March 27, 1973 E. HOFLING 3,723,269

METHOD OF PRODUCING TEARING LINES IN METAL CONTAINERS

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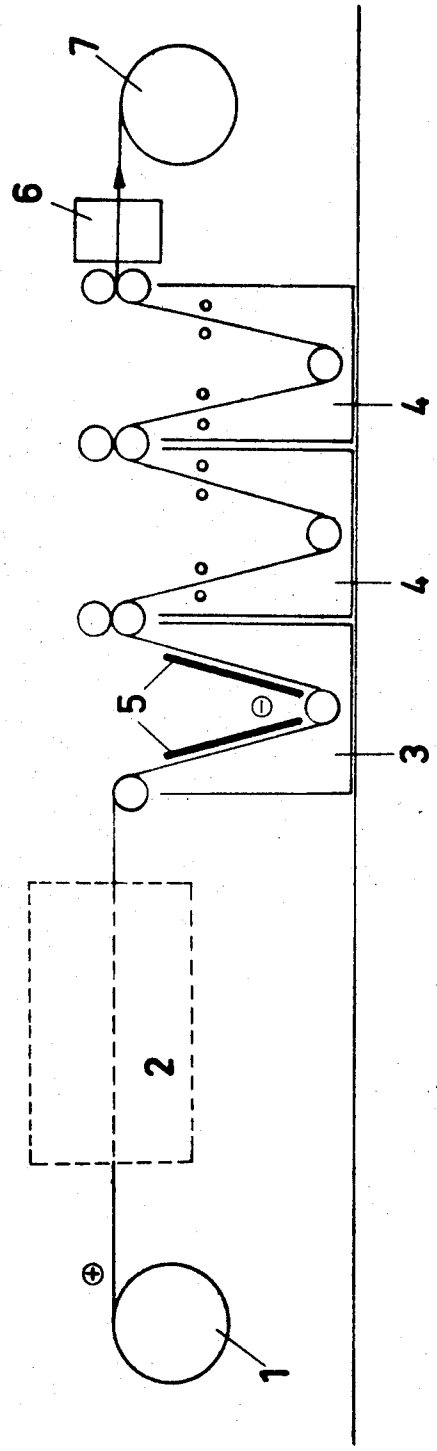


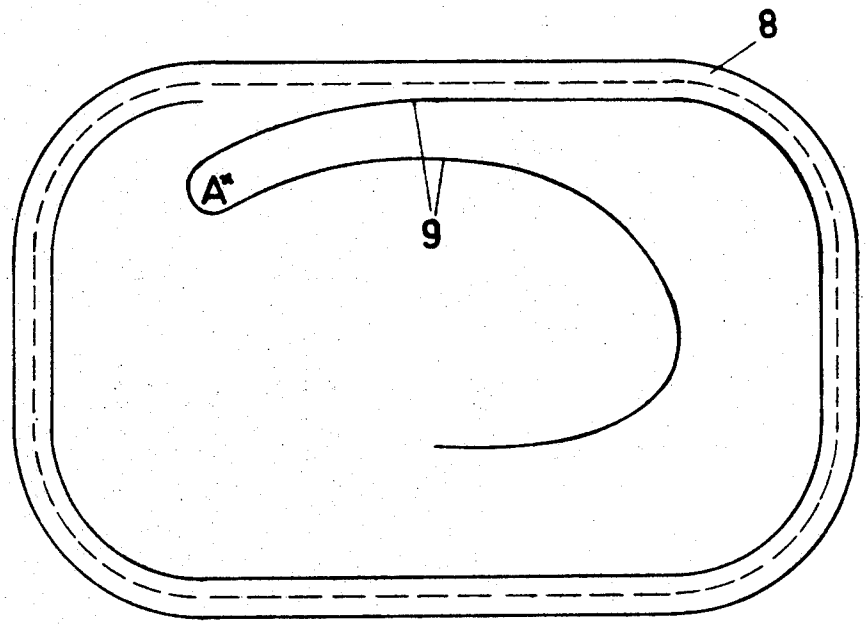
Fig.1

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Fig.2



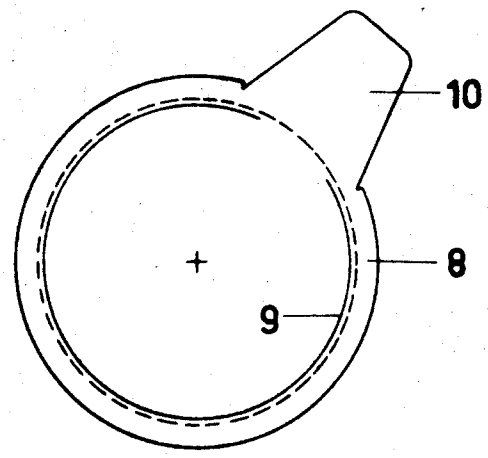


Fig. 3

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METHOD OF PRODUCING TEARING LINES IN METAL CONTAINERS

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ABSTRACT OF THE DISCLOSURE

Disclosed is a method of continuous production of tearing notches in metal cans. A continuously advancing metal material for the cans is first provided with an insulating mask having channels corresponding to the desired pattern of the tearing lines. The uncovered metal surface portion in the channels is subjected to a controllable electrochemical etching process.

BACKGROUND OF THE INVENTION

This invention relates generally to the processing of tin containers and, more particularly, to a method of producing tear-up notches in lid plates of such containers.

In the production of tin cans there have been for a long time employed tearing notches for opening top plates of the tin cans. The tearing notches are lines of a local weakening in the top plate of the can along which a separation of a portion of the top plate and thus the unsealing of the can may be effected in a simple manner. Also known are tearing contours associated with a riveted tear-up tongue for opening beer cans, for instance. The tearing notches that occur mostly on cover plates of the tin containers to be opened, are manufactured by punching or stamping a plate material which has been previously varnished. The inherent disadvantage of such conventional method is in that a considerable pressure must be applied on stamping tools in order to achieve a reliable and uniform notch effect of the tearing contours. Due to the pressure of the lower stamping tool, however, a deformation of the metal sheet will result and, frequently, this deformation causes damage also in the protective varnish layer on the bottom side of the processed lid plate material. As a consequence, an increased susceptibility to corrosion along the tearing lines will result. It is known from experience that the tearing lines of this kind really cause corrosion damage and give rise to complaints.

The above facts hold true even at cover plates having a normal thickness, that is in the range of 0.22 to 0.35 millimeter. Recently, there has been a tendency to produce thin-walled, light containers, predominantly of aluminum. The thickness of the metal strip for the lid lies, in this case, substantially below the above-mentioned range and mostly is in the range of 0.07 to 0.14 millimeter. Attempts to produce by mechanical means the tearing notches in such thin lid material have resulted in still increased difficulties than those occuring at metal straps for lids of normal thickness.

In the case of thin plates, a still greater deformation takes place at the bottom surface of the plate and, consequently, it produces still increased varnish damages.

It is, therefore, an object of this invention to provide a method for producing tearing notches in metal containers which removes the disadvantages of prior art methods.

In particular, an object of this invention is to provide a method in which the processed metal strap material is not deformed and the applied varnish film on the inside wall of the can remains undamaged.

Another object of this invention is to provide a method for continuous and automatic preparation of tearing notches for a substantially increased range of thickness of processed metal straps.

SUMMARY OF THE INVENTION

The above objects are attained by providing the outside surface of the metal material to be processed with a mask of electrically non-conductive material, mechanically engraving the desired tear-up lines into the mask as deep as to the metal surface, and electrochemically etching the engraved lines in an electrolyte with the application of an adjustable voltage.

The mask which has been applied on the can cover plate serves for the localization of the electrochemical attack on the engraved tearing line. It is advantageous to put on a varnish film which can be simultaneously employed as an outside protective varnish for the can.

The application of such masks can be carried out either mechanically or in a printing way. In the former case, prevarnished metal straps are employed which, on the intended interior surface thereof, are coated with a conventional protecting varnish for tin cans and, on the intended outer surface they are coated either with an identical protective varnish or with a similar one prepared on the basis of epoxy resins, epoxy phenol resins, and the like.

The manufacture of the tearing lines in the mask is started by engraving the varnish coating along a contour corresponding to the desired tearing notches to be produced. This engraving or scratching process is made by a needle-like tool of steel, cemented carbide or any hard metal having a conical tip. Since only a very thin varnish layer portion is to be removed and any mechanical deformation of the underlying metal must be prevented, it is necessary to apply a very low contact pressure of about 50 to 100 grams only, depending on the thickness and mechanical properties of the employed varnish film.

In case of the application of masks by printing, the varnish layer is put on the upper surface of bare metal straps by means of a gravure printing process whereby the contour of the intended tearing line remains untouched and free of varnish. In the following step, the printed varnish film is hardened by burning. The resulting channels in the varnish film, corresponding to the future tearing lines, should have a width in the range of 0.2 to 1.0 mm., since narrower channels are difficult to be produced by the gravure printing process. Wider channels, on the other hand, afford no advantage but cause an unnecessarily increased current consumption during the following etching process.

The electrochemical etching of the tearing notches is effected in a conventional manner in electrolytes consisting of a 25–30% solution of a sodium chloride in water. It is possible, of course, to make use of other electrolytes having a higher conductivity because of another type of anions, or through the addition of mineral acids. The method of this invention is effected with advantage in a continuously operating plant.

BRIEF DESCRIPTION OF THE DRAWING

The invention will now be described in conjunction with the accompanying drawing, wherein:

FIG. 1 is a schematical elevational view of a continuously operating device for producing tearing notches in a metal strap for cover plates of cans in accordance with the method of this invention;

FIG. 2 is a plan view of a can cover plate with a tearing notch as prepared according to this invention; and

FIG. 3 is a plan view of another embodiment of a tearing notch produced by the method of this invention.

DETAILED DESCRIPTION

Referring now to FIG. 1, a pre-varnished metal strap is wound off a magazine roll **1** and passes through an engraving station **2** where channels, corresponding to the intended tearing notches, are periodically engraved into the top varnish coating. Subsequently, the engraved portion of the strap passes through an electrochemical etching station **3** and rinsing stations **4**. The etching station **3** includes an electrolytical bath and electrodes **5** connected to the negative pole of a direct current source. The positive pole is connected, preferably through the conductive body of the device, with an uncoated end of the metal strap. Adjacent to the last rinsing station, there is arranged a drying furnace **5** and a wind-up roll **7**. The removal of the varnish layer from one end of the varnished metal strap is made prior to its winding-up on the magazine roll **1** and the resulting uncoated end portion is electrically connected through the shaft of the roll **1** with the positive pole of the source. The direct current source has an adjustable voltage which, after the setting of the device into the operation, is controllable in the range of 5 to 25 volts so as to provide an adjustment from 0.5–1 A. of the current flowing between the decoated metal lines in the engraved channels of the top varnish layer and the electrodes **5** in the etching station **3**. The most favorable time period for the electrolysis lies between 4–6 seconds and depends on the thickness and properties of the processed metal strap as well as the desired force for the tearing-up and tearing-off actions, that is on the desired notch effect. After the completion of this electrochemical etching process, the processed strap portion is repeatedly washed, dried and wound up on the roll **7**. The strap is then ready for stamping and shaping into the can upper plates.

FIGS. 2 and 3 illustrate two examples of tearing contours **9** which are suitable for can lids **8** sealed to a can body by hot sealing. Such cans may have lids of material of a thickness between 0.07 to 0.14 mm. To open the can according to FIG. 2 a more or less pointed object is cut into the area around the point A on the tearing lines **9**. The resulting detached tongue is lifted up to serve as a holding piece for the completion of the tearing movement. Because of the minute applied force (of about 300–600 g.), the tearing-off can be easily accomplished without any danger of injury. It is also possible to provide the tongue-tip A with a riveted tear-up flap made either of the same material as the lid plate, or of a plastic. The riveting is effected from the inner side of the lid by means of a heated tool so as to weld together the rivet and the inside varnish layer, thus insuring a hermetical seal.

In the embodiment as shown in FIG. 3, the tearing notch **9** is opened by means of a tear-up flap **10**, over the seal edge portions of the can lid **8**. In this case, the can lid **8** and the can body (dashed lines) are made of similar material to facilitate the tearing.

The tearing notch according to FIG. 2 is suitable for conventional aluminum cans which usually have a wall thickness up to 0.35 mm. maximum, and which are sealed by a rolled rim with the application of a rubber-like plastic sealing substance. In this kind of seal the use of a riveted tear-up flap in the tip A is particularly advantageous.

The following examples will more specifically describe the method of preparation of tearing notches of this invention:

EXAMPLE 1

A strap of pure aluminum in a hard-rolled condition and of a thickness of 0.1 mm. was provided on one surface thereof with a coating of an epoxyphenol resin varnish in the thickness of 0.006 mm. and, on the opposite surface, with similar coating in the thickness of 0.003 mm. Subsequently, a mechanical engraving operation was made in the latter varnish coating whereby a spring loaded crayon having a conical tip was guided in a template of the tearing contour, under a load of 70 grams and cut into the varnish layer. This engraving process was repeated in periodical intervals along the entire length of the strap. Thereupon the strap was guided through the 30% solution of a sodium chloride past a set of electrodes arranged in the electrolyte. A negative voltage, adjustable from 6 to 8 volts, was applied to those cathode electrodes. The metal strap was connected at one end thereof with the positive pole of the voltage source to serve as an anode. The advance of the strap was controlled so as to keep the strap for four seconds in the electrolyte. The applied voltage was controlled in such a manner as to maintain a constant current of 3.0 A. During the advance of the strap, the processed portion was washed, dried up and rewound. The resulting tearing notches can be easily torn up in the manner as described above in FIGS. 2 and 3. The notch effect appeared to be extremely reliable since by pulling in an arbitrary direction it was impossible to deviate the advancing tear from its predetermined path. The applied force for the tearing action was between 400 and 600 grams.

EXAMPLE 2

A strap of pure aluminum 0.1 mm. thick, in a hard-rolled condition, was provided at one surface thereof with an 0.006 mm. coating of an epoxyphenol resin varnish, and passed through an oven. In a second step, the opposite surface was coated by means of a gravure printing cylinder with a film of epoxyphenol resin varnish having negatively imprinted channels corresponding to tearing contours. The width of the negatively imprinted contours without varnish was 0.2–0.3 mm. The printed varnish film was burned and its thickness resulted in 0.0025 mm. The burned varnished strap was further processed in the electrolytic bath and in the rinsing stations similarly as in Example 1, with the only exception being the time period of the electrolysis which was extended to amount to six seconds. There was attained a little wider tearing line than that as disclosed in Example 1, but its quality remained unchanged.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

Having thus described the invention, what I claim as new and desire to be secured by Letters Patent is as follows:

1. A method of producing tearing notches in an aluminum container

comprising the steps of

applying a mask of an electrically insulating material on the upper surface of a piece of an aluminum strap to be used as a part of said container,

providing said mask with channels corresponding to the desired pattern of said tearing notches,

subjecting the uncovered metal surface portion in said channels to an electrochemical etching process,

controlling the depth of the etched line by the control of the time of treatment,

and forming a container having said strap as a part thereof.

2. A method of producing tearing notches according to claim **1** wherein the aluminum strap is first coated with an

insulating film and said channels are tool engraved into said film.

3. A method according to claim 2 wherein said insulating film is a varnish layer having a thickness in the range of 0.002 to 0.006 mm.

4. A method according to claim 1 wherein the aluminum strap is provided with said insulating mask together with said channels in a gravure printing process.

5. A method according to claim 1 wherein said aluminum strap after being provided with said mask, is fed into an electrolytic bath having a cathode electrode whereby said aluminum strap serves as an anode electrode.

6. A method according to claim 5 wherein the voltage applied to said electrodes is in range of 5 to 25 volts.

7. A method according to claim 5 wherein said electrolytic bath includes a water solution of 25% to 30% by weight of sodium chloride.

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TA-HSUNG TUNG, Primary Examiner

U.S. Cl. X.R.

156—8; 204—129.75