Description

This invention relates to a process for the production of labelled and/or lacquered aluminum cans.

It is more particularly concerned with an improvement in the procedure originally disclosed broadly in United States Patent Application Serial No. 057,129, and now embodied in our co-pending European Patent Applications No. 88 1 08669.8 now EP 0,293,820A and No. 92 2 03479.8 now EP 0 413 329A.

Both these European Applications form the background from which this invention has been developed, but for present purposes it is the latter which is the more directly relevant. Broadly speaking, the aforesaid Application No. 92 2 03479.8 is directed to a process for the production of aluminum cans to be used as beverage containers, in which the formed cans are cleaned with liquid acidic or alkaline cleaners to remove aluminum fines and other contaminants from at least the outside of said cans, the thus-cleaned cans are dried, and the dried cans are thereafter conveyed along a production line towards a station at which the thus-cleaned-and-dried cans are printed and/or lacquered, and in which so as to enhance the mobility of the cans along the production line one reduces the high coefficient of static friction of the dried exterior surface of the cans without preventing the adhesion of lacquer or printing ink thereto by applying to the exterior surface of the cans, before the last drying before the cans are printed and/or lacquered, a water-soluble organic surface conditioner so as to form a film of the latter on the exterior surfaces of the dried cans.

Besides the considerations which motivated the procedures of our earlier European Applications referred to above, it is also to be noted that the current trend in the can manufacturing industry is directed toward using, thinner gauges of aluminum metal stock. The down-gauging of aluminum can metal stock has caused a production problem in that, after washing, the cans require a lower drying oven temperature in order to pass the column strength pressure quality control test. However, lowering the drying oven temperature resulted in the cans not being dry enough when they reached the printing station, and caused label ink smears and a higher rate of can rejects.

Thus, it would be desirable to provide a means of improving the mobility of aluminum cans through single-filers and printers to increase production, reduce line jammings, minimize down-time, reduce can-spoilage, improve ink-laydown, and also simultaneously to enable lowering the drying oven temperature of washed cans, and it is indeed an object of this invention to provide means for overcoming the afore-noted problems.

We have now found that a lubricant and surface conditioner not only reduces the coefficient of static friction on the outside surface of the cans enabling a substantial increase in production line speeds, but it also provides a noticeable improvement in the rate of water film drainage and evaporation, resulting in savings due to lower energy demands while meeting quality control requirements, and indeed more specifically the lubricant and surface conditioner applied to aluminum cans after washing improves their water film drainage and evaporation characteristics to such an extent as to enable lowering the temperature of a drying oven by from about 14°C (25°F) to about 56°C (100°F) below the heretofore conventional oven-drying temperatures without having any adverse effect on the label printing process.

In high-speed aluminum can production the time available for drying each can as it passes through the drying oven is generally of the order of 3 minutes or less, and the conventional oven-drying temperature has heretofore been of the order of 227°C (440°F).

According to this invention there is therefore provided a process for production of labelled and/or lacquered aluminum cans which includes the successive steps of forming, washing, drying and labelling and/or lacquering said cans, and wherein before drying in an oven a lubricant and surface conditioner composition is applied to the surface of the washed cans so as to enhance the mobility of said cans along the production line, characterized in that oven-drying of said cans is effected for a conventional oven-drying period but at a lower-than-conventional temperature in the range of from 171°C to 213°C (340°F-415°F).

The application of a thin organic film to the outside surface of aluminum cans serves as a lubricant, imparting thereto a lower coefficient of static friction which consequently provides an improved mobility to the cans, and equally importantly it also increases the rate at which the cans may be dried and still pass the quality control column strength pressure test.

It has however been found that the improved mobility and drying rate of the cans varies with the thickness or amount of the organic film, and the chemical nature of the material applied to the cans.

The lubricant and surface conditioner for aluminum cans recommended for use in accordance with this invention may be selected from water-soluble alkoxylated surfactants such as organic phosphate esters; alcohols; fatty acids including mono-, di-, tri-, and poly-acids; fatty acid derivatives such as salts, hydroxy acids, amides, esters, ethers and derivatives thereof; and mixtures thereof.

The lubricant and surface conditioner for aluminum cans in accordance with this invention preferably comprises a water-soluble derivative of a saturated fatty acid such as an ethoxylated stearic acid or an

ethoxylated isostearic acid, or alkali metal salts thereof such as polyoxyethylated stearate and polyoxyethylated isostearate. In addition, the lubricant and surface conditioner for aluminum cans may comprise a water-soluble alcohol having at least about 4 carbon atoms and may contain up to about 50 moles of ethylene oxide. Excellent results have been obtained when the alcohol comprises polyoxyethylated oleyl alcohol containing an average of about 20 moles of ethylene oxide per mole of alcohol.

Further, the lubricant and surface conditioner for aluminum cans in accordance with this invention may comprise a phosphate acid ester or preferably an ethoxylated alkyl alcohol phosphate ester. Such phosphate esters are commercially available under the tradename Gafac PE 510 from GAF Corporation, Wayne, New Jersey, United States of America and as Ethfac 136 and Ethfac 161 from Ethox Chemicals, Inc., Greenville, South Carolina, United States of America. In general, the organic phosphate esters may comprise alkyl and aryl phosphate esters with and without ethoxylation.

The lubricant and surface conditioner for aluminum cans may be applied to the cans during their wash cycle, during one of their treatment cycles, during one of their water rinse cycles, or more preferably, during their final water rinse cycle. In addition, the lubricant and surface conditioner may be applied to the cans after their final water rinse cycle, i.e., prior to oven drying, by fine mist application from water or volatile non-inflammable solvent solution. It has been found that the lubricant and surface conditioner is capable of depositing on the aluminum surface of the cans to provide them with the desired characteristics. The lubricant and surface conditioner may be applied by spraying and reacts with the aluminum surface through chemisorption or physiosorption to provide it with the desired film.

Generally, in the cleaning process of the cans, after the cans have been washed, they are typically exposed to an acidic water rinse. In accordance with this invention the cans may thereafter be treated with a lubricant and surface conditioner comprising an anionic surfactant such as a phosphate acid ester. In such case, the pH of the treatment system is important and generally should be acidic, that is between about 1 and about 6.5, preferably between about 2.5 and about 5. If the cans are not treated with the lubricant and surface conditioner of this invention after the acidic water rinse, the cans are exposed to a tap water rinse and then to a deionized water rinse. In such event, the deionized water-rinse solution is prepared to contain the lubricant and surface conditioner of this invention which may comprise a nonionic surfactant selected from the afore-mentioned polyoxyethylated alcohols or polyoxylated fatty acids. After such treatment, the cans may be passed to an oven for drying prior to further processing.

The amount of lubricant and surface conditioner to be applied to the cans should be sufficient to reduce the coefficient of static friction on the outside surface of the cans to a value of about 1.5 or lower, and preferably to a value of about 1 or lower. Generally speaking, such amount should be of the order of from about 3 mg/m^2 to about 60 mg/m^2 of lubricant and surface conditioner to the outside surface of the cans.

For a fuller understanding of the invention, reference should be made to the following examples which are intended to be merely illustrative, and not limiting as to the scope of the invention.

Example I

This example illustrates the effect of the lubricant and surface conditioner of this invention on the water draining characteristics of aluminum cans treated therewith.

Aluminum cans were cleaned with acidic cleaner (Ridoline® 125 CO followed by Alodine® 404 treatment or Ridoline® 125 CO only) or with an alkaline cleaner solution (Ridoline® 3060/306 process), all the products being available from the Parker + Amchem Division, Henkel Corporation, Madison Heights, Michigan, United States of America, and then rinsed with deionized water containing about 0.3% by weight of the lubricant and surface conditioner recommended according to this invention. After allowing the thus-rinsed cans to drain for up to 30 seconds, the amount of water remaining on each can was determined. The same test was conducted without the use of the lubricant and surface conditioner. The results are summarized in Table below.

Table 1

Drain Time (sec)	Water Remaining (g/can)	
	DI Water	0.3% Conditioner
6	2.4 - 3.0	nd
12	2.1 - 3.5	2.8
18	2.2 - 3.4	2.3
30	1.8 - 3.4	2.3
[Note. The abbreviation "DI Water" stands for delonized water]		

It was found that the presence of the lubricant and surface conditioner caused the water to drain more uniformly from the cans, and that the cans remain "water-break" free for a longer time.

Example II

This example illustrates the effect of the oven dryoff temperature on the sidewall strength of aluminum cans. This test is a quality control compression test which determines the column strength of the cans by measuring the pressure at which they buckle. The results are summarized in Table 2.

Table 2

OVEN TEMPERATURE		COLUMN STRENGTH	
°C	(°F)	Kgm^{-2}	(PSI)
227	(440)	6.064×10^4	(86.25)
204	(400)	6.169×10^4	(87.75)
193	(380)	6.205×10^4	(88.25)
182	(360)	6.274×10^4	(89.25)
[Note. The abbreviation "PSI" (or "psi") stands for pounds per square inch]			

It can be seen from Table 2 that at an oven drying temperature of 193°C (380°F), a 1.406×10^3 Kgm^{-2} (2 psi) increase was obtained in the column strength test compared to the value obtained at 227°C (440°F) oven temperature.

The higher column strength test results are preferred and required because the thin walls of the finished cans must withstand the pressure exerted from within after they are filled with a carbonated solution. Otherwise, cans having weak sidewalls will swell and deform or may easily rupture or even explode. It was found that the faster and/or more uniform water film drainage resulting from the presence therein of the lubricant and surface conditioner composition of this invention makes it possible to lower

the temperature of the drying ovens and in turn obtain higher column strength results. More specifically, in order to obtain adequate drying of the rinsed cans, the cans are allowed to drain briefly before entry into the drying ovens. The time that the cans reside in the drying ovens is typically between 2 and 3 minutes, dependent to some extent on the line speed, oven length, and oven temperature. In order to obtain adequate drying of the cans in this time-frame, the oven temperature is typically about 227°C (440°F). However, in a series of tests wherein the rinse water contained about 0.3% by weight of the lubricant and surface conditioner, it was found that satisfactory drying of the cans could be achieved when the oven temperature was lowered first to 204°C (400°F), and then to 188°C (370°F), and dry cans were still obtained.

Claims

1. A process for the production of labelled and/or lacquered aluminum cans which includes the successive steps of forming, washing, drying and labelling and/or lacquering said cans, and wherein before drying in an oven a lubricant and surface conditioner composition is applied to the surface of the washed cans to enhance the mobility of said cans along the production line, characterized in that oven-drying of said cans is effected for a conventional oven-drying period but at a lower-than-conventional temperature in

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the range of from 171°C (340°F) to 213°C (415°F).

2. A process as claimed in claim 1, in which the surface conditioner composition applied to said can comprises a water-soluble organic material selected from the group consisting of an ethoxylated fatty acid, an alcohol having at least about 4 carbon atoms and containing up to about 20 mole of ethylene oxide per mole of alcohol, and an ethoxylated alkyl alcohol phosphate ester, said composition having a pH of between 1 and 6.5.

3. A process as claimed in claim 2, in which said alcohol is a polyoxyethylated oleyl alcohol containing an average of about 20 moles of ethylene oxide per mole of alcohol.

4. A process as claimed in claim 2, in which said ethoxylated fatty acid is selected from the group consisting of an ethoxylated stearic acid, an ethoxylated isostearic acid and alkali metal salt(s) thereof.

5. A process as claimed in any of claims 2 to 4, in which said organic material is applied to said can after said can has been washed.

6. A process as claimed in any of claims 2 to 4, in which said organic material is applied to said can during a treatment cycle for said can.

7. A process as claimed in claim 6, in which said organic material is applied to said can during the final water-rinse cycle after said can has been washed.

8. A process as claimed in claim 7, in which said treatment cycle is performed at a pH of between 1 and 6.5.

9. A process as claimed in claim 8, in which said treatment cycle is performed at a pH of between 2.5 and 5.

10. A process as claimed in any of claims 2 to 9, in which the amount of said organic material applied to said can is in the range of from 3 mg/m^2 to 60 mg/m^2 of said can surface.

Patentansprüche

1. Verfahren zur Herstellung von bedruckten bzw. etikettierten und/oder lackierten Aluminiumdosen, umfassend die aufeinanderfolgenden Stufen der Herstellung, des Waschens, Trocknens und Beschriftens und/oder Lackierens der Dosen, und worin vor dem Trocknen in einem Ofen ein Gleitmittel und eine Oberflächen-Konditionnier-Zusammensetzung auf die Oberfläche der gewaschenen Dosen aufgebracht wird, um die Beweglichkeit der Dosen entlang der Fertigungsstraße zu verbessern, dadurch gekennzeichnet, daß das Ofentrocknen der Dosen gemäß einer gebräuchlichen Ofentrocknungs-Zeitspanne durchgeführt wird, jedoch bei einer niedriger als gewöhnlichen Temperatur im Bereich von 171 °C (340 °F) bis 213 °C (415 °F).

2. Verfahren gemäß Anspruch 1, in welchem die auf die Dose aufgebrachte Oberflächen-Konditionnier-Zusammensetzung ein wasserlösliches organisches Material, ausgewählt aus der Gruppe bestehend aus einer ethoxylierten Fettsäure, einem Alkohol mit wenigstens etwa 4 Kohlenstoffatomen, der bis zu 20 Mol Ethylenoxid pro Mol Alkohol enthält, und einen ethoxylierten Alkylalkohol-Phosphatester umfaßt, wobei die Zusammensetzung einen pH-Wert von 1 bis 6,5 aufweist.

3. Verfahren gemäß Anspruch 2, in welchem der Alkohol ein polyethoxylierter Oleylalkohol ist, der durchschnittlich etwa 20 Mol Ethylenoxid pro Mol Alkohol enthält.

4. Verfahren gemäß Anspruch 2, in welchem die ethoxylierte Fettsäure ausgewählt ist aus der Gruppe bestehend aus einer ethoxylierten Stearinsäure, einer ethoxylierten Isostearinsäure und deren Alkalimetallsalz(en).

5. Verfahren gemäß irgendeinem der Ansprüche 2 bis 4, in welchem das organische Material auf die Dose nach dem Waschen der Dose aufgebracht wird.

6. Verfahren gemäß irgendeinem der Ansprüche 2 bis 4, in welchem das organische Material auf die Dose während eines Behandlungs-Zyklus für die Dose aufgebracht wird.

7. Verfahren gemäß Anspruch 6, in welchem das organische Material auf die Dose während des letzten Wasserwasch-Zyklus, nachdem die Dose gewaschen worden war, aufgebracht wird.

8. Verfahren gemäß Anspruch 7, in welchem der Behandlungs-Zyklus bei einem pH-Wert von 1 bis 6,5 durchgeführt wird.

9. Verfahren gemäß Anspruch 8, in welchem der Behandlungs-Zyklus bei einem pH-Wert von 2,5 bis 5 durchgeführt wird.

10. Verfahren gemäß irgendeinem der Ansprüche 2 bis 9, in welchem die Menge des organischen Materials, das auf die Dose aufgebracht wird, im Bereich von 3 mg/m² bis 60 mg/m² der Dosen-Oberfläche liegt.

Revendications

1. Procédé pour la production de boîtes en aluminium étiquetées et/ou vernies, qui comprend les étapes successives consistant à former, laver, sécher et étiqueter et/ou vernir les boîtes, et dans lequel avant le séchage dans un four on applique un lubrifiant et une composition de conditionnement de surface à la surface des boîtes lavées pour activer la mobilité de ces boîtes sur la chaîne de fabrication, caractérisé en ce que le séchage au four de ces boîtes s'effectue pendant une durée de séchage au four classique mais à une température inférieure à la température classique dans la plage allant de 171 °C (340 °F) à 213 °C (415 °F).

2. Procédé selon la revendication 1, dans lequel la composition de conditionnement de surface appliquée sur la boîte comprend un matériau organique hydrosoluble choisi dans le groupe constitué par un acide gras éthoxylé, un alcool ayant au moins environ 4 atomes de carbone et contenant jusqu'à environ 20 moles d'oxyde d'éthylène par mole d'alcool, et un phosphate-ester de l'alcool alkylique éthoxylé, cette composition ayant un pH entre 1 et 6,5.

3. Procédé selon la revendication 2, dans lequel l'alcool est un alcool oléylique polyoxyéthylé contenant une moyenne d'environ 20 moles d'oxyde d'éthylène par mole d'alcool.

4. Procédé selon la revendication 2, dans lequel l'acide gras éthoxylé est choisi dans le groupe constitué par un acide stéarique éthoxylé, un acide isostéarique éthoxylé et son ou ses sel(s) des métaux alcalins.

5. Procédé selon l'une quelconque des revendications 2 à 4, dans lequel le matériau organique est appliqué sur la boîte après son lavage.

6. Procédé selon l'une quelconque des revendications 2 à 4, dans lequel le matériau organique est appliqué sur la boîte pendant un cycle de traitement de la boîte.

7. Procédé selon la revendication 6, dans lequel le matériau organique est appliqué sur la boîte pendant le cycle de rinçage à l'eau final après avoir lavé la boîte.

8. Procédé selon la revendication 7, dans lequel le cycle de traitement s'effectue à un pH entre 1 et 6,5.

9. Procédé selon la revendication 8, dans lequel le cycle de traitement s'effectue à un pH entre 2,5 et 5.

10. Procédé selon l'une quelconque des revendications 2 à 9, dans lequel la quantité de matériau organique appliqué à la boîte se situe dans la plage allant de 3 mg/m² à 60 mg/m² de la surface de la boîte.