

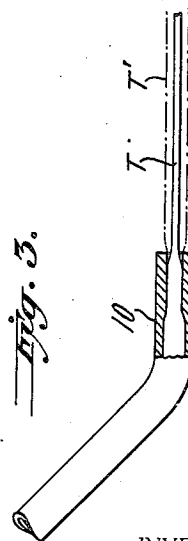
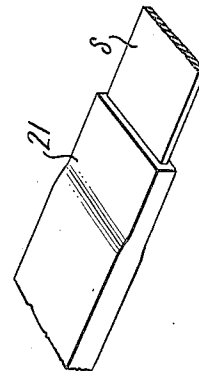
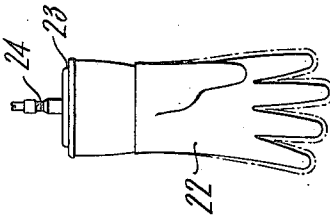
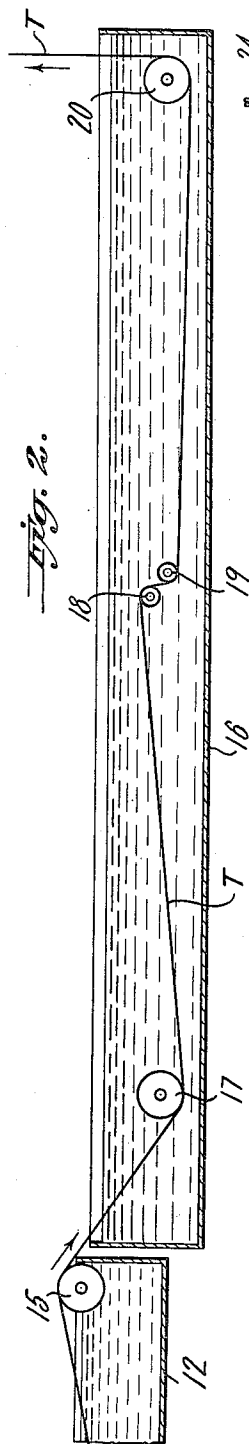
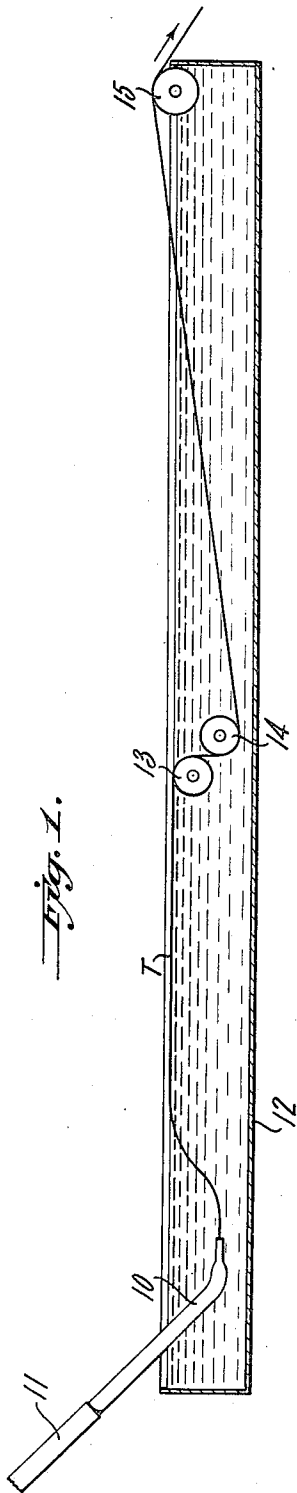
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METHOD OF CONTROLLING THE LIQUID ABSORBING PROPERTY OF COAGULATED LATEX

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METHOD OF CONTROLLING THE LIQUID
ABSORBING PROPERTY OF COAGULATED
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11 Claims. (Cl. 18—50)

This invention relates to a method of controlling or changing the liquid absorbing property of coagulated latex and other forms of coagulated rubber whereby the rubber may be caused to imbibe an added quantity of liquid and if desired, subsequently expel part of this liquid.

It is found that coagulated rubber articles when stretched have their liquid absorbing property increased and that if a coagulated rubber article which has imbibed additional liquid while stretched is permitted to contract, it will expel part of the absorbed liquid. By employing the present invention the liquid absorbing property of coagulated rubber articles may be controlled to thereby control the property of the coagulated rubber to imbibe and expel liquids such as coagulants, other reagents, accelerators, dyes or the like.

It has been proposed heretofore to produce a thread directly from an aqueous dispersion of rubber by extruding or streaming such aqueous dispersion of rubber through a nozzle or orifice and withdrawing and coagulating the dispersion in the form of a thread having the shape of the nozzle opening. In the Hopkinson and Gibbons Patent No. 1,545,257 issued July 7, 1925 there is disclosed one such extrusion or streaming process of making rubber thread directly from aqueous dispersion of rubber, wherein the dispersion is extruded or caused to flow through a nozzle into a bath of coagulant such as an acid, and the coagulum is withdrawn from the bath in the form of a continuous thread.

Large quantities of grainless rubber thread have been produced heretofore by the above mentioned method of extruding an aqueous dispersion into a coagulant, and then delivering the thread to a drying or vulcanizing chamber, and it is found that the speed at which such thread can be manufactured is limited by the rate at which the thread can be dried. If the coagulated rubber thread is dried too rapidly difficulty is caused by "blowing" that is, the formation of bubbles in the coagulum. This blowing tendency depends to a considerable degree upon the quantity of acid or other coagulant present in the thread as it is delivered to the drier, and it is found that reduction in the coagulant strength to a figure just sufficient for commercial complete coagulation permits high drier-operating speeds.

Having in mind the foregoing, one extremely important use of the present invention is in connection with the manufacture of extruded coagulated rubber threads or strips to control the action of the coagulum in the acid or other co-

agulant bath, or in a subsequent bath whereby a rapid penetration of a coagulant of the proper strength into the coagulum may be secured and, if desired, its partial removal by washing in a subsequent bath. As a result of this use of the invention the quantity of acid or other liquid associated with the coagulum when it is presented to the drier may be accurately controlled and consequently the rubber thread or strip may be dried or vulcanized much more rapidly than heretofore.

The present invention in its broader aspect contemplates the method whereby the moisture contents of various coagulated rubber articles may be varied by stretching or permitting contraction of the articles while in a coagulant or subsequent bath. This method of controlling the liquid contents of coagulated rubber has a number of highly valuable uses. For example, it may be employed to cause the coagulum to absorb an increased amount of a coagulant to thereby increase its penetration or migration into the coagulated article so as to secure a better setting or hardening of the rubber, or other improvements therein. It may be employed to reduce the amount of acid or other reagents in the coagulum when it is delivered to the drying chamber so as to increase the rate at which the coagulum may be dried or vulcanized. It may also be employed to cause the coagulated rubber to absorb and/or expel liquid in any desired bath, to cause the coagulum to absorb dyes or other substances.

It has been proposed heretofore to mix reagents for specific purposes in latex compounds but this prior practice is limited as to the reagents that can be used, in that they must not be decomposed by ammonia, formaldehyde or other agents in the original compound and must not be decomposed by the coagulant. It has also been proposed heretofore to introduce reagents in the coagulum by "soaking" but this is slow and is not generally applicable since the reagents tend to concentrate in the outside layer.

The present method of introducing reagents into coagulated rubber articles avoids these difficulties and permits the use of reagents that could not be used heretofore. Furthermore, its use secures a thorough penetration of the reagent and is applicable to continuous processes. It may also be readily employed to secure an internal washing to remove objectionable soluble materials or for other purposes.

The practical application of the present invention is or may be extremely simple, for example, if it is desired to cause a coagulated rubber thread,

strip or sheet of any desired dimensions to absorb an increased quantity of the coagulant to thereby increase its penetrating properties, all that is necessary is to vary the speed of the operating rolls associated with the coagulant bath to stretch the coagulum while in this bath and thus increase the quantity of the coagulant absorbed. If it should be desired to remove part of this absorbed liquid before delivering the coagulum to the drier, all that is necessary is to deliver the coagulum to a second bath in a stretched condition and allow it to contract in this bath to expel therein part of the liquid absorbed in the first bath, or the coagulum may be stretched in this second bath and then allowed to contract therein to effect a washing operation.

By treating the coagulum in the first and second bath in the manner just mentioned a coagulant of either higher or lower strength than has been commercially employed heretofore may be used, since a more thorough penetration of the coagulant is secured and the strength of the same may be reduced in the second or washing bath to a strength which is just sufficient for commercial complete coagulation.

If it should be desired to employ the method of the present invention in connection with dipped goods produced by dipping a mold in a latex compound or other forms of aqueous dispersions of rubber, this may be accomplished by employing a mold which is adapted to be expanded or inflated and then permitted to contract to thereby effect expansion and/or contraction of the dipped article in the coagulant or subsequent bath, as desired.

The various features of the present method will be more fully understood from the following description when read in connection with the accompanying drawing illustrating good practical forms of apparatus for carrying out different applications of the method.

In the drawing:

Fig. 1 illustrates, more or less diagrammatically, an extrusion or streaming method for making rubber thread from an aqueous dispersion of rubber, and shows the coagulant tray in longitudinal section;

Fig. 2 shows in longitudinal section the discharge end of the tray of Fig. 1 and a second thread receiving tray;

Fig. 3 is a side elevation with part in section of an extrusion nozzle or spinneret.

Fig. 4 is a perspective view of an extrusion nozzle having a slot-like opening for producing a strip or sheet; and

Fig. 5 is a face view of an expansible glove form.

Various forms of mechanism may be employed in carrying out the method of the present invention, and in Fig. 1 is shown an extrusion nozzle or spinneret 10 having its upper end connected to a supply pipe 11. The discharge end of the nozzle 10 may be submerged to any desired depth below the surface of the liquid in the tray 12. This liquid may be an acid or other coagulant which will cause the rubber thread to coagulate as it issues from the nozzle.

The latex compound or other aqueous dispersion of rubber is preferably supplied to the nozzle 10 through the pipe 11 under a constant hydrostatic head, to cause it to stream from the nozzle into the coagulant bath of the tray 12 to form the coagulated rubber thread T.

The thread T in the construction shown is continuously withdrawn from the nozzle 10 by

the pull rolls 13, 14 which preferably are spaced apart sufficiently to prevent them from pressing or crushing the thread between them, and the thread may be passed over one roll and under the other as shown to secure the desired driving friction. For round threads these rolls if desired may be provided with small semi-circular grooves having the configuration of the thread in cross-section. The thread T which in the present case is of less specific gravity than the coagulant rises to the surface of the liquid as shown as it is pulled forward by the rolls 13, 14.

The size and shape of the thread T will be determined primarily by the size and shape of the opening of the nozzle 10, but the size of this thread may be controlled within a considerable range by varying the speed at which it is withdrawn from the nozzle. For example, if the thread is withdrawn rapidly from the nozzle 10 its thickness will be reduced as shown in full lines in Fig. 3 and its length per unit time will be increased, whereas if it is withdrawn more slowly from the nozzle it will tend to form a larger thread as indicated by the dot-and-dash lines T' in Fig. 3.

Variation of the speed of the pull rolls 13 and 14 will not act to tension the thread between the nozzle 10 and roll 13 since the thread forming compound will flow freely from the nozzle 10 without producing a sufficient drag or resistance to the pull upon the thread to cause it to be appreciably stretched. Variations in the speed of these rolls, however, will vary the length per unit time and size of the thread as above stated.

By the time the thread T has reached the pull rolls 13 and 14 it will have become sufficiently firm to permit it to be stretched in the bath between the roll 14 and the roll 15 at the discharge end of the tank 12. Should the thread be stretched at this time it will absorb an added quantity of the coagulant and cause a more complete penetration or migration of the coagulant through the thread. To secure this stretch of the thread and increase absorption of liquid all that is necessary is to operate the roll 15 at a faster surface speed than the roll 14.

The second tray 16 shown in Fig. 2 may contain water at about room temperature or other liquid, and the thread T passing through this tray may be treated therein in accordance with the present invention to vary its liquid absorbing property. For example, the thread T may be stretched in tray 16 to cause it to absorb some of this liquid to dilute or wash out part of the coagulant which the thread absorbed in the first tray 12, or the thread may be stretched, say while traveling in one portion of this tray to cause it to absorb liquid and then permitted to contract while traveling in another portion of the tray, to cause it to expel the liquid. In this way an internal washing of the thread may be secured. This may be accomplished by operating the roll 17, say at the same surface speed as the roll 15 and the pull rolls 18 and 19 at a higher surface speed than 17 to stretch the thread between the rolls 17 and 18, and by operating the roll 20 at a slower surface speed than the roll 19 to permit the thread to contract between these rolls.

Should it be desired to produce a ribbon or strip of any desired dimensions in place of the thread T all that is necessary is to substitute the extrusion nozzle 21 of Fig. 4 having a slot-like opening for the nozzle 10 in Fig. 1 so as to ex-

trude the strip S of latex or other rubber therefrom.

It will be seen from the foregoing that by employing the present method to cause a thread, strip or the like of coagulated rubber to imbibe an additional quantity of liquid or expel part of the absorbed liquid, a much better control of the penetration of a coagulant, reagent or other liquid into the thread may be secured, and that this can be readily accomplished without in any way interfering with the continuous passage of the thread from the extrusion nozzle to the drying chamber or other apparatus.

By employing the present method it is possible to secure a very material increase in the speed at which an extruded rubber thread can be produced, since this method makes it possible to use a weaker coagulant in the tray and secure a more thorough penetration by stretching the thread in this tray between the rolls and to increase its absorption of the liquid. The thread may then be internally washed in the tray by stretching it and permitting the thread to contract therein so as to reduce the coagulant in the thread to a point low enough to permit proper vulcanization in the drier. This reduction in the strength of the coagulant permits a more rapid drying of the thread and a substantial increase in production.

The present method is equally well adapted for use in treating coagulated rubber thread or strips with various reagents, or to introduce dyes or accelerators therein. It is also well adapted for use in internally washing rubber to free it of soluble substances. Furthermore, these desired results can be secured without in any way interfering with the continuous production of the thread or strip and do not require the use of expensive or complicated apparatus.

The present method may also be employed in connection with coagulated rubber articles other than threads, as for example, in the manufacture of dipped goods, wherein forms are dipped in a tank containing a latex compound or other form of aqueous dispersion of rubber and the dipped goods are then permitted to dry on the form. In employing the method of the present invention in connection with dipped goods a form such as shown in Fig. 5 may be used which is so constructed that it can be stretched or inflated. This particular form has the shape of a glove, the top portion of which is closed with a block, and the portion of the form is made of stretchable rubber which may be expanded to the dotted line position of this view by introducing air under pressure in the form through the air valve.

By employing an inflatable form such as shown in Fig. 5 a coating of coagulated rubber deposited thereupon may be stretched when the form is inflated, and allowed to contract when the form is deflated. This stretching of the dipped goods may be used to increase its absorption of liquid, and the contraction to expel liquid, as in connection with the thread above described.

The term "rubber" in the description and claims is intended to include materials such as rubber substitutes and synthetic materials resembling rubber, as well as rubber-like natural materials such as balata, gutta-percha, and the like. The term "aqueous dispersion of rubber" as used in the description and claims comprehends natural dispersions such as latices and artificial dispersions of rubber, materials as de-

scribed above, treated or compounded as desired.

It is understood that the method of the present invention may be carried out by various means other than herein disclosed and it will be evident to those skilled in the art that the invention permits of various modifications without departing from the spirit thereof and it is my intention not to be limited in the scope of the invention except as required by the state of the art and as set forth in the appended claims.

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

1. The method of regulating the property of a coagulated rubber thread or ribbon to absorb and expel liquids, which consists in subjecting the rubber thread or ribbon to one bath while stretched and to a second bath while relaxed, to thereby effect an increased absorption of the first liquid by the coagulated rubber and a controlled expulsion of this liquid by the rubber in the second bath.

2. The method of regulating the property of a coagulated rubber article during its formative stage to absorb and expel liquids, which consists in subjecting the coagulated rubber to one bath while stretched and to a second bath while relaxed, to thereby effect an increased absorption of the first liquid by the coagulated rubber and a controlled expulsion of this liquid in the second bath.

3. The method of regulating the property of a coagulated unvulcanized rubber article to absorb and expel a liquid reagent, which consists in subjecting the coagulated unvulcanized rubber to a bath of the liquid reagent while stretched and to a second bath while relaxed, to thereby effect an increased absorption of the liquid reagent and its subsequent controlled expulsion in said second bath.

4. The method of regulating the property of a coagulated rubber article during its formative stage to absorb and expel a liquid, which consists in subjecting the article to a liquid bath while stretched and then allowing the article to contract in a liquid to thereby cause the coagulated rubber to imbibe and expel respectively the bath liquid so as to effect an internal washing of the coagulated rubber.

5. The method of regulating the absorption of a reagent by a rubber article during its formative stage and its subsequent partial expulsion of the reagent, which consists in stretching the rubber article in the presence of a liquid reagent to increase the penetration of the reagent into said article and then permitting the stretched article to contract in a bath to expel some of the absorbed reagent in said bath.

6. The method of regulating the property of an extruded latex thread to absorb and expel liquids, which consists in stretching a freshly extruded latex thread in a coagulant bath to increase the penetration of the coagulant into the coagulated thread, and then permitting the stretched coagulated thread to contract in a second bath to thereby effect a controlled expulsion of the coagulant in the second bath.

7. The method of controlling the property of an unvulcanized rubber article to absorb and expel a liquid, which consists in repeatedly stretching the unvulcanized article and permitting it to contract while in the presence of a liquid to thereby increase the absorption property of the rubber as it is stretched and to effect a partial expulsion of the liquid as the rubber contracts.

8. The method of regulating the property of a coagulated latex thread or strip while in the formative stage to absorb and expel a coagulant, which consists in stretching the latex thread or strip that is being formed in the coagulant bath to increase the penetration of the coagulant into the thread or strip and then permitting the stretched coagulated thread or strip to contract in a second bath to thereby expel part of the absorbed coagulant in the second bath.

9. The method of introducing a reagent into and expelling it from a coagulated rubber article produced on a form by a dipping operation, which consists in expanding the form while the article is in the formative stage to stretch the dipped goods in the presence of a liquid reagent to thereby increase its absorption of the reagent, and then contracting the form in the presence of a second liquid to contract the dipped goods and thereby expel part of the absorbed reagent in said second liquid.

10. The method of forming and coagulating

rubber from a dispersion which comprises forming a length of rubber coagulum by extruding a rubber dispersion into a coagulant, removing the freshly coagulated length of rubber therefrom and contacting it with a washing bath, stretching said length while in the washing bath, and then permitting said length to contract while still in the washing bath to effect an internal washing of the length of rubber.

11. The method of forming and coagulating rubber from a dispersion which comprises forming a length of rubber coagulum by extruding a rubber dispersion into a coagulant, increasing absorption of the coagulant by stretching the formed length of coagulum in the coagulant, disposing the freshly coagulated length of rubber in a washing bath, stretching said length while in said bath, and then permitting said length to contract while still in the washing bath to effect an internal washing of the length of rubber.

ERNEST J. JOSS.