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PROCESS FOR MAKING RUBBER THREAD

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This invention relates to processes for making rubber thread and more particularly to processes for manufacturing filaments, threads or bands, hereinafter generically termed "thread", from coagulable dispersions of elastic materials, such as rubber latex.

A process for manufacturing rubber thread from latex by passing a stream of latex through an orifice into a bath of coagulant, such as acetic acid or alcohol or a mixture of the same, and continuously withdrawing a formed rubber thread from the coagulating bath and subsequently drying and vulcanizing, if desired, has been known for some time. In my copending application Serial No. 595,235, filed February 25, 1932, I have disclosed a method for making rubber thread by continuously passing a stream of coagulent, such as acetic acid or alcohol or mixture of the same, through a nozzle into a body of latex, drawing the formed coagulum away from the nozzle, withdrawing the resulting filamentary coagulum from the body of latex, setting or coagulating the surface of the thread, if desired, by treatment with acid or alcohol or a solution of a bi- or trivalent metal salt, drying, and vulcanizing the finished thread.

The present invention relates to a process for making rubber thread from latices having different pH values, one latex being coagulated by means of another latex directly in filamentary form without the use of a non-latex coagulant.

In the present preferred method of carrying out my invention, I stream a latex of one pH value into a body of latex of a different pH value, one of the latices being a coagulant for the other, and thereby form a filamentary coagulum in the body of latex. This filamentary coagulum is withdrawn from the body of latex and the operation concluded by hardening or setting the surface of the thread, if desired, and drying. In the preferred practice the coagulable latex is passed through a nozzle into the main body of the coagulating latex but other methods of streaming one latex into the other to form a filamentary coagulum may be resorted to. If the latex that is passed through the nozzle is the one coagulable by the body of latex into which it is passed, then the thread will be formed primarily by coagulation of the issuing stream itself although on removal from the bath, the filamentary coagulum will be found to be coated with uncoagulated latex. If the latex in the main body is the one coagulable by the latex passing through the nozzle, then as the coagulating latex leaves the nozzle and comes in contact with the bath of coagulable latex, a filamentary coagulum or gel is formed initially surrounding a liquid core of the coagulating latex, but as the thread or filament is passed through the latex bath or through later stages of the process, it becomes substantially coreless. As in the first instance, that is, where a coagulable latex is streamed into a coagulating latex, the thread as it is removed from the bath will be coated with uncoagulated latex. In each case, therefore, it is desirable to thereafter harden the surface of the thread by subjecting it to a further setting or coagulating treatment. This may be done by drawing the thread from the main body of latex over a roll of which the surface is kept wet with coagulant, or by spraying or otherwise applying coagulant to the surface of the thread after it has been removed from the latex, or by passing the thread through a groove provided with an orifice in the bottom through which coagulant emerges into the groove in small quantities, or by any combinations of such steps, or by other methods within the skill of those familiar in the art. The size of the filament depends upon the size of the nozzle, the rate of flow of the latex through the nozzle, the nature of the latices, the rate of coagulation of the latex, the length of travel through the latex bath, the rate of withdrawal of the filament from the bath.

As specific illustrations of various manners of carrying out the invention, but without intention of limiting the invention except as required by the prior art, the following examples are included.

Example 1.—An acid latex having a pH between 7 and 4.5 is prepared by any of the methods described in the patents to McGavack and Shive Nos. 1,699,368–9. The acid latex may be compounded as desired and used as the coagulating latex, together with an alkaline latex which may be ordinary ammonia preserved latex and which may be compounded as desired as the coagulable latex. The alkaline latex may be passed through a nozzle into the acid latex or vice-versa. In either case a filamentary coagulum is removed from the main bath of latex and is preferably hardened by setting or coagulation as by treatment with acid and/or alcohol, or a solution of a salt of bi- or trivalent metal.

Example 2.—As in the previous example, a latex may be prepared by the methods disclosed in the patents to McGavack and Shive above referred to, and compounded as desired. In this case, however, this weakly acid latex will be the coagulable latex and as a coagulating latex, I prepare a more strongly acid latex by the method of Nikitin as disclosed in Patent 1,823,119.

According to the method set out in McGavack and Shive patents a latex may be prepared having a pH between 4.5 and 7, and according to the Nikitin patent a latex may be prepared with a pH as low as 1. A weakly acid latex prepared by the method of McGavack and Shive may be coagulated by a more strongly acid latex, such as one prepared by the Nikitin process. As described under Example 1 above, the coagulating latex may be streamed into the coagulable latex or vice-versa. In either case, however, it is advantageous and preferable to harden the surface of the thread after it is removed from the bath by treatment with a setting or coagulating agent as described above.

Example 3.—In this case the coagulating latex may be an acid latex with a pH as low as 1, preferably prepared by the process described in the Nikitin patent, while the coagulable latex may be an alkaline latex, for example ordinary ammonia preserved latex, both latices, of course, being compounded as desired.

It is obvious that the viscosities of the various latices, the method of drying the filament, the composition of the latices with reference to the various compounding ingredients, the rate of flow of one latex through the nozzle, the rate of withdrawal of the thread from the main body of latex, and the length of travel through the latex, may be varied as desired.

The latices may be vulcanized, or they may be unvulcanized with or without vulcanizing ingredients added thereto. If a vulcanized thread is desired, it may be obtained by compounding the various latices with suitable vulcanizing ingredients, forming a thread therefrom, and vulcanizing the final product; or it may also be formed from vulcanized latices as suggested above, or a thread formed from unvulcanized latices without vulcanizing ingredients may be subjected to the action of vulcanizing liquids or vapors, or to solutions containing vulcanizing ingredients. In addition, it is especially advantageous where it is desired to keep the temperature of the thread during manufacture as low as possible, to incorporate various parts of vulcanizing compounds in the coagulating and coagulable latices so that when the final thread is formed, the various increments of a complete vulcanizing compound have combined in the two latices to form a low temperature vulcanizing combination, in accordance with the invention comprised in the patent to Cadwell No. 1,777,960. In this manner the two latices may be compounded with the separate ingredients of a complete low temperature vulcanizing compound without danger of prevulcanization of the latex before formation into the finished thread. Where an alkaline latex is streamed into acid latex or where an acid latex is streamed into an alkaline latex to form a thread, the alkaline latex may be made heat sensitive by methods well known in the art, such as by the addition of small amounts of salts of bi- or trivalent metals dissolved in or suspended in the latex, and the acid latex may be maintained at an elevated temperature. In this manner whether the heat sensitive alkaline latex is streamed into a heated acid latex or a heated acid latex is streamed into a heat sensitive alkaline latex, the coagulation in thread form by virtue of the difference in pH values will be enhanced by the heat sensitive properties of the coagulating latex.

The term "latex" in the descripton and claims is used to designate broadly coagulable dispersions of elastic materials such as natural latex, which may be preserved or otherwise treated as desired, and which may be in a normal, diluted, concentrated or purified condition produced by methods well known in the art. It is also intended to include such artificial dispersions of rubber and rubber-like materials as may be treated in accordance with the present invention and utilized in the procedure as herein set forth.

Various other modifications will be apparent to persons skilled in the art and it is understood that I do not intend to limit myself to the specific improvements described above except as indicated in the appended claims.

Having thus described my invention, what I claim and desire to protect by Letters Patent is:

1. A process for making rubber thread comprising the step of forming a continuous length of coagulum from latices of different pH values at least one of which is a coagulant for another of said latices, and drying said coagulum.

2. A process for making rubber thread comprising the step of forming a continuous length of coagulum from two latices of different pH values one of which is a coagulant for the other and each of which contains part of a complete low temperature vulcanizing combination, and drying said coagulum.

3. A process for making rubber thread comprising the step of forming a continuous length of coagulum from a latex having a pH value lower than 7 and a latex having a pH value higher than said first latex, said first latex being a coagulant for the latex of higher pH value, and drying said coagulum.

4. A process for making rubber thread comprising the step of forming a continuous length of coagulum from a strongly acid latex and a weakly acid latex, and drying said coagulum.

5. A process for making rubber thread comprising the step of forming a continuous length of coagulum from an acid latex and an alkaline latex, and drying said coagulum.

6. A process for making rubber thread comprising preparing at least two aqueous dispersions of rubber at least one of which is a coagulant for another of said dispersions, and coagulating said coagulable dispersion by means of said coagulating dispersion in the form of a continuous length, and drying said coagulum.

7. A process for making rubber thread comprising streaming a latex into another latex of different pH value from said first latex, one of said latices being a coagulant for the other, and forming a continuous length of coagulum thereby, removing said coagulum, and drying.

8. A process for making rubber thread comprising streaming a latex having a pH value lower than 7 and a latex having a pH value higher than said first latex, said first latex being a coagulant for the latex of higher pH value, one into the other, and forming a continuous length of coagulum thereby, removing said coagulum, and drying.

9. A process for making rubber thread comprising streaming a strongly acid latex and a weakly acid latex one into the other and forming a continuous length of coagulum thereby removing said coagulum, and drying.

10. A process for making rubber thread comprising streaming an acid latex and an alkaline latex one into the other and forming a contiuous length of coagulum thereby, removing said coagulum, and drying.

11. A process for making rubber thread com-

prising streaming a latex having a high pH value into a latex having a lower pH value, one of said latices being a coagulant for the other, and forming a continuous length of coagulum thereby, removing said coagulum, and drying.

12. A process for making rubber thread comprising streaming a latex having a pH value lower than 7 into a latex having a higher pH value, said first latex being a coagulant for the latex of higher pH value, and forming a continuous length of coagulum thereby, removing said coagulum, and drying.

13. A process for making rubber thread comprising streaming a weakly acid latex into a strongly acid latex and forming a continuous length of coagulum thereby, removing said coagulum, and drying.

14. A process for making rubber thread comprising streaming an alkaline latex into an acid latex and forming a continuous length of coagulum thereby, removing said coagulum, and drying.

15. A process for making rubber thread comprising the step of passing a stream of latex of one pH value through a nozzle into a latex of a different pH value, one of said latices being a coagulant for the other, forming a filamentary coagulum thereby, removing said coagulum, and drying.

16. A process for making rubber thread comprising continuously streaming an alkaline latex into an acid latex which is a coagulant for said alkaline latex, withdrawing the resulting coagulum in filamentary form from the body of acid latex, setting or coagulating the surface of the thread, drying and vulcanizing.

17. A process for making rubber thread comprising continuously passing a stream of alkaline latex through a nozzle into a body of acid latex which is a coagulant for said alkaline latex, drawing the formed coagulum away from the nozzle, withdrawing the filamentary coagulum from the body of acid latex, setting or coagulating the surface of the thread, drying and vulcanizing.

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