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[54] Title: PROCESS FOR THE PRODUCTION OF COATED OR LACQUERED METAL CONTAINERS AND THE USE THEREOF

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E. P. 254,755
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[57]

A B S T R A C T

A process for the production of coated or lacquered metal containers for receiving foods is described, in which the internal coating takes place by first applying a vinylchloride-based organosol followed by baking for 8 to 15 minutes at 175 to 225°C. Then an epoxy-phenol lacquer is applied and also baked for 8 to 15 minutes at 175 to 225°C. The metal sheet is then shaped to the desired container. The shaping preferably takes place by deep drawing and especially DRD deep drawing. The double coating results in improved properties of the internal coating and has the particular advantage that colourings, which are set free from colouring delivering filled products, are not absorbed so that there is no staining when emptying the container.

ABSTRACT OF THE DISCLOSURE

A process for the production of coated or lacquered metal containers for receiving foods is described, in which the internal coating takes place by first applying a vinylchloride-based organosol followed by baking for 8 to 15 minutes at 175 to 225°C. Then an epoxy-phenol lacquer is applied and also baked for 8 to 15 minutes at 175 to 225°C. The metal sheet is then shaped to the desired container. The shaping preferably takes place by deep drawing and especially DRD deep drawing. The double coating results in improved properties of the internal coating and has the particular advantage that colourings, which are set free from colouring delivering filled products, are not absorbed so that there is no staining when emptying the container.

CASE 3168

26290

PROCESS FOR THE PRODUCTION OF COATED OR LACQUERED METAL CONTAINERS AND THE USE THEREOF

The invention relates to a process for producing coated or lacquered metal containers for receiving foods and the use thereof for the packing of shrimps, prawns and crab.

BACKGROUND OF THE INVENTION

Metal containers for receiving foods generally have a coating, so as to prevent contact between the filled product and the metal, so that there is no disadvantageous influence on the quality of said product and so as to prevent corrosion to the metal by said product. For producing containers of this type, such as tin cans, use is made of metal sheets which, prior to their deformation or shaping, are provided with a suitable coating. The known epoxy-phenolic lacquers are suitable for this purpose and as a result of their colour tone they are also referred to as gold lacquers. Of late and in particular in conjunction with modern processing and deformation processes (cf. below) more and more PVC-based organosols have been used, which in addition generally contain a phenolic resin, a polyester resin, a diluent, a catalyst, a polymer plasticizer and optionally conventional additives (cf. e.g. German Patent 20 29 629 and European patent application 254 755).

Of the various processing and deformation processes which can be used, within the scope of the present invention particular interest is attached to deep drawing and more especially multi-stage DRD deep drawing (draw and redraw). These processing and deformation processes make increased demands on the sheet metal coating, i.e. the coating must not

only be as free as possible from pores and cracks and adhere well, but must also have a good drawing property or capacity, so that the afore-mentioned characteristics are also present following deep drawing. Whereas for the production of three-part tin cans use is made of sheet metal thicknesses of approximately 0.19 to 0.25 mm, for DRD deep drawing harder, but thinner metal sheets with a thickness of 0.18 mm and less are used. A suitable material is e.g. tin plate. However, preference is given to metal sheets, which are given an extremely thin chromium surface coating.

The afore-mentioned organosols are particularly suitable for the coating of metal sheets, which are to be shaped or deformed in accordance with the afore-mentioned deep drawing processes. The organosol is applied prior to the deformation of the sheet (normally after a roll coating process) and is then normally baked for 8 to 15 minutes at approximately 175 to 225°C. For this purpose the metal sheet is generally passed through a drying tunnel. In the case of two-sided sheet metal coating, the organosol is firstly applied to one side of the sheet and then baked and subsequently the other side of the sheet is treated in the same way. As a function of the intended use, the coating thicknesses are between 7 and 30 g (dry weight) per m^2. It is important that the coating adheres well, has no pores and cracks and is mechanically stable, so that a coating or lacquer is obtained, which is resistant to corrosion and sterilization and which is not sensitive to mechanical stresses.

Although PVC-based organosols lead to coatings which largely meet the demands of deep drawing processes, there is a considerable need for further improvements to the coating

characteristics, i.e. in particular for a further reduction to the porosity and an improvement to the stability with respect to more or less aggressive filled products. Reference is also made in this connection to the prevention of the diffusing of the plasticizer into the filled material. An important disadvantage of coatings based on PVC-containing organosols is that the PVC absorbs colourings like the pink colouring of the shrimps and crabs, so that when emptying a can filled with such a product, an unattractive pink staining can be seen on the internal coating which, although admittedly not impairing the product quality, is certainly an irritant to the user.

Another possibility for the coating of metals for the production of receptacles such as tin cans, tubes and sheet metal containers of all types is the afore-mentioned use of epoxy-phenolic lacquers, which are applied to the sheet metal in the same way as the afore-mentioned organosols and are then baked for 8 to 15 minutes at approximately 175 to 225°C. The resulting coatings have excellent characteristics and in particular a very good chemical stability and therefore resistance to the action of aggressive filled products. However, these lacquers suffer from the disadvantage that resistance to aggressive filled products is not combined with adequate elasticity and that therefore they are not drawable and can consequently not be used for deep drawing processes and especially DRD deep drawing processes.

The problem of the invention is to further improve the coatings and in particular the inside coatings of metal containers for receiving foods and to avoid the afore-mentioned disadvantages of the known coatings.

SUMMARY OF THE INVENTION

According to the invention this problem is solved by a process for the production of coated or lacquered metal containers for receiving foods, in which a conventional PVC-based organosol is applied to the surface, subsequently forming the container inside, of a metal sheet of appropriate form and thickness and of a suitable material and is then baked for 8 to 15 minutes at 175 to 225°C, which is characterized in that an epoxy-phenolic lacquer is applied to the organosol coating and baked for 8 to 15 minutes at 175 to 225°C before the sheet metal is shaped to the desired container.

The invention also relates to the use of the containers produced according to the process of the invention for packing colouring delivering filled products, particularly shrimps, prawns and crabs.

DETAILED DESCRIPTION OF THE INVENTION

As a result of the inadequate elasticity of epoxy-phenolic lacquers and the poor compatibility thereof with thermoplastics based on PVC-containing organosols, the inventive combination of the two coatings appears to be completely inappropriate. However, it has surprisingly been found that the compatibility between epoxy-phenolic lacquers and coatings based on PVC-containing organosols is well enough, particularly if the baking of the organosol takes place under somewhat milder conditions than are typically used with organosols alone. In addition, the elasticity behaviour of the epoxy-phenolic lacquers is improved to such an extent through the application to the organosol priming coating that the double coating is able to withstand the stresses of the deep drawing process, particularly the DRD deep drawing

process, i.e. the thus produced lacquers or coatings have an extremely low porosity combined with an optimum chemical stability. It has also been found that the afore-mentioned undesired staining when packing colouring delivering filled products, particularly shrimps, prawns and crabs does not occur in the containers produced according to the invention, i.e. when removing the filled product the internal coating does not have unattractive pink staining.

Another advantage of the inventive double varnish coating is that the plasticiser content of the PVC-based organosol is no longer as critical, because it essentially does not diffuse through the epoxy-phenolic lacquer. This reduced plasticizer diffusion also leads to improved sterilization characteristics, which is in accordance with modern developments, because nowadays for economic reasons shorter sterilization times at higher sterilization temperatures are sought.

For the first coating, use is made of PVC-based organosols. They contain as the main component pulverulent PVC, preferably in the form of fine-grain, neutral homopolymerisate with a Brookfield viscosity in the range of 2000 to 6300 cP. The organosol preferably also contains a vinylchloride copolymer (e.g. a vinylchloride-vinylacetate-maleic acid copolymer), which contributes to the good adhesion of the epoxy-phenolic lacquer to the baked organosol coating.

Apart from the vinylchloride homopolymer and the vinylchloride copolymer suitable organosols conventionally contain as further important components phenolic resin, epoxy resin, polyester resin and/or acrylic resin. Suitable phenolic resins are thermosetting, non-plasticized phenol-formaldehyde-resol resins, which have a good

compatibility with epoxy resins and vinylchloride homopolymers. For example, butanol-etherified phenol-formaldehyde-resol resins are very suitable.

As epoxy resin, the suitable organosols preferably contain an epoxy resin with a molecular weight of 300 to 900 (number average) and a corresponding epoxy equivalent weight of 150 to 500. In particular non-modified, low- to medium-viscosity epoxy resins are suitable for the inventive purposes.

The polyester resin contained in the organosol serves both as a plasticizer and as an adhesion promoter. The same adhesion promoting effect is also to be attributed to the optionally present acrylic resin. The organosol conventionally further contains epoxidized oils, preferably epoxidized soy oil, which on the one hand serve as plasticizers and on the other hand as acceptors for PVC split-off products (mainly HCl).

Further conventional components of the organosol are additives such as lubricants (e.g. lanolin), catalysts (e.g. tin octoate or p-toluenesulphonic acid ester), pigments (e.g. aluminum pigments), stabilizers, dyes, fillers and other lacquer aids. The organosol solvent is matched in such a way that excessive swelling of the PVC is avoided, whilst ensuring an adequate dissolving of the other components.

The quantitative proportions of said components are dependent on the desired processing characteristics of the organosol and the desired characteristics of the baked lacquer coating. Suitable quantity ranges and other details in connection with the afore-mentioned components appear in the prior art, e.g. in European patent application 254 755 which is incorporated by reference.

For the second layer of the double coating according to the invention, an epoxy-phenolic lacquer is used. Such lacquers are well known for the lacquering of tin cans. It is applied in the form of a solution of an epoxy resin and a phenolic resin in organic solvents, said solution advantageously containing small amounts of catalysts (e.g. phosphoric acid) and lubricants (e.g. lanolin, polyethylene wax). Suitable epoxy resins are in particular products with a high molecular weight based on bisphenol A. These products have epoxy equivalent weights in the range of approximately 1500 to 3000 g. The phenolic resin can be constituted by known products used for this purpose, preference being given to hardenable, nonplasticized phenol-resols.

For obtaining especially flexible epoxy-phenol coatings it has been found advantageous to use the epoxy resin and the phenol resin in form of a precondensate. Such precondensates are commercially available, but can also be prepared by prepolymerization before the application of the lacquer.

The organosol applied to the metal sheet is baked for 8 to 15 minutes at 175 to 225°C and preferably for about 10 minutes at 180 to 200°C. The epoxy-phenolic system is then applied and also baked for 8 to 15 minutes at 175 to 225°C, a 10 minute baking at 200°C being preferred.

The thickness of the inventively used double coating is in the conventional range between 7 and 30 g (dry weight) per m^2 and is preferably 10 to 15 g/m^2.

The sheet metal side subsequently forming the container outside should also be coated for technical reasons of processing. For this purpose organosol or epoxy-phenolic coatings can be used. This is a function of the intended use

of the inventively produced container. If desired, the sheet metal side subsequently forming the container outside can be provided with a double coating in the above described way. The application of the coating to the sheet metal side subsequently forming the container outside usually takes place in a process step preceeding the coating step of the sheet metal side subsequently forming the container inside. However, it can also take place at the same time or at an intermediate or subsequent process step depending upon the production facilities.

The coated sheet metal is then shaped to the desired container. This shaping preferable takes place by deep drawing and especially by DRD deep drawing, preference being given to chrome-plated (see above) or tin-plated metal sheets. These are so-called ECCS (electrolytical chromium coated steel) or ETP (electrolytical tin plate) metal sheets.

Cans produced according to the process of the invention when compared with those having the known coatings (deformation always took place by DRD deep drawing) gave very satisfactory results in the porosity test (Waco test) and in sterilization tests (30 minutes; 121°C) in water, in 1% lactic acid, in a solution containing 1.5% acetic acid and 3% sodium chloride, in oil, and in 2% saline solution, and in all the tests carried out were at least as good, but usually better than the known coatings.

While the present invention has been described in relation to the preferred embodiments, other embodiments can achieve the same results. Variations, modifications and equivalents of the present invention will be obvious to one skilled in the art and it is intended in the appended claims to cover all such variations, modifications and equivalents as fall within the true scope and spirit of the present invention.

What is Claimed: 26290

1. A coating for metal containers comprising a first layer formed of a vinylchloride-based organosol applied to a metal substrate and a second layer formed on the first layer and composed of an epoxy-phenolic lacquer.

2. The coating of Claim 1 wherein the organosol is formed of a polyvinylchloride polymer and a plasticizer.

3. The coating of Claim 1 wherein the epoxy-phenolic lacquer is formed of a precondensate of a bisphenol A epoxy resin and a phenol-resol resin.

4. The coating of Claim 1 wherein the metal is selected from the group consisting of ECCS sheet metal or ETP sheet metal.

5. The coating of Claim 1 wherein the first and second layers are heated at a temperature of from about 175 to 225°C for a period of time of from about 8 to about 15 minutes.

6. A process for producing a coated metal container comprising coating a PVC-based organosol to a metal substrate, heating the coated substrate for a period of time of from about 8 to about 15 minutes at a temperature of about 175 to 225°C, applying an epoxy-phenolic lacquer to the coated metal substrate, heating the coated substrate for a period of time of from about 8 to about 15 minutes at a temperature of from about 175°C to about 225°C and shaping the metal substrate into a container of a desired configuration wherein the coating forms an inner surface of the container.

7. The process of Claim 6 wherein the shaping of the container is by deep drawing.

8. The process of Claim 7 wherein the deep drawing process is a draw redraw deep drawing process.

9. The process of Claim 6 wherein the organosol is formed of a vinyl chloride homopolymer and a plasticizer.

10. The process of Claim 6 wherein the epoxy-phenolic resin is formed of a precondensate of a bisphenol A epoxy resin and a phenol-resol resin.

11. The process of Claim 6 wherein the metal sheet is selected from the group consisting of chrome-plated and tin-plated metal sheets.

12. The process of Claim 11 wherein the metal sheet is selected from the group consisting of electrolytical chromium coated steel and electrolytical tin plate.

13. A process for forming a coated metal container comprising the steps of:

a) applying a PVC-organosol to a metal sheet;

b) baking the coated metal sheet for 10 minutes at a temperature of 200°C;

c) applying an epoxy-phenolic resin to the organosol;

d) baking the coated metal sheet for 10 minutes at a temperature of 200°C;

e) shaping the desired container configuration by a deep drawing process such that the coated surface of the metal sheet forms the inner surface of the container.

14. The process of Claim 13 wherein the coating on the metal sheet is from about 7 to about 30 grams (dry weight) per square meter.