned parallel to the central axis of can body **14** and to side seam juncture generally designated **24** (FIG. 2) of a side seam generally designated **26**. Label **18** also has a trailing edge **28** and an adjacent trailing marginal edge portion **30** which overlaps and is adhered to underlying leading marginal edge portion **22** (FIG. 2).

FIG. 2 is an enlarged section taken substantially along line 2—2 of FIG. 1 and shows a portion of locked side seam **26** secured by means of solder **28**. Label **18** is adhered to substantially the entire exterior surface of the body wall **15** by adhesive **34** which also secures trailing marginal edge portion **30** to underlying leading marginal edge portion **22**. The embodiment of label **18** shown in FIG. 2 comprises adhesive **34** and a base layer opaque composite of white water-resistant paper, PAPER, and a water-resistant overcoat of high density polyethylene, HDPE. FIG. 2 shows that wall **15** of can body **14** is not perfectly cylindrical since, for one thing, it has a generally flattened surface area **33** within side seam area generally designated **32**. For purposes of this invention, the side seam area, here **32**, is that portion of the exterior surface of a can body wall that is within about ½ inch to either side of the side seam juncture, here generally designated **24** and particularly designated **36**. The side seam area is intended to include within its bounds or margins any solder, weld flash, cement or other side-seaming, joining, working and treating materials which occur as physical irregularities such as projections on the wall surface, — any side seaming, joining or working effects such as junctions and indentations, — or any such or other unsightlinesses such as discolorations, e.g., the strip of wiped solder adjacent soldered side seams. The side seam area includes within its bounds, the side seam bow, if any, defined as that portion of the can body wall within the side seam area, that is radially inwardly bowed substantially from top to bottom ends of the can body wall, — the flattened wall surface area or areas, if any, which run alongside the side seam juncture and, such as herein depicted, the flattened surface **33** extends circumferentially from adjacent one side of side seam **26** to adjacent the other, i.e., from adjacent the rounded end of U-shaped inner fold **35** to adjacent section line 3—3 to the right of side seam juncture **36**, — the side seam itself, defined as the joined, overlapped or folded portions of the can body wall, — and the side seam juncture, generally defined as and usually being an axial line formed on the exterior surface of the can body wall where opposing wall portions meet, and more particularly defined as the exterior fold, here **36**, of locked wall portions of locked and of locked and lapped side seams, and as the exterior edge of the overlap for lapped and skived side seams. In FIG. 2, the overlapped marginal edge portions of label **18** are shown covering the side seam area **32**, flattened surface area **33**, and, for example, any strip of wiped side seam solder or other physical irregularities that appear therein. As will be explained, this overlap need not cover the entire side seam area, but it should be therewithin.

FIG. 3 is an enlarged fragmentary view taken axially through body wall **15** substantially along line 3—3 of FIG. 2. More particularly, FIG. 3 shows that labeled can body **10** is radially inwardly bowed from top to bottom ends of body wall **15**. FIG. 3 also shows end closure **12** secured to container body wall **15** by double seam **16** and shows a cross section of leading marginal edge portion **22** and an end view of trailing edge **28**. Label **18** comprises a base layer and an adhesive layer **34** which adheres the label to body wall **15**. The particular embodiment of label **18** shown in FIG. 2 is a non-stretchable, water-resistant opaque composite base layer of white, low-wick, water-resistant paper overcoated with a high density polyethylene, HDPE. The adhesive **34** is a quick-tack hot-melt selected from the group consisting of a wax material and an ethylenic acidic polymer.

FIG. 4 is an enlarged fragmentary section as would be taken through another embodiment of the labeled can body of this invention. FIG. 4 shows a labeled can body **14'**, its metal body wall **15'** having a label, generally designated **18'**, bonded thereto by adhesive **34'**. In this embodiment, label **18'** comprises a base layer composite of kraft paper-backed foil having printing on the foil and being overcoated with a rapid-curing oleoresinous coating material such as a thermosetting varnish.

FIG. 5 is a schematic view showing basic steps involved in the method of forming the labeled, cylindrical, side-seamed, metal can body of this invention.

In the usual manner of forming an empty side-seamed cylindrical metal can body having a locked side seam, a conventional bodymaker machine forms hooks on two ends of the body, bends the body about the mandrel, interlocks the hooks and bumps or presses them tight into a locked seam. The formed and locked can body is then conveyed over a roll revolving in a pot of molten solder which applies solder to the locked seam. The locked seam remains in contact with the roll until the seam is brought up to a temperature beyond the melting point of the solder, and excess solder is brushed or wiped off along the length of the side seam. This leaves a grey unsightly strip of wiped solder on the external wall of the can body, which is then sometimes sprayed with an organic coating to protect the solder, for example, from being rubbed off on rails during the rest of the can manufacturing operation. It is this heat and bumping action which causes the side seam area to bow radially inwardly and to be flattened axially from top to bottom ends of the can body wall.

Interior and/or exterior surfaces of the flanged or unflanged can bodies need not but can be coated and the coatings baked, although any coating thereof must be effected before labeling since temperatures employed for curing the coating greatly exceed the tackifying

temperature range of the adhesive and would impair adherence of the label to the can body wall. Commonly, formed and seamed can bodies are flanged just after they leave a bodymaker machine and their interior surfaces are spray-coated with product-protective organic materials and cured in ovens heated to about 400° F and higher.

The flanged and coated can body is then heated to a temperature within the tackifying temperature range of the quick-tack, hot-melt adhesive on the undersurface of the base layer of the label. Heating the can body activates the adhesive on the label so that the label adheres to the can body when they are brought into contact with each other. The tackifying temperature range may vary with the adhesive. For example, the range of the ethylenic acidic polymer adhesive is from about 195°–210°F. Generally speaking, the lower temperature value of the range must be high enough to obtain good, substantially 100% adhesion in the time allowed, and the higher temperature of the range must be low enough that the adhesive is not too fluid or soft and causes skating, or separation or unraveling of the overlap, also in the time allowed. When the time allowed is very short, usually substantially less than one second for high speed can lines, besides heating the can body, it sometimes is advantageous to also heat the adhesive on at least one or both marginal edge portions of the label, to the tackifying range of the adhesive, prior to or as the label is being applied to the heated can body. Heating the marginal end portions is advantageous when short dwell times do not allow enough time for can heat to penetrate the underlying leading marginal edge portion of the label and activate the adhesive on the overlapping marginal edge portion of the overlap.

The step of heating the can body for labeling can be effected by curing ovens during the curing step, or if curing heat is not employed, any conventional heating means such as a separate recirculating hot air oven can be employed. Heating of marginal edge portions of labels during high speed can manufacturing can be effected by any suitable means such as a closely applied gas burner.

The heated, or unheated, film label, which is bonded to substantially the entire circumference of the heated can body, can be supplied from any source, preferably from a roll or web, and when applied, is cut to a dimension that provides it with leading and trailing edges and allows it to cover the exterior can body wall surface within say about 1/64 inch to 1/32 inch of its top and/or bottom ends for cans with assembled end closures, such as aerosol cans, and within about 1/32 inch from start of each flange radius for open-ended cans.

In accordance with this invention, the film label is adhered to the can body by positioning and adhering the leading edge of the label parallel to the central axis of, and within the side seam area 32 of the can body wall. The side seam area as previously defined extends circumferentially about ½ inch to either side of the side seam juncture. The trailing marginal edge portion of the label should be lapped over and adhered to the underlying marginal edge portion of the leading edge so that the overlap is within the side seam area. When the side seam area includes a side seam bow and/or flattened surface area, the leading edge should be positioned and adhered therewithin. Although the bow and flattened surface of most side seams usually only extend from ¼ to ½ inch to either side of the juncture, they may extend further, and it is to be noted that this invention encompasses such situations. The aforementioned positioning and adhering of the leading edge of the label meets a primary objective of the invention by providing an opaque, paper-based label that is water-resistant and wrinkle-free, especially at the side seam, and the label's opacity meets another primary objective, that of hiding the hereinbefore mentioned side seam irregularities and unsightlinesses. For economic reasons, the length of the overlap in the side seam area is usually kept to the minimum that will obtain the adhesion and water resistance herein desired. Usually the minimum overlap is about 3/16 to ⅜ inch. Preferably, it is about 5/16 inch.

Though the overlap is to be positioned within the side seam area, some overlap beyond the side seam area is tolerable when it does not unduly impair the objectives of this invention. The leading edge can be positioned anywhere within the side seam area. It can be positioned adjacent one margin of the area so that the leading marginal edge portion covers the side seam juncture, or a substantial portion of, or the entirety of the side seam area.

It has been found that positioning and adhering the leading edge of the label within the side seam area according to this invention is the only way that substantially 100% bonded non-stretchable film labels can be applied to metal can bodies with irregularly contoured side seams without having wrinkles in the label at the side seam area. Starting, for example, with the leading edge in the side seam bow allows the label to bend and conform to the contour of the bow because no other portion of the non-stretchable label is already anchored to the can body. Contrastingly, conventionally, when the leading edge of such a label is applied to another portion of the can body and the label is progressively wrapped around and eventually adheringly anchored to the axially straight cylindrical can body wall at the axial edge of the side seam, the label, being axially anchored at the edge of the side seam, cannot stretch and conform to, for example, the inwardly bowed and/or circumferentially flattened surface area of the can body wall. Usually, only the top and bottom edges of the label are adhered to the least bowed top and bottom portions of the can body wall, but the more axially central portions of the label cannot stretch inwardly sufficiently to contact and be permanently adhered to the most aggravated portions of the side seam bow. Labels made of fairly stiff materials desirable, for example, for scuff resistance, such as polyethylene terephthalate, tend to spring back when forced radially inward to the contour of the side seam bow. Such labels are especially difficult to adhere to side seam bows in high speed short dwell times. Such inadequate adhesion at the side seam area causes air bubbles and pockets which collect water during water bath tests, such as for aerosol cans, and lift the label from the can and otherwise destroy its aesthetic qualities.

Once having positioned and adhered the leading edge of the label as desired within the side seam area, the adhesive side of the label is wrapped around and progressively adhered to substantially the entire circumference of the can body, and the trailing marginal edge portion of the label is lapped over and adhered to an underlying leading marginal edge portion in one of the aforementioned manners.

In applying the label to the heated can body, it has been found advantageous to employ means such as a pad or roller which provides sufficient resiliency and pressure to adhere substantially the entire marginal edge portions of the label to each other and to, for example, the bowed, flattened wall portions of the side seam area.

The can bodies labeled in accordance with this invention need not have an end closure secured to one or both of their ends. End closures can be secured to the body at any time; for example, for aerosol cans, satisfactory results have been obtained by securing them before as well as after the label adhering step.

For orienting the container side seam for positioning and adhering the leading label edge within the side seam area any suitable means can be employed, though it has been found advantageous to employ the apparatus disclosed in U.S. Pat. application Ser. No. 318,887, filed on Dec. 27, 1972, and assigned to the assignee of the subject invention. The apparatus therein disclosed orients can bodies by subjecting them to a pressurized fluid such as air at a volume sufficient to buoy the bodies and for a time sufficient to allow gravity to orient their side seams in a specific downward position.

The non-stretchable film labels which can be adhered to substantially the entire circumference of cylindrical side-seamed metal can bodies according to this invention are comprised of a base layer and an adhesive layer. The base layer can be a material selected from the group consisting of an opaque composite whose first layer is selected from the group consisting of a white water-resistant paper, and paper-backed foil, and whose second layer is a water-resistant overcoat selected from the group consisting of polyethylene having a density above about 0.940 grams per cc., polypropylene and a rapid-curing oleoresinous material.

The base layer includes at least one non-stretchable material such as vinylidene chloride polymer-coated cellophane. Though such materials, which can be employed in the film label of this invention, especially thin layers thereof, are inherently stretchable to some small extent, non-stretchable here means that they will not stretch enough naturally and without being specially treated or oriented, to conform and be adhered to the side seam area, for example, its bow, without wrinkling. The polyethylenes are commonly referred to as medium and high density polyethylenes. Those of high density in the range of about 0.950 to 0.960 grams per cc. are preferred. A desirable vinylidene chloride polymer-coated cellophane is commonly known as Saran-coated cellophane, sold under the trade designation K-Cello, and is manufactured by E. I. Du Pont de Nemours and Company.

The rapid-curing oleoresinous material can be any of the suitable thermosetting varnishes such as alkyd resin materials which are reaction products of (1) oils, such as linseed, soybean, coconut, castor, cottonseed, etc., or oils of converted fatty acids, and phthalic anhydrides modified by melamine or urea formaldehyde resins and dissolved in organic solvents. The coatings are usually activated by acid catalysts to decrease curing times. Examples of commercially available curing-type alkyd resins are sold under the trade designation Sparklenes, manufactured by Morton Chemical Company, and Crystophanes, manufactured by Inmont Corporation.

Water-resistant papers employable as the first layer of the opaque composite base layer of the film label employable in the method of this invention, are dense, highly water-repellant papers such as those heavily sized with rosins such as reaction products of an abietic acid and a fatty acid. An example of such a water-resistant paper found highly desirable for this invention is that sold under the trade designation Code Number CGSH72AW, and manufactured by Consolidated Paper Company. The water resistance of this paper is indicated by the fact that a 0.001 to 0.005 inch thick, 2 by 4 inch sheet of the paper wicks less than 1/32 inch when ¾ inch of the sheet is inserted in 70° F distilled water for about ½ hour, when ambient humidity is about 55%. This means that the observable wet line formed by water being drawn by capillary action up into the previously dry portion of the sheet is less than 1/32 inch above the water surface. The water-resistant papers employable in the opaque composite are those which wick less than 1/32 inch under the aforementioned conditions.

Any suitable paper-backed foil can be employed as the first layer of the opaque composite base layer of this invention. Kraft paper-backed foil is a suitable material that is commercially readily available. Its overall thickness need not be but usually is about 0.0025 inch. The kraft paper portion thereof is a strong, brownish paper made by the well-known kraft paper process. The kraft paper helps prevent the foil from wrinkling during processing of the overall film label and during its application to the can body. The foil portion can be any suitable metallic foil such as aluminum foil. It is opaque, is an excellent moisture barrier and can provide a decoratively desirable mirror-like surface, more shiny and more aesthetically advantageous than a duller, less uniform can body wall surface, as when it appears through a transparent or non-printed portion of a design of an overlying layer.

The wax material can be any suitable wax-based adhesive. Preferably, it comprises about 35% by weight of a petroleum wax, preferably an intermediate grade, about 40% by weight ethylene-vinyl acetate copolymer and about 25% by weight of a mixture of ethylene-vinyl acetate copolymer, terpene tackifier and rosin ester resin. The prefered tackifying range of this wax material is from about 195°–210°F.

The ethylenic acidic polymer adhesive includes ethylene acrylic acid copolymers believed disclosed in U.S. Pat. No. 3,239,370 assigned to The Dow Chemical Company, and zinc-neutralized ionic copolymers of ethylene and α,B-ethylenically unsaturated carboxylic acids, commonly known and sold under the trademark "Surlyn" by E. I. Du Pont de Nemours and Company. Methods of preparing Surlyn ionic copolymers and their properties are believed disclosed in U.S. Pat. No. 3,264,272, filed on Apr. 8, 1963 and assigned to "Du Pont." The tackifying range of the ethylenic acidic polymer adhesives is believed to be from about 185° to 250° F. For high speed can manufacturing and labeling lines wherein labels are applied to cans in less than one second at from about 175 to as high as 800 cans per minute, the adhesive must adhere without slippage to the heated can body in the aforementioned less than 1 second. The adhesives must have a melting point above 160° F, since, as will be explained, labels applied to cans used for packaging aerosol products, beer and carbonated beverages, must be sufficiently moisture or water resistant to maintain their adhesion to can bodies at temperatures ranging, for example, for aerosol cans,

up to about 160° F. The adhesives can be applied to the base layer of the film label in any conventional manner. The wax materials can, for example, be applied in liquid form to patterned rotogravure cylinders and then to the base layer which is then passed over a heated smoothing bar. The ethylenic acidic polymer adhesives can be extruded on the base layer material. When the label comprises polymer-coated cellophane and an overcoat, the adhesive employed must be compatible with the overcoat to provide proper adhesion at the label overlap. It is understood that the ethylenic acidic polymer adhesives can be employed where necessary to adhere respective layers of film label together. For example, the ethylene acrylic acid copolymer can be used to adhere the paper-backed foil and polyethylene layers of the composite base layer together. A polyethylene imine adhesive can be used to adhere the water-resistant paper layer to a polyethylene overcoat.

Base layers of this invention which are opaque or pigmented can be printed on their upper surfaces, and clear layers applied thereover, such as polyethylene, can be reverse printed on their under-surfaces, for example, to obtain maximum scuff protection. Although any suitable conventional printing ink can be employed, the inks must be compatible with their substrates and adjacent materials, and must not impair adhesion of the label to the can body or to itself at the overlap. It is often desirable to provide non-printed areas in clear overcoats to allow show-through of bright shiny body wall surface areas.

The overall thickness of the film label of this invention can be any suitable thickness. It need not be, but generally is, less than about 0.0035 inch, preferably less than about 0.00325 inch thick. Satisfactory results can be obtained with a label whose adhesive layer is about 0.0012 inch thick and whose base layer composite has a polymer-coated cellophane layer of about 0.00125 inch thick and a polypropylene layer of about 0.00075 inch thick; with a label whose wax material adhesive is about 0.001 inch thick, whose first layer of its opaque composite is a water-resistant paper of about 0.0015 inch thick, and whose high density polyethylene overcoat (having printing of negligible thickness on its under-surface) is about 0.0005 inch thick; and with a label whose wax material adhesive is about 0.001 inch thick and whose first layer of its opaque composite includes kraft paper-backed foil which is about 0.0025 inch thick (the foil portion being about 0.0003 inch thick), and whose overcoat of high density polyethylene is about 0.0005 inch thick, or whose overcoat of a thermosetting varnish is about 0.0001 inch thick.

The empty cylindrical metal can bodies to which the film labels can be bonded can be any metal side-seamed can bodies having the hereinbefore described and defined side seam areas which would cause non-stretchable labels to wrinkle at the side seam areas. Cylindrical here means essentially cylindrical, since, for example, the bow and flat are non-cylindrical.

The labeled metal can body of this invention has exceptional water resistance due to the combination of the water resistance of the exterior layer of polyethylene, the overcoat, the vinylidene polymer-coated cellophane, the water-resistant paper or paper-backed foil, the wax and ethylenic acidic polymer adhesive, and the wrinkle-free, substantially 100% bond achieved by the method of placing the leading edge of the label and the overlap within the side seam area.

The excellent water resistance of the labeled can bodies of this invention is demonstrated by their ability to withstand various heated water bath tests. This renders the labeled can bodies especially suitable for packaging aerosol products, beer and carbonated beverages, since the bodies when filled and secured, in the former instance, can withstand the 5 minute 160° F water bath needed to bring aerosol contents up to 130° F as federally required to identify leakers and potentially explosive containers. In the latter instance, they withstand the 140° F, 20 minute beer pasteurization water bath test, and the 90° F, 5 miniute pre-sterilized beer and soft drink can warming test.

That the labeled side-seamed can bodies of this invention provide a significant improvement in water resistance over the prior art is shown in the table below:

TABLE I

Can No.	Label Materials	Extent of Adhesion	Results of 5 min. 160° F Water Bath
1.	Polyethylene Kraft paper Wax-based adhesive	Substantially 100%	Water seeped in behind label at the side seam; paper absorbed water, swelled, blistered and puckered at the side seam.
2.	Thermoset varnish Conventional printable paper Wax-based adhesive	Substantially 100%	Wickage was: ½ inch at bottom, and ½ inch at overlap.
3.	Polyethylene Water-resistant paper Wax-based adhesive	Substantially 100%	No detectable wickage.
4.	Thermoset varnish Kraft paper-backed foil Aqueous casein adhesive	Loosely adhered by spaced, vertical rows of 8 dots.	1 inch wickage per minute at all edges.
5.	Thermoset varnish Kraft paper-backed foil Wax-based adhesive	Substantially 100%	No detectable wickage.
6.	Polyethylene Glassine Wax-based adhesive	Substantially 100%	Wickage of entire label.

The water bath test of Table I involved filling labeled cans with 70° F tap water and immersing the cans in a 160° F water bath for 5 minutes until the tap water contents reached 130° F. The labeled cans were removed

from the bath after the five minutes and immediately visually examined. All cans had soldered side seams. Except for can No. 4, all cans were for aerosol products and were made of uncoated, double cold-reduced electrolytic 55 lb. tinplate. Can No. 4 was a 3-piece, soldered, 16 ounce lithographed beer can having a spot adhered label thereover. All polyethylenes were of a high density.

Table I shows that whereas cans No. 3 and No. 5 had no detectable wickage and were aesthetically completely satisfactory, prior art cans No. 1, No. 2, No. 4 and No. 6 failed the water bath tests, had severe wickage, blister and pucker problems, and were aesthetically totally unacceptable. They also were unacceptable under commercial can handling standards, because wherever a label is wicked, the label scuffs, tears, and is abraded due to abuse of rails, transfer pockets, and automatic case packers as the can passes down the can processing line.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it is apparent that various changes may be made in the form, construction, and arrangement of the parts, without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the methods and materials hereinbefore described being merely preferred embodiments thereof.

What is claimed is:

1. A cylindrical side-seamed metal can body having a non-stretchable, wrinkle-free, water-resistant paper based film label bonded to substantially the entire circumference of the can body wall, which comprises:
   - a cylindrical side-seamed metal can body, the side seam area of the can body wall having an exterior surface which includes a side seam juncture, and
   - a non-stretchable, wrinkle-free, water-resistant paper-based film label bonded to substantially the entire circumference of the can body wall by a quick-tack hot-melt adhesive, the label being comprised of a base layer and an adhesive layer, the base layer being an opaque composite whose first layer is selected from the group consisting of a white water-resistant paper and paper-backed foil, and whose second layer is a water-resistant overcoat selected from the group consisting of polyethylene having a density above about .940 grams per cc., polypropylene and a rapid-curing oleoresinous material, the adhesive being selected from the group consisting of a wax material and an ethylenic acidic polymer, the label having a leading edge and a trailing edge, the leading edge being positioned parallel to the central axis of the can body within the side seam area and the trailing marginal edge portion being lapped over and adhered to the underlying marginal edge portion of the leading edge so that the overlap is within the side seam area.

2. The labeled can body of claim 1 wherein the water-resistant paper of the first layer of the opaque composite is treated for water-resistance by its fibers being coated by a rosin which is the reaction product of an abietic acid and a fatty acid.

3. The labeled can body of claim 1 wherein the water-resistant paper of the first layer of the opaque composite wicks less than 1/32 inch when a from 0.001 to 0.005 inch thick sheet thereof is immersed in 70° F distilled water for about ½ hour.

4. The labeled can body of claim 1 wherein the width of the overlap is from about 3/16 to ⅜ inch.

5. The labeled container of claim 1 wherein the label on the can body remains wrinkle-free and substantially 100% bonded to the can body when the labeled can body is subjected to a water bath of about 160° F for 5 minutes.

6. The labeled can body of claim 4 wherein the wax material adhesive comprises about 35% by weight petroleum wax, about 40% by weight ethylene-vinyl acetate copolymer, and about 25% by weight of a mixture of ethylene-vinyl acetate copolymer, terpene resin tackifier and rosin ester resin.

7. The labeled container of claim 4 wherein the ethylenic acidic polymer is a zinc-neutralized ionic copolymer of ethylene and an α,B-ethylenically unsaturated carboxylic acid.

8. The labeled can body of claim 1 wherein the leading edge of the label is positioned adjacent one margin of the side seam area, and the overlap covers the side seam juncture.

9. The labeled container of claim 1 wherein the overlap coincides with the side seam area.

10. The labeled can body of claim 1 wherein the overall thickness of the film label is no greater than about 0.0035 inch.

11. A cylindrical side-seamed metal can body having a non-stretchable, wrinkle-free, water-resistant paper-based film label bonded to substantially the entire circumference of the can body wall, which comprises:
   - a cylindrical side-seamed metal can body, the side seam area of the can body wall having an exterior surface which includes an inward bow and a side seam juncture within the bow, and
   - a non-stretchable, wrinkle-free, water-resistant, paper-based film label bonded to substantially the entire circumference of the can body wall by a quick-tack hot-melt adhesive, the label being comprised of a base layer and an adhesive layer, the base layer being an opaque composite whose first layer is selected from the group consisting of a white water-resistant paper and paper-backed foil, and whose second layer is a water-resistant overcoat selected from the group consisting of polyethylene having a density above about 0.940 grams per cc., polypropylene and a rapid-curing oleoresinous material, the adhesive being selected from the group consisting of a wax material and an ethylenic acidic polymer, the label having a leading edge and a trailing edge, the leading edge being positioned parallel to the central axis of the can body within the side seam bow and the trailing marginal edge portion being lapped over and adhered to the underlying marginal edge portion of the leading edge so that the trailing edge is also parallel to the central axis and is within the side seam bow.

12. The labeled can body of claim 11 wherein the water-resistant paper of the first layer of the opaque composite is treated for water-resistance by its fibers being coated by a rosin which is the reaction product of an abietic acid and a fatty acid.

13. The labeled can body of claim 11 wherein the water-resistant paper of the first layer of the opaque composite wicks less than 1/32 inch when a from 0.001 to 0.005 inch thick sheet thereof is immersed in 70° F distilled water for about ½ hour.

14. The labeled can body of claim 11 wherein the width of the overlap is from about 3/16 to ⅜ inch.

15. The labeled can body of claim 11 wherein the first layer of the opaque composite is water-resistant paper and the second layer overcoat is polyethylene having a density of from about 0.950 to 0.960 grams per cc.

16. The labeled can body of claim 11 wherein the first layer of the opaque composite is the paper-backed foil and the second layer overcoat is a rapid-curing oleoresinous material.

17. The labeled can body of claim 11 wherein the leading edge of the label is positioned adjacent one margin of the side seam bow, and the overlap covers the side seam juncture.

18. The labeled container of claim 11 wherein the overlap coincides with the area of the side seam bow.

19. The labeled can body of claim 15 wherein the wax material adhesive has a tackifying temperature range of about 195°–210° F and comprises from about 35% by weight petroleum wax, about 40% by weight ethylene vinyl acetate copolymer, and about 25% by weight of a mixture of ethylene vinyl acetate copolymer, terpene resin tackifier and rosin ester resin.

20. The labeled can body of claim 11 wherein the ethylenic acidic copolymer is a zinc ionized copolymer of ethylene and an α,B-ethylenically unsaturated carboxylic acid.

21. The labeled can body of claim 19 wherein the overall thickness of the film label is 0.0035 inch.

22. The labeled can body of claim 11 wherein the can body is empty and its top and bottom ends are flanged.

23. The labeled can body of claim 22 wherein the can body is for packaging carbonated beverages.

24. The labeled can body of claim 22 wherein the can body is for packaging beer.

25. The labeled can body of claim 22 wherein the can body is for packaging aerosol products.

26. The labeled can body of claim 11 wherein the can body is empty, is for aerosol products, and its top and bottom ends have end closures secured thereto.

27. The labeled can body of claim 11 wherein the label on the can body remains wrinkle-free and substantially 100% bonded to the can body when the labeled can body is subjected to a water bath of about 160° F for 5 minutes.

* * * * *