

PATENT SPECIFICATION

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803,013



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International Classification :—C08c, 1.

COMPLETE SPECIFICATION.

Improvements in and relating to the Preparation of Natural Rubbers.

We, THE BRITISH RUBBER ~~Products~~ RESEARCH ASSOCIATION, a Body Corporate duly organised, under the laws of Great Britain, of 19, Fenchurch Street, London, E.C.3, England, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement :—

This invention relates to the preparation of raw natural rubber with improved processing characteristics.

In the manufacture of rubber products the raw rubber is first masticated and mixed with compounding ingredients, and the mixture is then generally forced into the shape required by passing it through a sheeting machine or calender, or a heated die of appropriate contour.

It is known that rubber, on account of its elasticity does not wholly retain the contour or dimensions thus imparted to it but shrinks longitudinally and swells laterally when the mechanical stresses to which it is subjected in the sheeting or ~~extruding~~ machine are released. Consequently the dimensions of a calendered sheet of rubber or of an extruded strip differ from the dimensions of the calender nip or extruder die by an amount that depends mainly on the rheological properties of the particular rubber compound used. In order that the sheeted or extruded rubber may conform to a specified shape or size it is necessary to allow for this lateral or transverse swelling at the calender nip or extruder die. This constitutes a serious difficulty in rubber processing since the degree of swelling differs as between one rubber compound and another, and even in different parts of the same compound.

By masticating the rubber very thoroughly, and by incorporating fillers, or plasticisers, or "reclaimed" rubber, or any combination

of these in the rubber compound it is possible to enhance the plastic properties of the rubber at the expense of the elastic properties and thus to reduce the tendency of the rubber to swell or change its shape at the calender nip or extruder. The extent to which rubber can be treated to facilitate processing is limited, however, by the physical and chemical properties required in the finished article, so that the accurate control of dimensions after calendering or extruding is still largely dependent on the experience and skill of operators in adjusting machines to suit the rheological conditions of the compounded rubber.

According to the present invention a novel type of raw natural rubber is prepared which differs from ordinary natural rubber in that it has less tendency to swell at the calender nip or extruder die even when it is uncompounded or only lightly compounded with fillers and plasticisers. It also calenders, extrudes and otherwise moulds with a remarkably smooth surface after only a short period of mastication.

The method of preparing raw natural rubber in crepe or sheet form according to the invention is by coagulating natural rubber latex which has been mixed with latex that has been subjected to a vulcanising treatment, and from which excess vulcanising ingredients have been removed by centrifuging. The proportion of treated to untreated latex may be chosen so that the proportion of cross-linked rubber in the product is between 5% to 80% by weight of the total, or preferably between 15% and 30%. The cross-links may be introduced by ordinary sulphur vulcanisation at normal or elevated temperature or by any other known method of vulcanising latex with or without sulphur. Any excess of the chemicals used for

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vulcanisation is eliminated by centrifugal separation before the treated latex is mixed with the normal latex and co-precipitated. The co-precipitate is worked up into crepe or sheet rubber by methods known and practised in the industry for converting latex coagulum into the sheet and crepe rubber of commerce.

The following example illustrates the invention:—

Rubber latex containing 100 parts by weight of rubber and 0.75 parts of ammonia was mixed with sulphur 2 parts, zinc oxide 1.5 parts, sodium diethyldithiocarbamate 0.2 part, mercaptobenzthiazole 0.4 part, all of which were dispersed in water with the aid of glue 0.2 part. The latex containing dispersed vulcanising ingredients was heated to 80° C. and held at this temperature, with gentle stirring to keep the vulcanising chemicals in suspension for 2½ hours. The vulcanised latex was cooled, diluted with water to 25 percent dry rubber content and passed once through a centrifugal clarifier to remove the solid vulcanising ingredients. The vulcanised and clarified latex was then mixed with untreated latex containing 400 parts by weight of rubber that had been diluted to 25% dry rubber content. The mixture was coagulated with formic acid 4 parts added as a 5% solution in water. The coagulum that formed was well washed on creping rolls, machined to a thin crepe in the usual way, and dried in air at 35° C. for 6 days.

When the resulting rubber was compounded on mixing rolls with sulphur 3.5 parts, zinc oxide 6 parts, stearic acid 0.5 part, mercaptobenzthiazole 0.5 part and passed through a calendering machine a remarkably smooth sheet was obtained that showed little change in dimensions on cooling. When the same compound was extruded in the form of a tube from an extruding machine

the rubber had a smooth surface and showed little expansion on emerging from the extruded die. By contrast a similar rubber compound prepared from standard crepe rubber and calendered and extruded under the same conditions of temperature and pressure, showed marked roughness in both calendered sheet and extruded tube, and a large increase in lateral dimensions relative to the dimensions of the calender nip and the extruder die.

WHAT WE CLAIM IS:—

1. A method of preparing raw natural rubber in crepe or sheet form by coagulating natural rubber latex which has been mixed with latex that has been subjected to a vulcanising treatment, and from which excess vulcanising ingredients have been removed by centrifuging.

2. A method according to the preceding claim wherein the vulcanised latex has been subjected to a sulphur vulcanising treatment to introduce cross-links between the rubber molecules in the dispersed rubber particles thereof.

3. A method according to either of the preceding claims wherein the latices are mixed in such a proportion that the proportion of the cross-linked rubber is between 15% and 30% by weight of the total rubber in the resultant coagulum.

4. A method of preparing raw natural rubber for calendering, extrusion or other moulding operation substantially as described.

5. Rubber when prepared by the method substantially as described.

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This invention relates to the preparation of raw natural rubber with improved processing characteristics.

In the manufacture of rubber products the raw rubber is first masticated and mixed with compounding ingredients, and the mixture is then generally forced into the shape

required by passing it through a sheeting machine or calender, or a heated die of appropriate contour.

It is known that rubber, on account of its elasticity does not wholly retain the contour or dimensions thus imparted to it but shrinks longitudinally and swells laterally when the mechanical stresses to which it is subjected in the sheeting or extruding machine are released. Consequently the dimensions of a calendered sheet of rubber or of an extruded strip differ from the dimensions of the calender nip or extruder die by an amount that depends mainly on the



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5 or sheet rubber by methods known and practised in the industry for converting latex coagulum into the sheet and crepe rubber of commerce.

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the rubber had a smooth surface and showed 45 little expansion on emerging from the extruded die. By contrast a similar rubber compound prepared from standard crepe rubber and calendered and extruded under the same conditions of temperature and 50 pressure, showed marked roughness in both calendered sheet and extruded tube, and a large increase in lateral dimensions relative to the dimensions of the calender nip and the extruder die. 55

WHAT WE CLAIM IS :—

1. A method of preparing raw natural rubber in crepe or sheet form by coagulating natural rubber latex which has been mixed with latex that has been subjected to a vulcanising treatment, and from which excess vulcanising ingredients have been removed by centrifuging. 60

2. A method according to the preceding claim wherein the vulcanised latex has been subjected to a sulphur vulcanising treatment to introduce cross-links between the rubber molecules in the dispersed rubber particles thereof. 65

3. A method according to either of the preceding claims wherein the latices are mixed in such a proportion that the proportion of the cross-linked rubber is between 15% and 30% by weight of the total rubber in the resultant coagulum. 70 75

4. A method of preparing raw natural rubber for calendering, extrusion or other moulding operation substantially as described.

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5 rheological properties of the particular rubber compound used. In order that the sheeted or extruded rubber may conform to a specified shape or size it is necessary to allow for this lateral or transverse swelling at the calender nip or extruder die. This constitutes a serious difficulty in rubber processing since the degree of swelling differs as between one rubber compound and another, and even in different parts of the same compound.

10 By masticating the rubber very thoroughly, and by incorporating fillers, or plasticisers, or "reclaimed" rubber, or any combination of these in the rubber compound it is possible to enhance the plastic properties of the rubber at the expense of the elastic properties and thus to reduce the tendency of the rubber to swell or change its shape at the calender nip or extruder. The extent to which rubber can be treated to facilitate processing is limited, however, by the physical and chemical properties required in the finished article, so that the accurate control of dimensions after calendering or extruding is still largely dependent on the experience and skill of operators in adjusting machines to suit the rheological conditions of the compounded rubber.

20 According to the present invention a novel type of raw natural rubber is prepared which differs from ordinary natural rubber in that it has less tendency to swell at the calender nip or extruder die even when it is uncompounded or only lightly compounded with fillers and plasticisers. It also calenders, extrudes and moulds with a remarkably smooth surface after only a short period of mastication.

30 The novel raw rubber which is the subject of the invention consists essentially of crepe or sheet rubber in which colloidal particles consisting of groups of chemically cross-linked rubber molecules are dispersed. The rubber may be conveniently prepared by coprecipitating ordinary rubber latex with latex that has been subjected to a treatment designed to cross-link or vulcanise the dispersed rubber particles. The proportion of treated to untreated latex may be chosen so that the proportion of cross-linked rubber in the product is between 5% to 80% of the total, or preferably between 15% and 30%. The cross-links may be introduced by ordinary sulphur vulcanisation at normal or elevated temperature or by any other known method of vulcanising latex with or without sulphur. The chemicals used for vulcanisation are preferably eliminated or destroyed, for example by centrifugal separation, before

the treated latex is mixed with the normal latex and co-precipitated. The co-precipitate is worked up into crepe or sheet rubber by methods known and practised in the industry for converting latex coagulum into the sheet and crepe rubber of commerce.

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