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RUBBER CEMENT FOR FLOCKED FABRICS

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This invention relates to adhesives which are characterized by high resistance to tear and/or to abrasion and yet are sufficiently flexible for use on flocked pile fabrics.

According to my improvements I obtain superior results when as is usual cotton or viscose fibers are used as the pile flock, but these improvements are particularly important in connection with securing pile forming wool flock to a base fabric on which my adhesive has been applied.

Solvent rubber cements, ordinarily used for bonding ground or cut fibrous materials to a fabric base in the preparation of suede or pile flock fabrics, contain various types of inorganic fillers such as clays, whiting, barytes, zinc oxide and occasionally the organic material carbon black. These are added for the purpose of cheapening the compound by increasing its volume, thus permitting a given amount of rubber to cover a greater area when spread as a thin cement. This extension of its coverage has given rise to the use of the term "extenders" for materials of this class. Many times these "extenders" are added to a cement for the purpose of imparting special properties. The addition of whiting, for example, produces soft flexible films, and for this reason is much used by converters who wish to produce coated fabrics which are not too stiff. Some of the clays also impart this property of good flexibility. Zinc oxide, barytes and carbon black are sometimes used to produce smooth spreading cement. These last named fillers produce good tensile strength and fair resistance to abrasion. For resistance to abrasion and tear, carbon black has been considered the best of prior fillers but has the disadvantage of restricting the color range.

Cotton and viscose are the fibers which are usually used for making flocked fabrics. Many rubber cements of fair spreading qualities can be used for bonding these fibers because they are readily anchored. They are essentially straight fibers and so can be tightly packed into a given area, especially if some means is used to insure an erect position. These fibers packed closely together tend to reenforce one another against displacement.

Flock from wool and most other fibers of animal origin are usually not straight but are curved. Examination under a microscope proves wool to be crescent shaped. Because of this configuration it is difficult to pack wool fibers close together when they are converted into flocked fabrics and unless some special means, as in my

5 copending application Serial No. 379,467, filed Feb. 18, 1941, is used no reenforcing value from closely packed fibers is available. The reinforcing obtained by closely packing fibers is fully disclosed in this prior application. As set forth therein, it may result from a preliminary flocking with wool fibers, which as before stated are curved or crescent shaped, and a subsequent overflocking with shorter wool fibers, with straight fibers or with ground flock, each of which types of flock will sift through the initially applied wool even when the wool has been applied to the maximum degree to which application of wool flock is possible. The subsequently applied flock obviously gives visual effects dependent on their type and color, and in addition to this, increases resistance of the adhesive to tear or peeling. When used with the specific adhesives herein disclosed, the effects are cumulative. As stated in the prior application, a particularly desirable fabric has a pile portion of wool flock cut to substantially $\frac{1}{8}$ " lengths and a shorter flock of casein wool fiber cut to substantially $\frac{1}{16}$ " lengths. The wool flock is applied to substantially the maximum amount which can be applied by the flocking operation used, and the synthetic shorter and straighter fibers are applied uniformly in the same manner but over and through the initially applied flock, whereby, because of its flocking characteristics, it will penetrate the longer flock and be secured to the base by the same anchoring adhesive.

In addition to improving the coverage of the backing fabric the short fibers improve the bond of the longer fibers, greatly reduce the tendency of the adhesive to peel or tear, and increase the wearability as measured by standard rub testing machines by several hundred per cent.

The cements which have heretofore been used to anchor viscose and cotton flock are not satisfactory for anchoring wool flock to a base material such as cotton. This is due in part to the curved shape of the wool flock, which prevents the packing of great numbers of fibers into a given area on the base fabric, and in part to the naturally poor bond which these cements have for wool.

I have found that my rubber cements which possess high resistance to tear and excellent resistance to abrasion exert a peculiar and unexpected anchoring and bonding action on wool flock. Cements which possess these properties contain from 65% to 150% by weight of dry rubber present of very finely divided fillers which are well disposed throughout the rubber. A

common characteristic of these fillers, aside from their very fine state of division, is that they are hard particles which may be classed as abrasives. These microscopic particles, which may vary from one micron down to one-twentieth of a micron or even less particle size, offer a remarkable resistance to the sliding of wool fibers through and out of the cement when the ends of the fibers are in contact with the cement, as in flocked pile fabrics.

The films may be made still more resistant to abrasion by the incorporation of small amounts of certain hydrocarbon resins which are characterized by their toughness but which are compatible with rubber.

It appears that the surface serrations of the wool formed by the overlapping of the epithelial scales become enmeshed in the mass of finely divided particles, and as a result the wool is held in the adhesive very much more firmly than the wool which is bonded by rubber cements containing ordinary fillers. The cements may, of course, contain suitable accelerators, antioxidants and solvents.

The fillers which I have found to impart to rubber cements these unusual properties, all have in common a low specific gravity and are very finely divided. Examples are specially prepared calcium carbonate, known as Kalvan, specially prepared calcium carbonate known as Calcene, specially prepared calcium silicate known as Silene, and specially prepared hydrated aluminum oxide known as aluminum hydrate. These materials may be blended with rubber and intimately mixed therewith on a rubber mill, after which the rubber and filler is dispersed in an aqueous or other liquid medium to form rubber cements. The dry rubber used may be natural, such as pale crepe and smoked sheet, or synthetic rubber such as Neoprene. Both natural and synthetic rubber will be referred to in the claims as rubber.

An object of my invention is to provide an improved natural or synthetic rubber cement which is resistant to tear and abrasion.

Another object is to provide a rubber cement in which hard finely divided abrasive materials are incorporated in the rubber before the rubber is dispersed in a liquid medium.

Another object is to provide a rubber cement having hard very finely divided abrasive material and a tough hydrocarbon resin compatible with rubber intimately mixed with the rubber.

Another object is to provide a flocked pile fabric having a wool flock face which is secured to a backing by my improved adhesive.

Another object is to provide a rubber adhesive which is resistant to tear and abrasion and which may be dyed any desired color.

Another object is to incorporate finely divided abrasive material having particle size of one micron or less in rubber on a rubber mill and thereafter dispersing the mass in a liquid medium.

Another object is to provide a rubber cement in which hard very finely divided abrasive materials having a low specific gravity and bulking values ranging from 15 to 21 pounds per cubic foot are intimately mixed with the rubber and dispersed therewith.

These and other objects will be manifest from a consideration of the following description and claims.

According to my improvements, I incorporate finely divided abrasive fillers, which are considered inferior to carbon black as a tear resist-

ant producer for molded rubber articles, and provide a rubber cement for bonding wool flock which is superior to rubber cements depending on carbon black to provide resistance to abrasion and tear. Small proportions of carbon black may, of course, be used for its color producing properties if desired. If no coloring matter is added the cement will be translucent or it can be colored as desired.

I prepare my cement by taking the various compounding ingredients and milling them together to an intimate mixture in a standard rubber mill or mixer by established mixing procedures. If it is desired to convert these compounds into cements of the solvent rubber type, the milled composition is brought into contact with a suitable solvent mixture in a mixer of the churn or dough mixer type and milled to a smooth homogeneous mass of suitable consistency. If, on the other hand, it is desired to convert the composition to an artificial aqueous dispersion, this may be accomplished by any one of a number of standard techniques. Sometimes such aqueous dispersions are to be desired, especially in those procedures for making flocked fabric which use high potential electrostatic fields for the deposition or the straightening of the flock. In these cases the fire hazard due to the presence of inflammable solvents is considerable and hence the use of aqueous dispersions is highly desirable. It is to be understood that these artificial dispersions of milled or synthetic rubber produce a result which cannot be duplicated or approached by compounding naturally occurring latex. In the latter case the addition of reinforcing fillers and aqueous dispersions of tough hydrocarbon resins does not increase the tear or abrasion resistance of the latex film for the reason that the reinforcing particles do not become an integral part of the rubber film. In other words, as viewed through a microscope, it would be evident that particles of rubber were contiguous with particles of filler or resin, but the particles would be discrete and separate and so the filler or resin would merely serve to separate the rubber particles and so to dilute the rubber film by moving the rubber particles further apart. The effect would be one of weakening rather than strengthening.

According to my invention, however, films of artificially dispersed mill compositions of the nature of those described above show that the mineral filler alone or with the resin is intimately associated with the rubber so that each particle contains within it a homogeneous mixture of rubber, filler and/or resin.

The films of my improved cements when spread on cloth are quite flexible but are very resistant to abrasion and to tearing. This may be illustrated by attempting to scratch the surface of a film with a thumb nail. It will be found that the films are very tough and not readily broken by repeated attempts using all the force of which the thumb is capable. The same cement formulations containing the usual fillers are easily abraded and torn open by such treatment.

As stated, it has been further found that these films may be made still more resistant to such abrasion by the incorporation of small amounts of certain resins which are characterized by their toughness but which are compatible with rubber. The most remarkable of these resins is one known as Marbon B. As little as 5% of this resin on the basis of the rubber imparts considerable increased toughness and resistance to tearing.

There is also an increased improvement in the quality of the bond between the cement and the wool flock. Another such resin known as Isolac, although somewhat less effective than Marbon B, very definitely improves the bonding action of the cement for the flock and for the same reason. Marbon B and Isolac are tough, thermoplastic, resin-like derivatives of rubber. More specifically "Marbon B" is commonly called a cyclo or cyclized rubber, which is the result of the treatment of rubber to cause a rearrangement of the rubber molecule so as to convert it to a different physical state. The production of this material is disclosed in United States Patent No. 2,230,359. "Isolac" is a chemical derivative of rubber made by reacting crude rubber with phenol in accordance with the procedure outlined in United States Patents Nos. 2,158,530 and 2,203,597. Both "Marbon B" and "Isolac" are the reaction products of crude rubber and a phenol in the presence of an acid catalyst. Polystyrene may also be used.

Examples of satisfactory compounds before dispersion for bonding pile forming wool flocks are as follows. All figures refer to parts by weight. The compounds of the examples may be combined with suitable hydrocarbon solvents such as solvent naphtha, solvesso or Skelly-solve types, aromatics, chlorinated hydrocarbons or alcohols, esters or ketones, or they may be prepared as aqueous dispersions by the use of dispersing agents in a known manner.

Example 1

	Parts
Smoked sheet (rubber).....	100
Specially prepared calcium carbonate having a particle size of one micron or less, such as "Kalvan".....	125
Sulphur.....	2
Zinc oxide.....	3
Accelerators, such as captax and zimate.....	1.75
Age rite white.....	1
Telloy.....	1
Stearic acid.....	1
Reogen.....	1

Example 2

	Parts
Smoked sheet (rubber).....	100
Specially prepared calcium carbonate having a particle size smaller than one micron, such as "Kalvan".....	100
Marbon B.....	5
Sulphur.....	0.75
Zinc oxide.....	5
Butyl 8.....	3
Age rite white.....	1
Stearic acid.....	1
Reogen.....	1
Carbon black.....	1

Example 3

	Parts
Smoked sheet (rubber).....	100
Specially prepared calcium silicate, particle size smaller than one micron, such as "Silene".....	80
Sulphur.....	2
Zinc oxide.....	3
Accelerators such as captax and zimate.....	1.75
Age rite white.....	1
Telloy.....	1
Stearic acid.....	2
Reogen.....	1
Carbon black.....	2

Example 4

	Parts
Smoked sheet (rubber).....	100
Specially prepared hydrated aluminum oxide, particle size smaller than one micron, such as "aluminum hydrate C-740".....	100
Sulphur.....	1.5
Zinc oxide.....	5
Accelerators.....	1.85
Age rite white.....	1
Telloy.....	1
Stearic acid.....	1
Reogen.....	1
Carbon black.....	0.5

Example 5

	Parts
Smoked sheet (rubber).....	100
Specially prepared hydrated aluminum oxide, particle size smaller than one micron, such as "aluminum hydrate C-741".....	125
Marbon B.....	10
Vulcanizing, accelerating and anti-ageing oxidants in the approximate proportions of the previous example.	

Example 6

	Parts
Smoked sheet (rubber).....	100
Aluminum hydrate C-741.....	150
Sulphur.....	1
Zinc oxide.....	5
Butyl 8.....	4
Altax.....	1
Age rite white.....	1
Telloy.....	1
Stearic acid.....	2
Reogen.....	1
Carbon black.....	2

The above examples are all specific to the use of natural rubber, although satisfactory adhesives may be made from synthetic compounds such as Neoprene (type GN).

Example 7

	Parts
Neoprene (type GN).....	100
Kalvan.....	100
Zinc oxide.....	5
Calcined magnesia.....	4
Accelerators.....	2
Age rite white.....	1
Stearic acid.....	1
Reogen.....	1
Carbon black.....	1

Example 8

	Parts
Neoprene (type GN).....	100
Kalvan.....	75
Marbon B.....	5
and the other compounding ingredients recited in Example 7 in the same number of parts.	

As hereinbefore stated, my finely divided fillers are characterized by a low specific gravity. The specially prepared calcium carbonate (Kalvan) has a specific gravity of 2.65 and a particle size varying from .05 to .2 microns. The bulking value in pounds per cubic foot is 21. Silene has a specific gravity of 2.25, particle size of from .1 to .4 microns and a bulking value of from 15 to 16 pounds per cubic foot. The hydrated aluminum oxides C-740 and C-741 have a specific gravity of 2.35, particle size of from .1 to .6 microns and a bulking value of approximately 15

pounds per cubic foot. These materials when compounded as above described produce superior resistance to tear and abrasion and increase the adhesion of the rubber cement to the fabric and as has hereinbefore been stated, provide an excellent bond for pile forming wool flock. In all the examples the flexibility of the fabric is satisfactory and the cement is translucent, unless pigments are added.

In general, the natural or synthetic rubber constituent of my cement being 100 parts by weight, the Kalvan, Silene or aluminum hydrate C-740 and C-741 may be used to the extent of 65 to 150 parts. Other recommended amounts in parts by weight of the compounded ingredients are as follows: Marbon B 0-10, sulphur 0-3, zinc oxide 2½-10, accelerators 1-5, anti-oxidants .5-3, softeners or plasticisers .5-5, pigments 0-20, calcined magnesia 0-6, the hydrocarbon solvents are preferably below 500 parts by weight and in the event that an aqueous dispersion is made, the dispersing agent may vary up to 20 parts by weight.

Having described my invention, I claim:

1. A rubber cement including a dispersing medium having dispersed therein approximately 100 parts by weight of a hard abrasive mineral filler

as by milling, the particle size of said hard abrasive mineral filler being less than one micron and the filler being any one of the group consisting of calcium carbonate, calcium silicate and hydrated aluminum oxide and about 10 parts by weight of a tough thermoplastic resin-like derivative of rubber comprising the reaction product of crude rubber and a phenol in the presence of an acid catalyst.

2. A flocked pile fabric having a base material, wool pile flock and a binding material, said binding material being a rubber cement which is intimately mixed with a hard abrasive mineral filler of the group consisting of calcium carbonate, calcium silicate and hydrated aluminum oxide, the particle size of said hard abrasive mineral filler being less than one micron.

3. In the article of claim 2, said mineral filler being present in the cement to the extent of from 65 to 150 parts based on the dry weight of rubber.

4. In the article of claim 2, said rubber cement containing about 10 parts by weight of a tough thermoplastic resin-like derivative of rubber comprising the reaction product of crude rubber and a phenol in the presence of an acid catalyst.

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