

1

2,884,338

METHOD OF OILING TINPLATE AND PRODUCT

Garold C. Jenison, Carrollton, Ohio, assignor to National Steel Corporation, a corporation of Delaware

No Drawing. Application June 12, 1956
Serial No. 590,834

6 Claims. (Cl. 117—68)

The present invention relates to oiled tinplate and to a method of applying an oily liquid to tinplate. More particularly, it relates to tinplate having a thin uniform film or di-octyl sebacate and to a method of applying the same to tinplate.

It will be obvious from the following specification that the invention is not limited to the application of di-octyl sebacate to tinplate. The present invention may be employed wherever it is desirable to apply a thin uniform film consisting essentially of di-octyl sebacate on a metallic material regardless of whether or not the material has been tinned previous to the application of the di-octyl sebacate.

In the manufacture of tinplate it has been found desirable to provide a thin coating of oil on the tinned strip after the coating operation has been completed. The oil is desired in order to facilitate handling of the tinplate product and to protect the same against abrasion, scratches, corrosion, etc. Without the oil, the sheets tend to stick together and, in general, do not handle well in subsequent fabricating steps utilizing automatic machines. The amount of oily liquid necessary to eliminate these difficulties is quite small and must be maintained within narrow limits for best results.

The quantity of oil applied to the tinplate is critical and must be maintained within narrow limits. An excess of oil causes excessive slippage so that it is difficult to stack and handle the individual sheets properly. Also other objectionable factors are introduced in lacquering, labeling, etc. If an insufficient amount of oil is applied to the tinplate or if the oil is not applied uniformly, the oil will not provide lubrication to prevent abrasion and sticking together of the sheets during subsequent fabrication steps. Experience in this field dictates that the amount of di-octyl sebacate applied to the surfaces of the tinplate should not be more than approximately 0.5 gram per base box, i.e., 62,720 square inches of surface, and not less than .05 gram per base box. The term base box is used herein for the purpose of convenience only, the term being understood to mean a quantity of product, whether or not tinplate, having a total surface area of 62,720 square inches.

It will be apparent from the foregoing that very small quantities of oil must be uniformly applied to the tinplate surface. Electrostatic oiling is the only method which has been found suitable for the application of such an oil film at the high speeds generally employed in the manufacture of electrolytic tinplate.

A number of factors have been found to enter into the selection of a suitable oil for coating tinplate. Among the more important factors are the following:

(1) Since electrostatic precipitation of a thin film of oil on the electroplated tinplate surface is the only practical method found for application of the oil in modern

2

electrolytic tinplating lines, it is important that the particular oil selected be readily atomizable, capable of electrostatic precipitation upon tinplate moving at high speeds in a thin uniform film and resistant to oxidation in the presence of ozone.

(2) Retention of the oil on the tinplate during warehousing should be assured for a reasonable period of time.

(3) There should be freedom from discoloration upon baking or heating to relatively high temperatures.

(4) The oil should have no effect on the adhesion of protective or decorative coatings to the tinplated surface.

(5) The oil should be compatible with protective or decorative coatings.

(6) The oil should be non-toxic in the amounts applied.

(7) The oil film should remain fluid over reasonable periods of time and not harden or otherwise change its character to such an extent it loses its value as a lubricant and protective coating.

(8) The oil should be relatively free of taste and odor in the amounts applied.

Heretofore a number of materials have been proposed as oiling agents for tinplate but none has been entirely satisfactory. Among the more commonly used oiling agents are vegetable oils such as cottonseed oil, and esters such as di-butyl sebacate. Vegetable oils have been found to be unsatisfactory due to, among other things, the tendency of such oils to oxidize in a relatively short time to a solid film which is no longer a lubricant. Di-butyl sebacate has been found to be unsatisfactory when the tinplate is stored for any appreciable length of time since among other reasons the film of di-butyl sebacate is rapidly lost from the tinplate surface.

I have discovered that di-2-ethyl hexyl sebacate which is commonly known as di-octyl sebacate largely overcomes the foregoing disadvantages, and also possesses to a remarkable degree the above enumerated desirable properties of oiling agents for tinplate.

It is an object of the present invention to provide a novel tinplate having a thin uniform film of di-octyl sebacate on at least one surface area of the tinplate.

It is a further object of the present invention to provide a method of applying a thin uniform film of di-octyl sebacate to at least one surface area of tinplate.

Still other objects of the present invention will be apparent to those skilled in the art by reference to the following detailed description.

In accordance with the present invention, a thin uniform film of di-octyl sebacate is applied to at least one surface area of tinplate by any suitable method and, in the case of electrocoated tinplate, preferably as the tinplate is delivered from an electrolytic tinplating zone. The di-octyl sebacate is uniformly applied in quantities not less than 0.05 gram and not exceeding 0.5 gram for each 62,720 square inches of surface area to be oiled with the di-octyl sebacate.

If less di-octyl sebacate than the minimum quantity of .05 gram per base box is used, the tinplate is not properly lubricated and the sheets of tinplate tend to stick together and to be abraded excessively as one sheet is moved relative to another during handling or passage through fabricating equipment. If quantities of di-octyl sebacate in excess of 0.5 gram per base box is used, the di-octyl sebacate causes excessive slippage and it is very difficult to stack and handle the tinplate properly during subsequent operations. Also lacquering and labeling are adversely affected. Preferably, the amount of di-octyl

sebacate per base box should be about 0.20 gram as this quantity is sufficient to overcome the disadvantages of improperly lubricated tinplate above referred to, yet there is not sufficient di-octyl sebacate to cause excessive slippage and other disadvantages of overly lubricated tinplate.

As mentioned above, electrostatic oiling is the only method which has been found suitable for the application of di-octyl sebacate as a thin uniform film to tinplate moving at the high strip speeds commonly employed in the manufacture of electrocoated tinplate. However, other methods are suitable at low strip speeds, or in situations where the tinplate is in the form of sheets. For example, a solution of di-octyl sebacate in volatile solvent may be applied to the surface of tinplate and the solvent quickly evaporated to leave behind a film of di-octyl sebacate.

In accordance with one preferred form of the invention electrocoated tinplate strip delivered from an electrolytic tinplating zone, preferably at a temperature of about 135° F. to 190° F. and provided with an electrical charge of one polarity, is passed continuously through an ionizing zone or chamber at a speed corresponding to the speed of the tinplating line. The ionizing zone or chamber is preferably constructed with an entrance and an exit and so as to surround the strip. An electrostatic field which is capable of providing each particle of the finely divided di-octyl sebacate with an electrical charge of opposite polarity to that of the tinplate is formed in the ionizing zone or chamber and preferably on both sides of the tinplate. The electrostatic field may be created by any suitable means such as by wires about 0.01 inch in diameter arranged in spaced relationship on either side of the moving tinplate strip carrying a charge of from 35,000 to 60,000 volts D.C. A liquid stream of di-octyl sebacate is atomized by passing liquid di-octyl sebacate and a suitable gaseous medium under pressure, such as compressed air, through nozzles to form a mixture of finely divided particles of di-octyl sebacate suspended in the gaseous medium. The gaseous dispersion of atomized di-octyl sebacate is then passed into the electrostatic field in the ionizing chamber and so as to surround the strip. As the gaseous dispersion enters the electrostatic field, each finely divided particle of di-octyl sebacate acquires an electrical charge opposite to that of the tinplate. The charged particles are then attracted to the moving tinplate and deposited on the surface as a thin uniform film. The amount of di-octyl sebacate deposited on the tinplate may be controlled by increasing or decreasing the voltage impressed upon the wires forming the electrostatic field, by increasing or decreasing the amount of di-octyl sebacate passed into the electrostatic field as the gaseous dispersion, or by increasing or decreasing the speed at which the tinplate moves through the ionizing chamber. These three factors should be correlated properly to give the desired results.

Any suitable apparatus may be used for accomplishing the various steps comprising the foregoing method. However, preferred apparatus for applying di-octyl sebacate to electrocoated tinplate is disclosed in U.S. Patent No. 2,666,716, issued to A. E. Kadell, January 19, 1954.

Thin uniform films of di-octyl sebacate applied to electrocoated tinplate as a lubricant and protective coating have been found to possess the above enumerated properties which are desirable in such a coating to a remarkable degree. For example, the di-octyl sebacate film is easily and uniformly applied by means of electrostatic deposition in desired quantities, very resistant to oxidation and hardening, compatible with decorative as well as protective organic coatings, satisfactory in flavor and odor, non-toxic in the amounts used and retained for extended periods of time during storage of the tinplate.

Retention of di-octyl sebacate when applied to electrocoated tinplate in accordance with the present invention

is outstanding, as illustrated by the following tabulated data:

Table I

Oiling Agent	Days in Storage at 100° F.	Loss of Oiling Agent
di-butyl sebacate.....	3	100
di-capryl sebacate.....	42	64
di-2-ethyl hexyl sebacate.....	77	70
di-2-ethyl hexyl phthalate.....	23	83

While the present invention has been specifically described and illustrated herein with reference to a preferred embodiment of the invention, it is to be understood that the present invention may be otherwise practiced than as specifically described and illustrated within the scope and spirit of the appended claims.

What is claimed is:

1. Tinplate having a thin uniform film of di-2-ethyl hexyl sebacate on at least one surface area, the quantity of di-2-ethyl hexyl sebacate being in the range of 0.05 to 0.5 gram for each 62,720 square inches of surface area on which di-2-ethyl hexyl sebacate is present.

2. Tinplate having a thin uniform film of di-2-ethyl hexyl sebacate on at least one surface area, the quantity of di-2-ethyl hexyl sebacate being about 0.20 gram for each 62,720 square inches of surface area on which di-2-ethyl hexyl sebacate is present.

3. A method of oiling tinplate comprising depositing a thin film of di-2-ethyl hexyl sebacate on at least one surface area of the tinplate, the rate of application being from 0.05 gram to 0.5 gram for each 62,720 square inches of surface area on which di-2-ethyl hexyl sebacate is deposited.

4. In a method of continuously applying a thin uniform film of oily liquid to each surface of electrocoated tinplate strip delivered from an electrolytic tinplating zone, which method includes continuously passing the tinplate strip from the tinplating line through a zone at a speed corresponding to the speed of the strip in the line, forming an electrostatic field in the zone on both sides of the strip capable of giving finely divided particles coming within the field an electrical charge of one polarity, applying an electrical potential of an opposite polarity to the first mentioned polarity to the strip at least while the strip is in the zone, atomizing a stream of oily liquid to form finely divided particles of oily liquid dispersed in a gaseous medium, passing the gaseous dispersion of oily liquid into the electrostatic field on both sides of the strip to charge the particles of oily liquid with a charge of opposite polarity to that of the strip, the charged oily particles being attracted to each surface of the oppositely charged strip thereby coating the strip with a thin uniform film of oily liquid, the film of oily liquid being deposited on the tinplate in a quantity equal to at least 0.05 gram but no greater than 0.5 gram of oily liquid per base box, the improvement which comprises supplying as the stream of oily liquid to be atomized a liquid stream consisting essentially of di-2-ethyl hexyl sebacate.

5. In a method of continuously applying a thin uniform film of oily liquid to each surface of electrocoated tinplate strip delivered from an electrolytic tinplating zone, which method includes continuously passing the tinplate strip from the tinplating line through a zone at a speed corresponding to the speed of the strip in the line, forming an electrostatic field in the zone on both sides of the strip capable of giving finely divided particles coming within the field an electrical charge of one polarity, applying an electrical potential of an opposite polarity to the first mentioned polarity to the strip at least while the strip is in the zone, atomizing a stream of oily liquid to form finely divided particles of oily liquid dispersed in a gaseous medium, passing the gaseous dispersion of oily liquid into the electrostatic field on both sides of the

5

strip to charge the particles of oily liquid with a charge of opposite polarity to that of the strip, the charged oily particles being attracted to each surface of the oppositely charged strip thereby coating the strip with a thin uniform film of oily liquid, the film of oily liquid being deposited on the tinplate in a quantity equal to about 0.20 gram of oily liquid per base box, the improvement which comprises supplying as the stream of oily liquid to be atomized a liquid stream consisting essentially of di-2-ethyl hexyl sebacate.

6. A method of oiling tinplate comprising depositing a thin film of di-2-ethyl hexyl sebacate on at least a portion of the tinplate surface area, the rate of application

6

of di-2-ethyl hexyl sebacate being about 0.20 gram for each 62,720 square inches of oiled tinplate surface area.

References Cited in the file of this patent

UNITED STATES PATENTS

2,666,716 Kadell ----- Jan. 19, 1954

OTHER REFERENCES

- 10 Bried et al.: "Synthetic Lubricant Fluids from Branched-Chain Diesters," Ind. and Eng. Chemistry, April 1947, pages 484-491.