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METHOD OF RECOVERING FIBERS FROM USED TEXTILE MATERIALS

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12 Claims. (Cl. 28—1)

This invention relates to the treatment of waste textile materials for purposes of separating undesirable strands and threads of material from valuable and usable fibers associated therewith, and it has particular relation to a process of separating rubber and similar more or less elastic threads and strands from wool and similar fibers with which they may be combined in a textile fibre.

The main objects of the invention are to provide:

A method of so treating textile fibers containing strands of rubber or similar materials as will admit of removal of the rubber by such simple steps as dusting, beating or rolling;

A process which is simple and economical in operation; and,

A process for the above indicated purposes which is relatively non-injurious to the fibers which are to be recovered.

The invention is based upon the discovery that textile fabrics containing rubber strands or threads woven therein, by suitable treatment with chemical reagents, for example a vulcanizing agent such as sulphur chloride, may be rendered hard and friable. In this condition they may be beaten or rolled from the accompanying fibers without material injury to the latter.

One source of material suitable for the purpose is a fabric which comprises rubber strands, usually wound or sheathed with finer threads of wool or wool containing material. These rubber threads are cross-woven with ordinary wool or wool containing threads to form a fabric similar in appearance to ordinary wool cloth. The resultant fabrics possess a high degree of elasticity in the direction of extension of the rubber strands and only slight elasticity in a transverse direction. Such fabric is well adapted for use in bathing suits, but it is also excellent for other uses where elasticity of the fabric is desirable.

In one embodiment of the invention, rags of rubber containing fabric of the above indicated character are chopped up into a suitable state of subdivision, placed in a container such as a vacuum chamber and there subjected to the action of sulphur chloride. The rags may be placed upon a shelf or partition in the container and the sulphur chloride may be introduced into a compartment or container therebeneath. Vapors of the sulphur chloride are then impelled upwardly through the mass of chopped up rags by application of suction to the upper portion of the container. This application is continued for a period of time sufficient to insure hardening of the rubber threads to a friable, crumbly state. Ordinarily a period of from 4 to 8 hours is sufficient. However, this period may be adjusted as required by the character of the material and working conditions.

Often or usually, the fabrics contain other fibers than wool and it is desirable to remove these as well as the strands of rubber from the wool. Examples of such undesired fibers are cotton, artificial silk, etc. These may be removed by what is termed "carbonization" which, in ordinary practice, is effected by treating fibers with a suitable reagent such as a mineral acid or aluminum chloride. Sulphuric acid, for example, is a suitable agent. The rags undergoing treatment are soaked in this acid at a concentration of about 8° Twaddell for a period (e. g. overnight) and are then centrifuged and dried without washing at a temperature somewhat below 100° C. They are then baked at 100° C. for a period of about 4 hours.

The rubber threads in fabrics treated as above described are quite crumbly and are decomposed into fine powder-like particles and are removed by the simple process of beating or dusting upon a wool dusting machine.

It will be appreciated that the carbonization of the cotton or similar fibers which are to be eliminated from the wool, may be effected either before or after treatment to harden the rubber.

Carbonization may also be effected by use of hydrochloric acid vapors. These should be employed at a temperature of the order of 170° F. to 180° F. and they may be obtained in any convenient way. One satisfactory method involves distillation of muriatic acid at the above temperature to obtain a vapor relatively rich in hydrogen chloride. The vapors may also be obtained by bubbling or otherwise contacting a hot gas, such as air, with muriatic acid. The vapors are conducted into a suitable acid resistant container. Here they are caused to contact with the rags which may be contained in a tumbling barrel or other suitable means for agitating them. This carbonization may be conducted either before or after treatment of the rubber with sulphur chloride. Where sulphur chloride in vapor phase is used the steps of carbonization and vulcanization may also be conducted simultaneously.

The invention, of course, is not limited to the use of sulphur chloride in vapor phase. For example, a preferred embodiment of the invention involves the addition of the chloride to a suitable solvent such as petroleum naphtha in which the rags or comminuted textile material may be im-

mersed for a convenient period of time. Almost any grade of naphtha may be used as a solvent, however, naphtha of fairly high volatility is preferred because such naphtha volatilizes from the fabrics more quickly than naphthas of lower vapor pressure.

In one application of the invention, sulphur chloride in the proportion of 150 cm. was admixed with 2850 cm. of naphtha. A 300 gram portion of chopped up woolen rags containing rubber strands or threads were allowed to soak with occasional stirring in this solution for a period of about 1½ hours. The liquor was then drained from the fibers, after which the latter were subjected to rinsing in three successive 300 cm. portions of naphtha. Excess naphtha was also drained from the fibers, after each rinsing.

It was found that about 500 cm. or one-sixth of the original sulphur chloride-naphtha bath was carried over into the first rinsing bath by the wool. This represented approximately 25 cm. of sulphur chloride and 475 cm. of naphtha. This amount of material may, of course, be reduced by running the fibers through suitable rollers before introducing into the first rinsing bath. It is desirable to compensate for this loss of sulphur chloride and naphtha in the first treating bath by the introduction of equivalent portions of sulphur chloride and naphtha after the treatment of each portion of rags. By thus compensating for loss of solution, the use of a treating bath may be continued indefinitely.

It is found that there is a gradual accumulation of sulphur chloride carried over from the first bath into the rinsing baths and after a number of portions of rags have been treated (generally approximately 4) the concentration of sulphur chloride in the first rinsing bath becomes so great that rinsing therein becomes impractical. However, there is no loss of material resultant because the rinsing bath may then be fortified by additional sulphur chloride and used to replace the material carried away from the first or treating bath. Of course, the second rinsing bath then becomes the first and so on through the series. It will be apparent that the only loss of sulphur chloride and naphtha occurs through evaporation from the baths and by reason of the carrying of naphtha from the final rinsing bath by the fibers. This naphtha may be recovered by suitable condensing apparatus in conventional manner.

Woolen rags containing rubber fibers treated as above described may be carbonized for the removal of cotton or artificial silk contained therein by means of the reagents described in connection with the treatment of the rags with vaporous sulphur chloride. For example, sulphuric acid of approximately 5.5 Bé. may be used. The rags may be placed in this bath over night and then subjected to centrifugation at a temperature below 100° C. These rags are also baked, as previously described in connection with the first embodiment of the invention, for a period of four hours at 100° C.

The proportions of ingredients in the above example are, of course, for laboratory scale work. A larger scale application involves the use of ingredients in the following proportions:

Sulphur chloride	6 gallons
Naphtha	114 gallons
Wool	100 pounds

Upon such scale, after the fibers have been drained, approximately 20 gallons of liquor are removed from the first bath and this liquor consists of about 19 gallons of naphtha and one gallon of sulphur chloride.

The fibers, after treatment with sulphur chloride, are rinsed in three 120 gallon baths of naphtha.

It will be appreciated that the proportions of naphtha and sulphur chloride, as well as the periods required for treatment, may be varied over a relatively wide range. For example, the following table represents specific applications of the invention. All of these, by actual test, were found to result in the hardening of the rubber and there was but slight, if any, damage to the wool fibers which were subjected to treatment.

No.	Cc. sulphur chloride	Cc. naphtha	Amount of clippings	Hours soaked
			Grams	
1	5	95	10	1
2	10	90	10	1
3	20	80	10	1
4	40	60	10	1
5	5	95	10	1 or 1¼
6	10	90	10	1
7	20	80	10	1
8	40	60	10	1
9	5	95	10	4
10	5	95	10	4
11	10	90	10	4
12	10	90	10	4

It appeared from the results of the tests that the 10:90 ratio of sulphur chloride and naphtha was more active than the 5:90 ratio. However, the latter appeared to be entirely satisfactory. There appeared to be somewhat greater action upon the rubber by subjecting the material to four hour periods of soaking but the action was by no means in proportion to the period of time and it was evident that the greater part of the work was done during the first hour.

The treated fibers were subjected to rinsing for the purpose of removing the sulphur chloride which was found to decompose to a certain extent when not rinsed away and thus to discolor the fibers containing it. Under some conditions, where the staining action is not objectionable, the rinsing may be reduced or eliminated entirely in the process.

Although in the preferred embodiments of the invention the fibers after treatment with sulphur chloride are subjected to carbonization to remove cotton or other undesired fibers, it is to be understood that the broad principle of hardening the rubber strands by means of a suitable agent, such as sulphur chloride, is not limited to this specified embodiment. On the contrary, under some conditions it may be desirable to retain the cotton or other fibers, and when this is the case the step of carbonization may be eliminated.

Sulphur chloride has been specifically described as a preferred agent for hardening the rubber strands, however, it is also intended to include other ingredients for the same purpose. For example, the strands may be subjected to over-vulcanization by other means as for example by application of the so-called Peachey process which involves alternate treatments with hydrogen sulphide and sulphur dioxide.

Although only the preferred and more obvious applications of the invention have been described it will be appreciated that the invention is not limited to these specific forms but that numerous modifications may be made therein without departure from the spirit of the invention or the scope of the appended claims.

What I claim is:

1. A method of removing rubber strands from woolen textiles containing them which comprises selectively hardening the rubber strands by means of a chemical reagent adapted to convert the rubber into a friable condition and then crumbling and dusting them from the fibers.

2. A method of removing rubber strands from textile fibers containing them which comprises vulcanizing the strands until they are hard and friable and then dusting them from the fibers.

3. A method of removing rubber strands from woolen textile materials containing them comprising vulcanizing the strands in the fibers until they are hard and friable and then dusting them from the fibers in pulverulent state.

4. A method of removing rubber strands from textile fibers which comprises exposing the fiber material containing the strands to the action of sulphur chloride until they are hard and friable and then dusting the strands from the fiber.

5. A method of removing rubber strands from woolen textile materials which comprises exposing the material to the action of sulphur chloride until the strands are hard and friable and then dusting them from the fiber.

6. A method as defined in claim 6 in which the sulphur chloride is employed in vapor phase.

7. A method as defined in claim 6 in which the sulphur chloride is dissolved in a suitable solvent.

8. A method as defined in claim 6 in which the sulphur chloride is dissolved in naphtha.

9. A method as defined in claim 3 in which the textile material is further subjected to carbonization for the removal of cotton and similar fibers.

10. A method of removing rubber strands from textile fibers containing them which comprises introducing the fibers into a bath containing a selective hardening agent for the rubber dissolved in a neutral solvent, then rinsing the treated fibers in a bath of the same solvent, drying the fibers and dusting out the hardened rubber.

11. A method as defined in claim 10 in which the rinsing bath after use is reinforced with additional hardening agent and then used for replenishing the treating bath.

12. A method of treating rubber strands preparatory to removing them from woolen textile materials which comprises immersing the material in a bath of sulphur chloride dissolved in petroleum naphtha until the rubber is rendered hard and friable, then washing the material with additional naphtha, and after the naphtha has become materially mixed with sulphur chloride, reinforcing it with additional sulphur chloride and using it to replenish the treating bath.

IVAN V. WILSON.

CERTIFICATE OF CORRECTION.

Patent No. 2,073,916. March 16, 1937.

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 15, for "300 cm." read 3000 cm.; page 3, first column, lines 27 and 29, claims 6 and 7, and second column, line 1, claim 8, for the reference numeral "6" read 5; and second column, line 3, claim 9, for the reference numeral "3" read 2; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 6th day of July, A. D. 1937.

(Seal) Acting Commissioner of Patents.

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