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TEXTILE FIBER DRAFTING ELEMENT CONTAINING A SURFACE-ACTIVE MATERIAL

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This invention relates to roll covers or cots for textile fiber drafting machines such as spinning, drawing, and roving frames and to aprons and other drafting elements used in the textile industry. The invention will be considered specifically with reference to cots, for such drafting elements are widely used and are typical of many different forms of fiber drafting surfaces.

With the advent of oil-resistant synthetic rubbers, such as so-called "Buna-N," a butadiene-acrylonitrile elastomer, the theretofore conventionally used leather and cork composition covered drafting rolls and leather aprons gradually have been replaced, until today in the United States practically all cotton spinning is performed with synthetic rubber drafting surfaces. The more recently popularized man-made fibers have in most instances required the use of synthetic rubber drafting surfaces because of the tendency of these fibers to lap excessively, i. e., the fibers being drafted tend to wrap around the drafting roll.

An object of the present invention is to provide a textile fiber drafting element having an improved drafting surface.

Another object of the invention is to provide a textile fiber drafting element including butadiene-acrylonitrile synthetic rubber having an improved drafting surface.

I have discovered that the drafting qualities of textile fiber drafting elements made of butadiene-acrylonitrile synthetic rubber may be improved by incorporating into the rubber a quantity of compatible surface-active material, i. e., a material which markedly lowers the interfacial tension between water and an immiscible material.

According to this invention there is compounded with the butadiene-acrylonitrile elastomer 2 to 70 parts, and preferably 10 to 25 parts, of a compatible surfactant for each 100 parts by weight of elastomer. The surfactant is preferably one which is essentially fully compatible with the elastomer at textile mill-operating temperatures and in the proportions used so as not to sweat out during service. The nonionic surfactants are preferred, although the compatible cationic surfactants may be used.

The actual theory of the action of these surface-active materials in the synthetic rubber is not understood at this time. They may affect the electrical conductivity of the material and alter the effect of static electricity or its accumulation or generation or they may affect the "wetability" at the interface between the roll surface and the yarn being drafted and thus enhance the drafting qualities of the product. A great deal of effort is being put forth in the field of surfactants to explain their behavior and bring to light their physical reactions in various systems, including water phases. These may some day explain the results which are achieved when such materials are combined with butadiene-acrylonitrile rubber in textile drafting and brought into contact with cotton or other fibers, including synthetic fibers such as rayon, nylon, Orlon, and the like, under the high humidity conditions experienced in textile mills.

The following examples illustrate typical compounding formulas for textile cot compositions:

Example I	Parts by weight
Butadiene-acrylonitrile rubber e. g. "Chemigum N–4"	100.0
Animal glue	50.0
Curing agent, e. g. sulfur	10.0
Curing accelerator	.5
Activator, e. g. zinc oxide	5.0
Plasticizer	8.7
Pigments and fillers	15.3
Nonionic surfactant e. g. polyethylene glycol (400) monolaurate	15.0

The product has a Shore A hardness of 78–88 after vulcanization for 50 minutes at 300° F. The compounding and curing of the composition may be carried out generally in the conventional manner as disclosed in Baymiller Patent 2,450,409, for example, with the nonionic surfactant being added in the manner disclosed in my application Serial No. 427,344, filed concurrently herewith and entitled "Method of Making Textile Fiber Drafting Elements Containing Animal Glue and a Surface-Active Material" to insure proper distribution of the animal glue throughout the compound.

The following is an example of another cot composition:

Example II	Parts by weight
Butadiene-acrylonitrile rubber e. g. "Chemigum N–4"	100.00
Curing agent, e. g. sulfur	3.00
Curing accelerator	1.75
Activator, e. g. zinc oxide	5.00
Pigment (blue)	1.00
Coarse nonreinforcing filler, e. g. limestone	75.00
Nonionic surfactant e. g. polyethylene glycol (400) monolaurate	20.00

The product may be compounded in a conventional manner and when cured for 50 minutes at 300° F. will have a Shore A hardness of 55–60, considerably softer than the composition of Example I.

The following is an example of a harder composition for cot stocks:

Example III	Parts by weight
Butadiene-acrylonitrile rubber e. g. "Chemigum N–4"	100.0
Curing agent, e. g. sulfur	10.0
Curing accelerator	1.0
Activator, e. g. zinc oxide	5.0
Plasticizer	5.0
Coarse nonreinforcing filler, e. g. limestone	40.0
Pigment (red)	.5
Extender—processing aid e. g. vulcanized oil	10.0
Nonionic surfactant e. g. polyethylene glycol (400) monolaurate	20.0

This product may be prepared in the same manner as Examples I and II and when similarly cured will have a Shore A hardness of 65–75.

The cot composition of the following example illustrates a composition including cork granules:

Example IV	Parts by weight
Butadiene-acrylonitrile rubber e. g. "Chemigum N–4"	100.0
Extender—processing aid e. g. vulcanized oil	10.0
Curing agent, e. g. sulfur	10.0
Curing accelerator	1.0
Activator, e. g. zinc oxide	5.0
Coarse nonreinforcing filler, e. g. limestone	40.0
Pigment	15.0
Ground organic filler e. g. 20–40 U. S. standard mesh cork	50.0
Nonionic surfactant e. g. polyethylene glycol (400) monolaurate	20.0

This composition may be prepared and processed similarly to Example I and when cured for 50 minutes at 300° F. will have a Shore A hardness of 75–85. It will be especially resistant to eyebrowing because of the presence of cork granules distributed through the mixture and exposed at the working surface. It will be lap resistant even when drafting the more difficult synthetic fibers, for the polyethylene glycol (400) monolaurate substantially improves lap resistance.

The example below illustrates the invention with a cationic surfactant instead of the nonionic surfactants of the prior examples.

Example V

	Parts by weight
Butadiene-acrylonitrile rubber e. g. Paracril 26NS90	100.0
Animal glue	50.0
Curing agent, e. g. sulfur	10.0
Curing accelerator	2.0
Activator, e. g. zinc oxide	5.0
Plasticizer	18.7
Pigment and filler	15.3
Lubricant, e. g. carbowax 4000	15.0
Cationic surfactant, e. g. amide of polyamine stearate (Nopcogen 18S)	2.0

This composition may be prepared and processed similarly to the other examples, care being taken to avoid scorching due to the accelerating effect cationic materials have on the curing of the composition. This cot will possess adequate lap resistance, permitting its use in drafting most fibers, better than a conventional Paracril stock.

The following example is another illustration of a cot stock including a cationic surfactant, the proportion of cationic material being about 25 parts by weight to 100 parts by weight of the rubber. This composition contains no animal glue.

Example VI

	Parts by weight
Butadiene-acrylonitrile rubber e. g. "Chemigum N-1"	100.0
Curing agent, e. g. sulfur	10.0
Activator, e. g. zinc oxide	5.0
Plasticizer	18.7
Pigment and filler	15.3
Lubricant, e. g. carbowax 4000	5.0
Cationic surfactant, e. g. alkyl biguanidine-(Soromine BSA—50% solids)	50.0

This stock may be prepared in the same manner as the other examples, provided extreme care is exercised to avoid scorching in factory production due to the presence of a substantial quantity of the cationic material. The lap resistance of the product is satisfactory to permit use of the composition for most textile fiber drafting services, being better than a conventional Chemigum stock.

The nonionic and cationic surfactants when they are compounded with butadiene-acrylonitrile rubber and the mass is vulcanized provide a new fiber drafting surface. Obviously, as with most chemical combinations, certain members of the class will perform in an outstanding manner in one composition while others may similarly perform in other compositions but will be less effective in still other compositions.

There are many nonionic surfactants available, and in the development of the present invention a large number have been secured and compounded with butadiene-acrylonitrile rubber and then evaluated for textile drafting uses. The following is a list of commercially available nonionic surfactants which are compatible with butadiene-acrylonitrile copolymer rubberlike materials in the proportions desired for use in accordance with this invention and at mill-operating temperatures and have given significant improvement in textile drafting qualities when compounded with butadiene-acrylonitrile rubber generally as described in the foregoing examples and compared with similar compounds which do not include the nonionic material. These materials are referred to herein as "compatible" with the butadiene-acrylonitrile copolymers, it being understood of course that some of the materials may not be fully compatible in all proportions and at all temperatures, the significant factor being that the materials be compatible and not "sweat out" the synthetic rubber when compounded in the proportions found desirable to provide the improved results and when the drafting element is operated under normal textile mill conditions.

Trade Name	Composition
Pluronic 44	Polyethylene Glycol-Polypropylene.
Pluronic 62	Glycol condensation products.
Sterox CD	Polyethylene Glycol Ester.
Sterox SE	Polyethylene Glycol Thioether.
Sterox SK	Do.
Nonisol 100	Polyethylene Glycol (400) Monolaurate.
Nonisol 210	Polyethylene Glycol Monooleate.
Nonisol 300	Polyethylene Glycol (400) Monostearate.
Ethofat 242/25	Polyethylene Glycol Ester.
Nonic 218	Polyethylene Glycol Tertdodecyl.
Nonic 234	Thioether Glycol Tertdodecyl.
Nonic 261	Do.
Tergitol NPX	Polyethylene Glycol Alkyl Phenyl Ether.
Tergitol TMN	Polyethylene Glycol Trimethyl Nonyl Ether.
Antarox G-100	Alkyl Polyethylene Glycol Amide.
Igepal CO-430	Alkyl Phenoxy Polyoxyethylene Ethanol.
Igepal CO-630	Do.
Aldo 25	Propylene Glycol Monostearate.
Aldo 33	Glyceryl Monostearate.
Aldo 40	Glycerol Oleostearate.
Diglycol Laurate	Diglycol Laurate.
Ninol 713	A fatty acid alkanolamide.
Ninol 737	Do.
Ultrapole S	Fatty acid amine condensate.
Ultrapole G Extra conc	Do.
Onyxol 336	A fatty alkanolamide.
D-Spers-W	Condensation product of a polyglycol, fatty acid and sod. sulfosuccinic acid.
Alrosol B	Fatty Alkylol amide condensate.
Alrosol C	Do.
Detergent W-1653	A fatty acid amine condensate.
Michelene DS	Alkyl amido alcohol.
Michelene DLD	Fatty acid amide ester.
Victamul 20	Organic esters of phosphate.
Victamul 89	Do.
Victamul 116C	Do.
Penetrator WH-9	Amino condensate.
Cerfak N-100	Poly ethanolamine fatty acid condensate.
Polymene G-24	Fatty amide condensate.
1011	A secondary amide of lauric acid.
G1493	Polyethylene Glycol Sorbitol lanolin reaction prod.
G9446N	Polyethylene Glycol Sorbitan Monooleate.
Span 20	Sorbitan Monolaurate.
Span 40	Sorbitan Monopalmitate.
Span 60	Sorbitan Monostearate.
Span 65	Sorbitan Tristearate.
Span 80	Sorbitan Monooleate.
Span 85	Sorbitan Trioleate.
Tween 20	Polyethylene Glycol Sorbitan Monolaurate.
Tween 21	Do.
Tween 40	Polyethylene Glycol Monopalmitate.
Tween 60	Polyethylene Glycol Sorbitan Monostearate.
Tween 61	Do.
Tween 65	Polyethylene Glycol Sorbitan Tristearate.
Tween 80	Polyethylene Glycol Sorbitan Monooleate.
Tween 81	Do.
Tween 85	Polyethylene Glycol Sorbitan Trioleate.
Triton X-45	Alkyl aryl polyether alcohol.
Triton X-100	Do.
Triton B-1956	Modified phthalic glycerol alkyd resin.

Any of these or mixtures of two or more may be used.

Practically all of the nonionic surfactants currently available are liquids, and this may present a rubber compounding problem in some instances, especially where relatively large volumes are to be incorporated. The use of animal glue in the composition or finely divided organic or inorganic fillers aids in processing of the composition.

The following is a list of commercially available cationic surfactants which may be used in the practice of the invention. The same precautions with respect to compatibility as mentioned above with respect to the nonionic materials should be observed.

Trade Name	Composition
Duomeen T-dioleate	N-"tallow" trimethylenediamine dioleate.
Arquad 2HT	Di-hydrogenated tallow dimethyl ammonium chloride.
Nopcogen 18S	Amide of polyamine stearate.
Soromine BSA	Alkyl biguanidine.

Any of these or mixtures of two or more may be used. Mixtures of cationic and nonionic surfactants may be used also.

In the specific examples Chemigum N-4, Chemigum N-1, and Paracril 26NS90 have been referred to as commercially available butadiene-acrylonitrile synthetic rubbers. Any butadiene-acrylonitrile rubber of similar physical characteristics may be used. They are so well known now that recitation of specifications is not deemed to be necessary. The products sold under the following trade designations will be acceptable, as well as others:

Chemigum—Goodyear Tire and Rubber Company
Hycar—B. F. Goodyear Chemical Company
Paracril—United States Rubber Company
Butaprene—Firestone Tire and Rubber Company

Any of the conventional curing agents may be used in the composition; sulfur with zinc oxide and an accelerator is the preferred combination. Ground limestone is a suitable filler which works well with the other compounding ingredients in equipment commonly used in drafting element production. Other useable inorganic fillers are barytes, calcium carbonate, and calcium silicate. Organic fillers may also be used.

The proportioning of the surfactant on the weight of the rubber may be varied over a wide range, from about 2 to 70 parts for each 100 parts of the butadiene-acrylonitrile rubber. The cationic surfactants generally will be used in lesser amounts than 70 parts because of their tendency to unduly accelerate the cure of the synthetic rubber, resulting in scorching. Substantially no improvement is noted with an amount less than 2 parts. It is preferred to use at least 10 parts to 100 parts of the synthetic rubber. Optimum results are achieved with 15 to 20 parts, such amount being in most instances significantly better than 10 parts per 100 of the synthetic rubber. It is generally undesirable to incorporate more than 25 parts of the surfactant to 100 parts of butadiene-acrylonitrile rubber, for it appears that substantially greater amounts tend to be incompatible and weaken the cured composition; and, as noted above, larger amounts of cationic surfactants unduly accelerate the cure of the synthetic rubber. As noted in Examples II, III, and IV, 20 parts per 100 of synthetic rubber are preferred in compounds which do not contain animal glue and in which nonionic surfactants are employed. As noted in Example VI where a cationic surfactant is used, the quantity added may be as much as 25 parts to 100 parts of the synthetic rubber with good results. Where glue is added, as in Example V, as little as 2 parts of cationic surfactant to 100 parts of rubber give significant improvement in lap resistance. The ratios employed will, of course, differ with different fillers, synthetic rubbers, and softeners or plasticizers if they be used. Thus, the invention in its broader aspects is not concerned with proportioning of the components except within the wider ranges given above. When it comes to compounding and fabrication, however, the skilled worker will have no unusual difficulty in preparing a composition which may be handled on the particular rubber-working equipment available for his use.

As mentioned previously, the nonionic surface active agents are preferred. The drafting elements made in accordance with Examples II, III, and IV which contain nonionic surfactants are particularly resistant to "eyebrowing," i. e., a tendency for waste fiber pulled from the roving by the cot and not carried rearwardly of the clearer board by the cot to accumulate at the front of the clearer board in a bunchlike formation. Example IV which contains cork granules possesses a significant advantage in this regard over Examples II and III, these two compositions being better than Example I which in itself is an excellent material for drafting surfaces. Examples II, III, and IV possess a high degree of lap resistance and better than normal eyebrow resistance for a lap-resistant product—normally, the lap-resistant products are poor in eyebrow resistance and vice versa. With the present invention it is possible to attain both characteristics to a high degree in the drafting surface.

I claim:

1. A textile fiber drafting element having a working surface characterized by its lap resistance comprising a vulcanized composition of rubberlike butadiene-acrylonitrile copolymer containing as a permanent ingredient uniformly dispersed in the copolymer, in the proportion of about 2 parts to about 70 parts for each 100 parts by weight of the copolymer, a material selected from the group consisting of nonionic and cationic surface-active materials containing long chain hydrophobic molecular groups and mixtures thereof which imparts in said proportion lap-resistance to the element.

2. A textile fiber drafting element in accordance with claim 1 in which the surface-active agent includes a nonionic surfactant.

3. A textile fiber drafting element in accordance with claim 1 in which the surface-active agent includes a cationic surfactant.

4. A textile fiber drafting element in accordance with claim 1 in which the surface-active agent includes polyethylene glycol thioether.

5. A textile fiber drafting element in accordance with claim 1 in which the surface-active agent includes alkyl aryl polyether alcohol.

6. A textile fiber drafting element in accordance with claim 1 in which the surface-active agent includes alkyl biguanidine.

7. A textile fiber drafting element in accordance with claim 1 in which the surface-active agent includes amide of polyamine stearate.

8. A textile fiber drafting element in accordance with claim 1 in which the surface-active agent includes polyethylene glycol (400) monolaurate.

9. An eyebrow-resistant roll cover for textile fiber drafting in accordance with claim 1 having cork granules distributed through the mixture and exposed at the working surface.

10. A fibre-contacting element for use in processing textile fibres and composed of an oil-resistant synthetic rubber composition containing as a permanent ingredient, in the proportion of at least two parts by weight to one hundred parts by weight of synthetic rubber, a recognised textile fibre dressing material which is an organic surface active agent containing long-chain hydrophobic molecular groups and imparts in said proportion an anti-licking character to the element.

11. A fibre-contacting element in accordance with claim 10, in which the surface active agent ingredient is present in the proportion of the order of twenty parts by weight to one hundred parts by weight of synthetic rubber.

12. A fibre-contacting element for use in processing textile fibres and composed of an oil-resistant synthetic rubber composition containing as a permanent ingredient, in the proportion of at least two parts by weight to one hundred parts by weight of synthetic rubber, a surface active agent having the property of imparting in said proportion an anti-licking character to the element and selected from the group of surface active agents ex-

hibiting said property and consisting of: amine salts and quaternary ammonium compounds; and reaction products of phenols, alcohols and higher fatty acids respectively with ethylene oxide; and reaction products of alcohols and higher fatty acids respectively with propylene oxide; all the foregoing containing long-chain hydrophobic molecular groups.

13. A fibre-contacting element in accordance with claim 12, in which the surface active agent ingredient is present in the proportion of the order of twenty parts by weight to one hundred parts by weight of synthetic rubber.

14. A textile fiber drafting element having a working surface characterized by its lap resistance comprising a vulcanized composition of ruberlike butadiene-acrylonitrile copolymer containing as a permanent ingredient uniformly dispersed in the copolymer, in the proportion of about 10 parts to about 25 parts for each 100 parts by weight of the copolymer, a material selected from the group consisting of nonionic and cationic surface-active materials containing long chain hydrophobic molecular groups and mixtures thereof which imparts in said proportion lap-resistance to the element.

15. A textile fiber drafting element having a working surface characterized by its lap resistance comprising a vulcanized composition of rubberlike butadiene-acrylonitrile copolymer containing animal glue and as a permanent ingredient in the proportion of about 2 parts to about 70 parts for each 100 parts by weight of the copolymer, a material selected from the group consisting

of nonionic and cationic surface-active materials containing long chain hydrophobic molecular groups and mixtures thereof which imparts in said proportion lap-resistance to the element.

16. A textile fiber drafting element having a working surface characterized by its lap resistance comprising a vulcanized composition of rubberlike butadiene-acrylonitrile copolymer containing nonreinforcing mineral filler and as a permanent ingredient in the proportion of about 2 parts to about 70 parts for each 100 parts by weight of the copolymer, a material selected from the group consisting of nonionic and cationic surface-active materials containing long chain hydrophobic molecular groups and mixtures thereof which imparts in said proportion lap-resistance to the element.

17. A textile fiber drafting element in accordance with claim 14 in which the surface-active agent includes polyethylene glycol (400) monolaurate.

References Cited in the file of this patent

UNITED STATES PATENTS

1,988,491	Hazell	Jan. 22, 1935
2,450,409	Baymiller	Oct. 5, 1948
2,450,410	Baymiller	Oct. 5, 1948
2,466,826	Romaine	Apr. 12, 1949
2,579,375	Eisen	Dec. 18, 1951
2,624,725	Bjorksten et al.	Jan. 6, 1953
2,629,707	Charles	Feb. 24, 1953