Fig. 1
This invention comprises an improved method for producing dipped latex products by applying an electrical charge on a form which is periodically dipped into and withdrawn from a natural rubber or synthetic rubber latex, the presence of the electrical charge on the form at the instant of contact of the form with the latex permitting the formation of blisters in the resultant product. The voltage of the applied electrical charge is in the range of 5–1000 volts, preferably 100–400 volts, and for reasons of safety, the amperage is desirably kept very low, for example in the neighborhood of 50 milliamperes per form.

This invention relates to an improved method for dipping forms into a latex bath for the purpose of effecting a chemical deposition of latex thereon. More specifically, it relates to an improved process whereby the formation of "dipping blisters" is avoided. Still more particularly, this invention relates to the application of an electrical charge to the dipping form so as to avoid the formation of dipping blisters in effecting a chemical deposition of latex upon dipping the form into a latex bath.

In the chemical deposition of latex upon a form for the manufacture of balloons and various other similar articles, it has been found that the initial point of contact of the form with the latex very often causes a condition which eventually results in a dipping blister. It is believed that one or more small bubbles of air are trapped at this initial point of contact and as the latex wets the form each bubble is entrapped in the deposited latex so as to form a blister.

Where coagulants are used in chemical deposition, the film formation is apparently so rapid that any air bubble trapped upon initial contact of the latex with the form results in a blister or window having a thin film on the outside of the bubble.

It is conventional in the trade to have the dipping form pointed at one end and to have this pointed end make the first contact or entry into the latex bath. In this way, as the latex wets the form, the sharp vertical angle of the form as it enters the bath allows any air bubbles, that might otherwise be entrapped, to escape by rising along the surface of the form.

Even though this practice has reduced the number of such dipping blisters, there still are occasional dipping blisters formed even with forms having a pointed or angular portion. In other cases where it is not possible to have the form pointed at the area of first contact because of the particular shape of the article to be formed, or because of the type of equipment being used to lower the form into the latex bath, the formation of such dipping blisters becomes still more critical and frequent.

Although the waste or spoilage of balloons, etc., is less in the conventional practice of having a pointed section make the initial contact with the latex, it is desirable to avoid even this small amount of waste. This problem of waste becomes even more important where the conventional practice of using a pointed form cannot be employed or where the manner of lowering the form does not permit the entry of a pointed or angular portion of the form.

In accordance with the present invention, it has now been found that the formation of dipping blisters can be avoided completely. This elimination of dipping blisters is effected by insulating the dipping form or otherwise avoiding electrical grounding thereof, applying an electrical charge of considerable voltage but small amperage to the form just prior to the entry of the form into the latex bath, so that there is an electrical discharge from the form to the latex bath at the instant of entry. It is believed that this practice confines the initial contact to a very small area of the latex as the latex is attracted upward toward the form by the electrical charge. Therefore, when the wetting spreads the latex over a larger area of the form it moves any air bubbles that might otherwise be formed on entrapped away from the wetted area and thus avoids entrapment of these bubbles.

In the practice of this invention, the voltage desirably applied to the form will vary according to the size or mass of the form. However, for forms having a weight range of 4 ounces to 1 pound, a voltage of 350–400 volts is particularly appropriate. For smaller forms voltages as low as 250 are generally appropriate, and with minute forms voltages as low as 100 operate satisfactorily. With very low metal mass, such as with a plastic or ceramic form where merely a metal tip is used at the point of entry of the form into the latex, a voltage as low as 5 volts shows a considerable improvement in reduction of blister formation as compared to the prior art methods. For extremely large forms, for example up to 5 pounds, voltages up to 1,000 are accordingly used. Variations in the amperage are not too critical although it is generally desirable to use very low amperage, such as approximately 50 milliamperes per form. Generally, varying or increasing the amperage has no beneficial or harmful effects. For reasons of personal safety of the operators, however, it is generally desirable to use as small amperage as needed.

The type of latex bath, the forms used and the conditions used for the dipping operation are those normally used in the chemical deposition of latex. Likewise the coagulents used are similar to those used for such purposes.

The natural rubber latex used in the examples described below consists of: 100 parts natural rubber latex; 0.1 part KOH; 2 parts isopropylamine; 0.75 part sulfur; 5 parts TiO₂; 3 parts coloring material; 2.5 parts Sarna wax; and very minor amounts of modifiers including 0.5 part Agorile Alba; 0.5 part Agerile Stilite; 0.2 part heptane base; 0.1 part methyl zimate; and 0.05 part Rotax.

A typical synthetic rubber dipping latex is the isoprene latex used in Example VI which consists of 100 parts isoprene 700; 2 parts TiO₂; 3 parts coloring material; 1.5 parts ZnO; 2 parts antioxidant D; 1.25 parts sulfur; and very minor amounts of modifiers including 1.22 parts Set Set; 0.75 part Oxaf; 0.75 part Baroc; and 0.5 part of Neapel BA75.

The form can be made of any appropriate type of metal so as to conduct the electrical charge. Aluminum forms are advantageous because of their lightness. If it is desirable to use glass, porcelain, wood or plastic forms, a metal conductor is desirably passed through the center of the form or along a groove in the surface of the form so as to have a metal tip at the point of initial contact. In certain cases it may be desirable to have the form made of a conducting plastic, that is one coated with a thin layer of metal. Where it is possible to apply a static charge on a non-conducting form, such a system is also appropriate.

The latex can be any type of latex used in chemical
deposition including compounded latices normally used for the manufacture of balloons, gloves and related articles. The latex can be prepared from natural rubber, synthetic rubber such as styrene-butadiene copolymers, neoprene, etc. A particularly desirable coagulant is a solution of calcium nitrate in alcohol. However, other appropriate coagulants can be used depending on the particular latex being used.

The coagulant used in the working examples given below consists of 200 parts of ethyl alcohol, 190 parts of Ca(NO₃)₂, 50 parts Zn(NO₃)₂, 60 parts ethyl lactate, 50 parts lactic acid and 1 part of wetting agent (Igepall).

Both continuous and batch dipping can be used in the practice of this invention.

The electrical charge is precisely controlled by having the electrical contact made at the time of the dipping contact or an instant or more before. Where conditions are such that the charge is not appreciably dissipated, it can be applied at a longer period before dipping.

Various means for applying the electrical charge can be used depending upon the particular type of dipping operation. In a continuous system for dipping the forms, a portion of the form, where it is made entirely of metal, can be made to move over a metal contact or conductor which carries the electrical current. Where the entire forms are not made of metal, the conductor which carries the charge to the point of initial entry of the form into the latex bath is contacted with the source of electrical charge.

If the container in which the bath is held is of metal, this can be grounded or if desired can be connected by a metal conductor to complete the electrical circuit with the source of electricity. If the container is of a non-conductive material, a conductor can be inserted in the bath at a point some distance from the point of entry of the forms into the latex bath.

In the drawings, Fig. 1 illustrates a simple electrical circuit used in applying an electrical charge to forms being dipped manually into a bath.

FIG. 2 illustrates an arrangement of equipment for a continuous dipping and processing operation wherein electrical contacts are made with a series of forms passing in continuous fashion over the electrical contact areas and these forms individually receive an electrical charge during the time they are being lowered to the surface of the bath.

The invention is best illustrated by the following examples. These examples are given by way of illustration and are not intended to restrict in any way the scope of the invention nor the manner in which it can be practiced. Unless specifically provided otherwise, parts and percentages are given as parts and percentages by weight respectively.

EXAMPLE I

A latex bath containing a compounded natural rubber latex normally used for making balloons is electrically grounded and a number of forms of varying sizes as indicated below are dipped manually into the latex bath. The form in each case is connected to a source of D.C. current which supplies a voltage of 260 volts and an amperage of 40 milliamperes (m.a.) per form. A number of balloon forms of various standard balloon sizes, namely Nos. 8, 9, 11, 426 and 527 are dipped into the latex bath with the aforementioned charge applied. Nine forms of each of the aforementioned sizes are dipped into the latex after dipping into soapstone coating and coagulant solutions respectively. In this case, the coagulant is the Ca(NO₃)₂ solution described above. In each case the resultant balloon after being stripped from the form is found to be in excellent condition and completely free of dipping blisters.

EXAMPLE II

The procedure of Example I is repeated except that the electrical charge is 290 volts and 50 milliamperes, and nine forms of each of standard sizes 8, 9, 11, 462 and 524 are dipped. Here again every one of the resultant balloons is completely free of dipping blisters.

EXAMPLE III

The procedure of Example I is repeated except that the electrical charge applied is 350 volts and 57 ma., and nine forms each of standard sizes, 8, 9, 481, 440 and 524 are used. In each case the resultant balloon is completely free of the blisters.

EXAMPLE IV

A continuous dipping machine such as shown in Gannett Patent 2,299,269 is operated with a number of forms moving along a continuous conveyor system with the forms suspended from swivelled blocks as shown in FIG. 2. These swivelled blocks are made of plastic and insulated each form from the conveyor system. These blocks are pivotedly attached to a groove rod parallel to and carried by the conveyor system in such a way that the position of the form is governed by a guide rail running parallel to the conveyor system. A ball bearing roller on the stem of the form rolls on the guide rail and the relative positioning of the guide rail determines whether the form is carried substantially horizontally or lowered at an angle into respective baths positioned along the course of the conveyor system. In this way the respective forms are lowered into a bath for a desired period and, as the conveyor system moves the forms along, the guide rail likewise effects a lifting of each form out of the bath and the form is then carried in a horizontal or lowered position until the next bath is reached, at which time the guide rail permits each form to be lowered into and then raised out of this next bath, and likewise through subsequent baths. In this way the forms are lowered respectively into baths of soapstone solution, alcoholic Ca(NO₃)₂ coagulant solution, natural rubber latex as in Example I and then a leaching solution, following which the regular procedure of curing and/or drying is effected by passing through a heated chamber, and powder is applied by lowering the form into an alcoholic solution of soapstone. Then the individual balloons are removed from the forms by an automatic device such as described in the Frits Cremer copending application, Ser. No. 94,903, filed Mar. 10, 1961, now U.S. Patent No. 3,176,039. The guide rail which controls the relative horizontal and oblique or vertical position of the forms as they travel along their path is constructed in any way the scope of the invention nor the manner in which it can be practiced. Unless specifically provided otherwise, parts and percentages are given as parts and percentages by weight respectively.

EXAMPLE V

The procedure of Example IV is repeated using different size forms, namely standard size forms No. 7, 8, 9, 11,
The procedure of Example IV is repeated using respectively in place of the natural rubber latex three synthetic latices, one being a styrene-butadiene latex, another an isoprene latex, and the other a neoprene latex suitable for manufacture of balloons. In each case, similar excellent results are obtained in eliminating the formation of dipping blisters.

FIG. 1 shows an arrangement for the application of an electrical charge to a number of dipping forms adapted to manual dipping of the forms into a latex bath. The forms are fastened by stems 2 to the supporting means 3 which is held by handle 4 by an operator during the dipping operation. Electrical source 5 delivers an electrical charge through conductor 6 to the individual connections lines 6' just prior to dipping the forms into latex 8 contained in bath 7. The bath is connected by conductor means 9 to the opposite pole of the electrical source.

In FIG. 2, a section of a continuous dipping apparatus is shown in that region of the apparatus in which the electrical charge is applied and the dipping operation is performed. Dipping forms 1 are supported through stems 2 by swiveted connector 11 to a supporting rod 12 which in turn is fastened by rod 13 to a section of a continuous conveyor system 14 for which exact details are omitted herein. Stem 2a has a freely rotatable sleeve portion 15 which rests on a guide rail 16.

The guide rail 16 is positioned and shaped so as to support form 1 in a horizontal or raised position during most of its travel and then by having the guide rail turned inward in section 16' toward the conveyor system, this allows the form to be lowered into dipping relationship with the latex. Then as the forms reach the opposite end of the bath, the guide rail is again positioned in such a manner that the form is raised toward and finally into a horizontal position out of the bath. Just prior to the position in which the guide rail allows the form to be lowered in dipping relationship with the latex, the rotatable sleeve portion 16 comes into contact with contact areas 19 to which individual connecting lines 6 are connected to deliver an electrical charge of appropriate voltage and amperage as described herein. These contact areas 19 are insulated from the main portion of the guide rail and from each other so that the individual charge is applied only to an individual form as the rotatable sleeve portion 16 passes over the contact areas 19. This contact and delivery of electrical charge is effected prior to the dipping form entering the latex.

As previously indicated, the various conditions in the dipping operation as well as in the prior and subsequent operations used in the manufacture of the latex dipped products are those normally used for such manufacture. The only change occasioned by the practice of this invention is the application of the electrical charge to the forms as described herein. In applying the electrical charge, either the positive or the negative pole of a D.C. source can be connected to the form, or in any manner of generating an electrostatic charge, such as rubbing a non-conductive form with a cloth or other material capable of generating such a charge, can be used.

The dipping time in the latex bath depends on the size and desired wall thickness of the resultant product. However, the only time element critically involved in the practice of this invention is that instant of initial contact of the form with the latex bath.

While mention has been made of producing dipped products from various latices of natural rubber, synthetic rubber and neoprene, it is also possible to use in the practice of this invention any other latex used in a chemical deposition dipping operation. The chief merit of this invention is in the elimination of dipping blisters believed to be promoted by the fast deposition of the latex solid as it is chemically coagulated on the form. Regardless of the material being deposited, this problem exists so long as there is such a rapid deposition that involves the possibility of entrapping air bubbles on the form during the initial wetting. Therefore this application of the electrical charge as described herein has the same utility for such other wetting operations in the production of dipped products.

While certain features of this invention have been described in detail with respect to various embodiments thereof, it will, of course, be apparent that other modifications can be made within the spirit and scope of this invention and it is not intended to limit the invention to the exact details shown above except as they are defined in the following claims:

The invention claimed is:

1. In the process of producing a dipped latex product by dipping a series of individual forms into a latex selected from the class consisting of natural rubber latex and synthetic rubber latex and withdrawing each said form from said latex after said form has become coated with said latex, the improvement comprising the step of applying an electrical charge to each said dipping form prior to contact of the form with the latex and in such a manner that the charge is present on the form at the instant of initial contact of the form with the latex, thereby inhibiting the formation of dipping blisters in the resultant product.

2. The process of claim 1 in which said latex is a synthetic rubber latex.

3. The process of claim 2 in which said latex is a styrene-butadiene synthetic rubber latex.

4. The process of claim 2 in which said latex is an isoprene synthetic rubber latex.

5. The process of claim 2 in which said latex is a neoprene synthetic rubber latex.

6. The process of claim 1 in which said latex is a natural rubber latex.

7. The process of claim 6 in which the voltage of the applied electrical charge is in the range of 5-1000 volts.

8. The process of claim 6 in which the voltage of the applied electrical charge is in the range of 100-400 volts.

9. The process of claim 6 in which the voltage of the applied electrical charge is in the range of 350-400 volts.

10. The process of claim 1 in which the voltage of the applied electrical charge is in the range of 5-1000 volts.

11. The process of claim 1 in which the voltage of the applied electrical charge is in the range of 100-400 volts.

12. The process of claim 1 in which the voltage of the applied electrical charge is in the range of 350-400 volts.

References Cited
UNITED STATES PATENTS

3,200,057 8/1965 Burnside et al. 204—181
3,200,058 8/1965 Oster 204—181

JOHN H. MACK, Primary Examiner.
E. ZAGARELTA, Assistant Examiner.