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STRIPPING COMPOSITION FOR METAL COATING

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This invention relates to a method and composition for use in metal coating operations as in hot dip tinning andterne plating either by hand or machine. The invention relates particularly to a stripping oil medium and method and will be illustrated first by description in connection with the stripping of tin plate.

In this hot dip tinning art, it is customary to pass steel sheets through a flux, then through a bath of molten tin, and, while the tin is still in molten condition, through a layer of an oil stripping medium. The oil reaches a temperature of about 450° to 550° F. The oil strips off excess of molten metal and returns it to the bath below. The oil also provides over the coating a film which prevents oxidation of the coating which at this stage is necessarily very hot. The coated steel then passes between pairs of rolls arranged in tandem. These rolls smooth the coating and act as conveyors for the sheets through the tin pot.

As the stripping medium or oil, triglycerides have been used heretofore. Of these the most widely used is palm oil.

There has long been need of a better material than palm oil for this purpose. The palm oil to be used requires pretreatment for a considerable period of time, such as 40 to 80 hours at an elevated temperature of about 400° to 500° F. Furthermore the palm oil undergoes changes at the very high temperature of use of the stripping oil. The oil undergoes such decomposition and change that it is necessary to replace a considerable part of the oil at intervals with fresh oil. Thus, it is common practice to replace at least 25% of the palm oil every two weeks in addition to supplying oil as required to make up losses representing the oil carried away as a film on the coated sheet. Also considerable smoke and odor arise from the hot palm oil.

In place of the palm oil, there have been proposed for this purpose various fats including natural and hydrogenated fatty oils, tallow, and the like. These materials on the whole are not as satisfactory even as the palm oil. They show the disadvantages above, including need of replacement of a part of the fats at intervals and also relatively rapid increase in viscosity under the operating conditions.

We have now discovered that the introduction in the fatty oil of a minor proportion of an ester of a higher monohydric aliphatic alcohol with a higher fatty acid not only gives improved results in the stripping operation but also makes unnecessary the replacement of any of the remaining triglyceride over periods of six months or longer.

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Briefly stated, our invention comprises a stripping medium for hot dip metal coating including a mixture, i. e. a solution of a triglyceride and a monohydric alcohol ester of kind described, in the proportion of about 10 to 35 parts of the ester to 100 parts of the stripping medium. The invention comprises also the herein described method utilizing this stripping medium on products coated with molten metal.

Proportions here and elsewhere herein are expressed as parts by weight.

The equipment used and the steel to be coated are conventional in the art to which the invention relates. The order of method steps is also that which is usual except as otherwise specifically stated.

Among the advantages of the use of our mixture of the monohydric alcohol ester and triglyceride, in place of the triglyceride media previously used, is the effect of the ester, even in small proportion, in reducing the changes in the triglycerides, as, for instance, in body or viscosity to such an extent that the triglycerides remain substantially permanently satisfactory in the properties required for a stripping oil. When our new stripping oil is replaced for the previously used oils, there result less decomposition of the triglycerides, less smoke and odor around the stripping area, a better coating, and a lower percentage of coated product which has to be rerun because of imperfections in the coating or sold at lower value. Tin plate made with the use of our new stripping medium and method have better enamel adhesion than obtained with the use of palm oil or the other fatty triglycerides alone in accordance with the previous practice in the industry. While this last advantage applies especially in the tin can industry, one or more of the advantages listed are realized under any condition of use of the stripping oil in the hot dip tin orterne plating industry.

The following data for viscosity change with period of use give a measure of the stability of a stripping medium consisting of 83 parts of triglyceride and 17 parts of the monohydric alcohol ester: viscosity of the original 57 sec. Saybolt at 210° F.; viscosity of same mix after six months' use in actual operations and at temperatures of about 460° F., 85 sec.

During this six months' period there were no additions of stripping medium except for added portions to replace the oil lost or consumed necessarily in the operation. The amount of the stripping medium required to make up the losses and consumption has averaged only about half that required in a comparable run of the same

duration with palm oil, including necessary discardings of part of the latter at intervals. Furthermore, the final viscosity of 85 sec. for our medium in the test above is considered one that is satisfactory in this art, even for fresh oil, as it is customary to start with palm oil which has been previously raised in viscosity to about 72 sec. or somewhat more.

As to the materials used, the triglyceride should be a fat that is nearly or substantially completely saturated. For use in machine dipping operations, the triglyceride should have an iodine number below 30. For hand dipping operations the iodine number may be higher but should not be above 60 by any substantial amount. Examples of satisfactory triglycerides are hydrogenated fish oils, such as menhaden, sardine, pilchard, cod, herring, or whale oil; hydrogenated vegetable oils examples of which are soya, cottonseed, peanut and rape oils; and hydrogenated animal oils, as, for instance, hydrogenated tallow, lard, or lard oil. These hydrogenated fatty oils, when of iodine number not above 60 by any substantial amount, have softening points above winter temperatures, i. e. are normally solid.

The monohydric alcohol ester referred to as the material to be admixed with the triglyceride must be an ester of a higher monohydric aliphatic alcohol with a higher fatty acid. The alcohol represented in the ester should be one containing 12 to 22 carbon atoms to the molecule of the alcohol and the higher fatty acid also should be one containing 12 to 22 carbon atoms to the molecule of the acid. Examples of alcohols that may be represented in the esters are n-dodecanol, n-tetradecanol, n-hexadecanol, and n-octadecanol. Examples of the fatty acids that may be used in the esters are n-tetradecanoic, n-hexadecanoic, n-octadecanoic, n-eicosanoic, and n-docosanoic. Isomers and homologs of these alcohols and acids may be represented within the stated ranges of carbon atoms. Examples of esters that meet the requirements and contain alcohols and acids of the kind described are, in the older system of nomenclature, cetyl palmitate, stearate, and myristate; stearyl stearate and palmitate; myristyl stearate and palmitate; spermaceti; and the higher monohydric alcohol ester of jojoba oil.

These esters may be made synthetically. They may be used either singly or in admixture with each other, as in naturally occurring form or in mixtures made of the several components. A commercially available form of such esters that we have used to advantage is hydrogenated sperm oil. The hydrogenated sperm oil contains around 65% of the esters of the higher aliphatic alcohols with the higher fatty acids and about 35% of triglycerides.

As to proportions, we must use at least 10 parts by weight of the ester of the kind described for 100 parts of the total mixture with the triglycerides if we are to obtain the desired stability of the mixture when used at the high temperatures to which the stripping medium is subjected in use. We may go as high as 35 parts of the ester to 100 of the mixture. The choice of specific proportion of the ester, within this range 10% to 35%, is determined by the properties desired in a particular operation. In the example above, in which the stripping medium was used in the hot dip tinning operation for 6 months, the proportion used was 25 parts of hydrogenated sperm

oil. This corresponds to approximately 17 parts of the monohydric alcohol esters to 83 parts of hydrogenated marine oil.

Sometimes the sheets or other articles coated by the hot dip method described are allowed to cool before passage through the stripping oil. In this case the oil is separately heated to about 450° to 550° F., so that the heated oil reheats the coating and places it in suitable condition for stripping.

Our process and composition may also be used in a modification of the hot dip coating method. In this modification the metal coating is applied electrolytically and the plated articles are brightened by passage through heated stripping oil of kind described and at the temperature stated.

In making terne plate, there is used a stripping medium containing the same kinds of materials and in the same proportions as described above in connection with the hot dip tinning process. Thus we have used the stripping medium in the coating of steel plate with a molten mixture of 85 parts of lead to 15 of tin, all equipment and the order of steps in the making of the terne plate being those that are conventional, with the exception of the replacement of our new stripping medium, and the procedure used in this being suitably continuous terne plating. The advantages in the use of our stripping medium were similar to those described in detail above in connection with the tinning operation.

The mixture of hydrogenated fatty oils and monohydric alcohol esters, for use as described above, may be provided by hydrogenating varieties of shark, porpoise, seal oil, or the like, the natural product selected for the hydrogenation being one containing originally the monohydric ester in proportion within the range 10 to 35 parts for 100 parts of total weight of oil.

It will be understood that it is intended to cover all changes and modifications of the examples of the invention herein chosen for the purpose of illustration which do not constitute departures from the spirit and scope of the invention.

What we claim is:

1. A stripping medium for hot dip metal coating which comprises a mixture of a normally solid hydrogenated fatty oil of iodine number not substantially above 60 and an ester of a monohydric aliphatic alcohol with a fatty acid, the said alcohol and fatty acid represented in the ester each containing 12 to 22 carbon atoms to the molecule and the proportion of the ester being 10 to 35 parts for 100 parts of total weight of the mixture.

2. A stripping medium for hot dip metal coating which comprises a normally solid hydrogenated fatty oil of iodine number not substantially above 60 and hydrogenated sperm oil in the proportion of 10 to 35 parts of the sperm oil to 100 of the mixture.

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