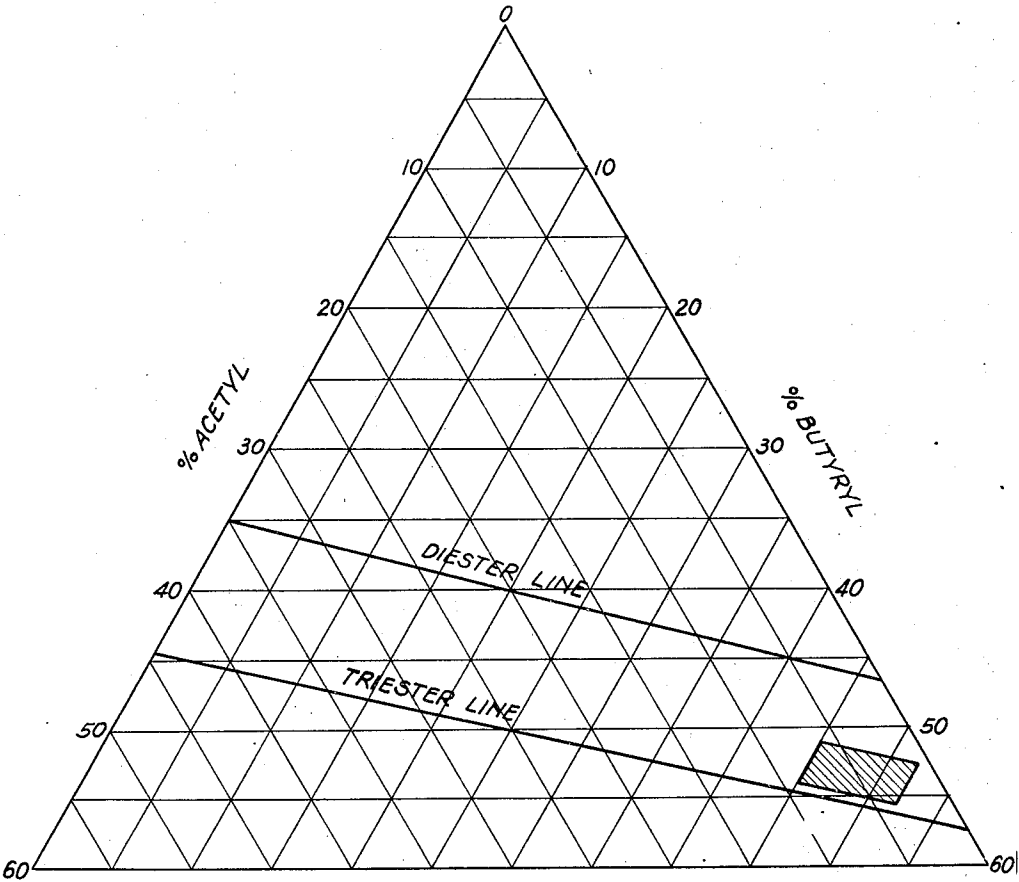


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G. D. HIATT
HEAT STRIPPABLE COATING COMPOSITION AND
METAL ARTICLES COATED THEREWITH
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Gordon D. Hiatt
INVENTOR
BY *N. M. Perrins*
Daniel J. Mayne
ATTORNEYS

UNITED STATES PATENT OFFICE

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HEAT STRIPPABLE COATING COMPOSITION
AND A METAL ARTICLE COATED THERE-
WITHGordon D. Hiatt, Rochester, N. Y., assignor to
Eastman Kodak Company, Rochester, N. Y., a
corporation of New Jersey

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This invention relates to a composition adapted to the coating of metal pieces to prevent rusting or other types of corrosion which composition consists of a partially hydrolyzed cellulose acetate butyrate of certain characteristics and at least an equal amount of an oil-like material containing a substantial proportion of mineral oil, at least 30% of the oil-like material being castor oil, methyl abietate, or hydrogenated methyl abietate, or a mixture thereof. This invention also includes the application of that composition to metal articles and the articles protected by a coating of this composition.

In the transporting of metal parts, particularly of iron or steel, there is danger from rusting or other types of corrosion. This has been particularly true in recent years because much of this material was in transport for long periods of time and in many cases in regions of unusual dampness and other adverse conditions. Formerly metal articles were prevented from rusting by applying thereto a heavy grease which would adhere to the article, thereby forming a coating thereon. This practice, however, had the disadvantages that the articles were difficult to handle and after arriving at the destination required the use of a solvent to remove the grease therefrom. As a consequence, compositions have been developed which would form a coating on metal articles which could be handled without coming off onto the hands and which could at the point of destination be stripped from the metal article making any cleaning operation unnecessary. As most coatings are not completely moistureproof, it has been necessary for this purpose to develop coatings which would form a protective covering for the metal through which no moisture would penetrate. Also, the coating compositions which have been used give coatings of comparatively poor strength necessitating thick coatings such as in the order of magnitude of $\frac{1}{4}$ inch.

One object of my invention is to provide a coating composition for metal articles which can be readily handled but through which no moisture can penetrate to the metal itself. Another object of my invention is to provide a composition which forms a protective coating that may be readily peeled off from an article at the time of use. A further object of my invention is to provide a cellulose ester composition which may be applied as a melt to a rust-susceptible article by a dipping operation and upon cooling, a hard, transparent flexible surface is obtained. A still further object of my invention is to provide a composition which forms films of superior

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strength, thus making possible comparatively thin coatings. Other objects of my invention will appear herein.

I have found that articles susceptible to rust or corrosion are well protected by coating those articles with a melt consisting of a cellulose acetate butyrate having certain prescribed characteristics and at least an equal amount of an oil-like material of which at least 30% is castor oil, alkyl abietate or hydrogenated alkyl abietate and 4–20% of the oil-like material is a mineral oil. This material is applied by heating the composition to a temperature of 130–200° C. and thoroughly mixing the cellulose ester and oil-like material together, whereupon the composition is applied as a layer on the metal part, such as by a dipping operation. Upon removal of the article from the melt, the coating on the metal article solidifies forming a hard, transparent, flexible surface which prevents contact of the article with water, air, or other corrosive agents. The coating which is obtained may be readily peeled from the article at any time.

It is a feature of my composition that it permits the slow exudation of mineral oil or rust-preventive oil from the coating onto the metal article. This exudation results in a very thin oil coating directly on the metal article underneath the protective coating thereon so that any moisture vapor which should penetrate the outer coating will not reach the metal surface. Polished mild steel plates to which had been applied coatings of my composition $\frac{1}{16}$ inch thick were held in a closed container for 150 days under water at 100° F. without showing any sign of rust.

Another feature of my composition is that the coatings thereof have good strength and, therefore, the coatings which are applied to metal articles may be comparatively thin and still constitute good protection against handling. For instance, coatings within the range of .02 to 0.1 inch are ordinarily quite suitable for adequately protecting a metal article although, if desired, coatings of greater thickness may be employed. If the article coated has sharp projections, it is desirable to apply a preliminary coat to those projections prior to the general coating of the entire article.

The accompanying drawing is a triangular graph showing the region from which the cellulose acetate butyrates must be selected for use in compositions in accordance with my invention, these esters having the right compatibility and strength characteristics for use in my invention. This triangular graph is made up of three points,

one of which is on the line designating butyryl and is at 57.2%, the percentage of butyryl in a fully esterified cellulose butyrate. The point on the line designating acetyl is at 44.9%, the percentage of acetyl in a fully esterified cellulose acetate. Any point within the triangle represents a cellulose ester of a certain acetyl and butyryl content, indicated by the location of the point in the triangle. For instance, the point where the 30% acetyl line initially intersects the S in "triesters" represents a cellulose acetate butyrate having an acetyl content of 30% and a butyryl content of approximately 17%. Also, it may be concluded that this is not a fully esterified ester as the point is not on the triester line. These useful esters range from 45 to 52% combined butyryl and 1 to 9% acetyl and have a hydroxyl content ranging from 0.1 to 0.4 hydroxyl per glucose unit. The esters which are used in preparing compositions of my invention must have a viscosity within the range of 15-150 centipoises as measured by their 10% solution in acetone at 25° C. Lower viscosity esters give coats of poor strength which are characterized by tearing, whereas esters having a high viscosity necessitate too high an operating temperature for practical value. Cellulose esters suitable for use in preparing my compositions may be prepared by reacting upon cellulose with butyric anhydride, preferably after a pre-soaking or pretreatment with a small amount of acetic acid. For instance, by means of a pretreatment such as described and claimed in Malm Patents Nos. 2,342,415 and 2,342,416, the cellulose is activated using only a small amount of acetic acid. Esterification of this pretreated cellulose with butyric anhydride and catalyst, such as by the method described and claimed in Blanchard Patent No. 2,304,792, or Malm Patents Nos. 2,362,576 and 2,345,406, results in a high butyryl cellulose ester, the butyryl and acetyl contents of the esterification bath being adjusted so as to give a butyryl content within the range of 45 to 52%. The ester is then hydrolyzed to impart thereto a hydroxyl content of 0.1 to 0.4 hydroxyl per glucose unit. If the esters are to be subjected to heat for a considerable time, it might be desirable to also subject those esters to a stabilization treatment, such as by the method described in Malm and Kirton Patent No. 2,250,201 or that described in Malm and Crane Patent No. 2,346,498. Whether or not stabilization of the ester is desirable will depend on whether or not any discoloration of the unstabilized ester takes place in the dipping operations and, if so, if the amount of discoloration is objectionable for the particular purpose for which the coating is employed.

The oil-like material with which the cellulose ester is mixed may be castor oil, an alkyl abietate or a hydrogenated alkyl abietate, or may be a mixture of these materials with themselves or with other high-boiling esters, such as dibutyl sebacate, di-2-ethyl hexyl phthalate, methoxy ethyl stearate, a chlorinated diphenyl known as Arocolor, or some other plasticizer of high molecular weight. In accordance with my invention, however, the oil-like material should be composed of at least 30% of castor oil, alkyl abietate, hydrogenated alkyl abietate, or their mixture. This oil-like material contains in accordance with my invention a proportion of mineral oil within the range of 4-20%. The mineral oil which is used is preferably a light oil characterized as a rust-preventive oil. However, any type of light

mineral oil, such as spindle oil, fuel oil Nos. 5 and 6 (bunker C oil) or lubricating oil may be employed as the mineral oil constituent of the oil-like material which is mixed with the cellulose ester to form compositions in accordance with my invention. In view of the use to which the composition is put, it is desirable that the oil employed have a boiling point of at least 200° C.

If an alkyl abietate is employed, it may be any one of methyl, ethyl, isopropyl, butyl, or amyl abietate. The most readily available alkyl abietate is methyl abietate which is marketed under the trade name "Abalyn," preparation of this ester being described in U. S. Patent No. 1,944,241 of Humphrey. Also, any of the hydrogenated alkyl abietates may be employed. Hydrogenated methyl abietate is the most common of these materials, at the present time this material being marketed under the trade name "Hercolyn" and described in U. S. Patent No. 1,944,241. If it is desirable to mix other materials with the castor oil or the abietates, we have found that a chlorinated diphenyl is very useful for this purpose. Chlorinated diphenyls are marketed at the present time under the trade name "Aroclor," those having low melting points as represented by Aroclors Nos. 4465 and 5442 being especially suitable as a diluent in preparing compositions for protective coating purposes. It is desirable that the castor oil or the abietates or their mixture, however, constitute at least 30% of the oil-like material used.

I have found that the most useful compositions in accordance with my invention consist of an amount of cellulose ester within the range of 50-60%, the remainder being the oil-like material described herein. With the use of a cellulose ester within the range of 50-60% of the total composition, a composition is obtained having good coating properties, and the resulting coating exhibits no tackiness after it has cooled. This composition is useful for coating metal gears, housings, valves, rods, assemblies of parts, or, in fact, any metal part which is to be transported before use. The coatings in accordance with my invention are transparent and, hence, not only can the nature of the part enclosed be determined without stripping the coating therefrom, but any lettering which is present thereon may be observed. The preferred method of coating merely consists in forming a melt composition in accordance with my invention at a temperature within the range of 130-200° C. and dipping the clean metal part therein. The thickness of the coating which is to be applied may be adjusted by the viscosity of the bath in which the part is dipped. This viscosity may be adjusted by the viscosity of the ester which is used, or by the temperature to which the melt is heated. If desired, a small proportion, such as 1% of an antioxidant, such as hydroquinone, may be incorporated in the molten mass.

The following examples illustrate my invention:

Example 1.—A composition was prepared by mixing together 55 parts of a cellulose acetate butyrate having a butyryl content of 47%, an acetyl content of 6.5%, and approximately .2 hydroxyl per glucose unit, and a viscosity of 25 centipoises with 40 parts of hydrogenated methyl abietate and 5 parts of a rust-preventive mineral oil. At 150° C. the mass was found to form a clear homogeneous melt, and this bath was used as a dipping bath to apply protective coatings on the surface of metal parts.

Example 2.—A mixture of 60 parts of cellulose acetate butyrate of a similar type to that used in the preceding example was mixed with 33 parts of castor oil and 2 parts of mineral lubricating oil and was heated to 160° C. to give a smooth solution. Clean steel plates suspended by a wire were dipped into this solution and then allowed to drain and cool. The plates were protected against corrosion by this covering.

Example 3.—Fifty-five parts of cellulose acetate butyrate of the type described above were mixed with 35 parts of methyl abietate and 10 parts of a rust-preventive mineral oil. The mixture was heated to 180° C., then cooled to 150° C. for dipping. Metal pieces were dipped, and the coating was found to set quickly after removal from the dipping bath.

Example 4.—A composition was prepared consisting of 50 parts of cellulose acetate butyrate of the type prescribed herein, 20 parts of castor oil, 10 parts of hydrogenated methyl abietate, 15 parts of Aroclor No. 5460, and 5 parts of rust-preventive mineral oil. The composition was melted together and a clean steel plate was dipped therein. Upon cooling and setting, a good protective coating resulted, the coating having a tensile strength of 351 pounds per square inch.

Example 5.—A composition was prepared consisting of 50 parts of cellulose acetate butyrate, 30 parts of Herculyn, 15 parts of Aroclor No. 5460, and 5 parts of mineral oil. A clean steel plate was dipped at 190° C. resulting in a clear coating thereon having a thickness of .077 inch. The resulting coating had a tensile strength of 372 pounds per square inch.

I claim:

1. A heat strippable protective coating composition essentially consisting of 50–60% of a cellulose acetate butyrate having a butyryl content of 45–52%, an acetyl content of 1–9%, 0.1–0.4 hydroxyl per glucose unit and a viscosity within the range of 15–150 centipoises and 40–50% of an oil-like material essentially consisting of 4–20% of mineral oil, at least 30% of a chlorinated diphenyl and at least 30% of an ester selected from the group consisting of the lower alkyl abietates and the hydrogenated lower alkyl abietates.

2. A heat strippable protective coating composition essentially consisting of 50–60% of a cellulose acetate butyrate having a butyryl con-

tent of 45–52%, an acetyl content of 1–9%, 0.1–0.4 hydroxyl per glucose unit and a viscosity within the range of 15–150 centipoises and 40–50% of an oil-like material essentially consisting of 4–20% of mineral oil, at least 30% of a chlorinated diphenyl and at least 30% of a methyl abietate.

3. A heat strippable protective coating composition essentially consisting of 50–60% of a cellulose acetate butyrate having a butyryl content of 45–52%, an acetyl content of 1–9%, 0.1–0.4 hydroxyl per glucose unit and a viscosity within the range of 15–150 centipoises and 40–50% of an oil-like material essentially consisting of 4–20% of mineral oil, at least 30% of a chlorinated diphenyl and at least 30% of a hydrogenated methyl abietate.

4. A heat strippable protective coating composition essentially consisting of 55% of a cellulose acetate butyrate having a butyryl content of 45–52%, an acetyl content of 1–9%, 0.1–0.4 hydroxyl per glucose unit and a viscosity within the range of 15–150 centipoises, 30% of hydrogenated methyl abietate, 15% of chlorinated diphenyl, and 5% of mineral oil.

5. A metal article which is subject to corrosion having a strippable oil-exuding coating thereon consisting of 50–60% of a cellulose acetate butyrate having a butyryl content of 45–52%, an acetyl content of 1–9%, 0.1–0.4 hydroxyl per glucose unit and a viscosity within the range of 15–150 centipoises, and 40–50% of an oil-like material containing 4–20% of mineral oil, at least 30% of a chlorinated diphenyl and at least 30% of hydrogenated methyl abietate.

GORDON D. HIATT.

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