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PRODUCTION OF ASBESTOS SLURRIES

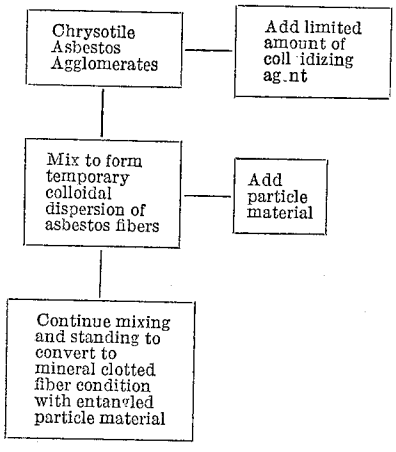
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6 Claims. (Cl. 162—145)

This invention relates to the production of flocked unit fibered asbestos particularly adapted for paper making, particularly in conjunction with cellulose fibers.

A simplified flow diagram of the process is as follows:



I am fully aware that unit fibered asbestos has been used in the production of papers from colloidal dispersions of such fibers, and the characteristics of such dispersion and such papers, and I shall distinguish this invention therefrom hereinafter.

I am also aware that milled asbestos fiber as a product of asbestos mining is used as such in paper making to produce the standard commercial asbestos paper and asbestos board. This type of asbestos paper is relatively coarse and uneven in density because the milled asbestos fiber is a mixture of bundles of the unit fibers of widely varying diameters and lengths due to the relatively unopened character of the fiber. Prior to my Patent 2,626,213 it was not generally known that these milled coarse fibers could be resolved into unit fibers of great uniformity of fiber diameter, and the only method of smoothing out commercial asbestos paper was to grind and beat milled asbestos fiber to very small bits, both lengthwise and in diameter, which, of course, produced very weak but smooth papers.

Surface area determinations have indicated that the area of a given weight of my unit asbestos fibers is at least five times that of milled asbestos fiber. Since the increase in the number of fibers is at least five times the increase in surface area as a bundle of fibers is opened to its unit fibers, there must be at least 25 times as many fibers in a given weight of my fibers as in milled fiber. This is responsible for the much greater smoothness, softness, and uniformity of asbestos papers made from these opened fibers. This also accounts for the much greater efficiency of these fibers in separating cellulose fibers from each other when used with cellulose fibers in cellulose paper making.

The softness and inertness of asbestos fiber has been desired as a modifier of the relatively harsher cellulose fibers, but combinations have been unsatisfactory because of the same coarseness and ununiform fiber character that exists in commercial asbestos paper. Bits of unopened asbestos fiber that might be tolerated in the latter, would be fatal to the expected uniformity of cellulose

papers. On the other hand, my opened fiber in slurry form is as smooth and uniform as a well-made cellulose paper making slurry, and can therefore be used therewith in any desired proportion to provide its characteristic properties to the composite of fibers.

The present invention is characterized by the employment of chrysotile asbestos fibers of papermaking, and even of the spinning grades, wherein the fiber bundles of mechanically opened mill fiber are agitated in an aqueous vehicle containing an organic chrysotile asbestos colloidizing agent to produce a colloidal dispersion of asbestos fibers, as described in my Patent No. 2,626,213.

The process of treating asbestos, as there described, is adapted to open and disperse mecroscopic bundles of chrysotile asbestos fibers to a condition where the majority of the component fibers in a body have a diameter of between about 200 and about 500 Angstrom units, and largely of unit or single fiber character. The opening and dispersing is effected by mixing and agitating the mill fiber bundles or agglomerates of chrysotile asbestos fibers, in the presence of organic chrysotile asbestos colloidizing agents such as for example aryl alkyl sulphonates, ammonium oleate, Aerosol OT (dioctyl sodium sulphosuccinate), etc., in an aqueous solution. As also set forth in the aforesaid patent, these agents are adsorbable on and thereby effective to disrupt the molecular bond contained in the asbestos fibers.

The proportion of surface active agent required to satisfy the asbestos fibers is related to the quantity of asbestos in the dispersion, in a straight line relationship. Further, since the action is progressive, there is generally provided an adequate amount of the agent in the liquid phase so as to fully satisfy the progressively increasing number of surfaces developed, and for the purpose of producing suitable colloidal dispersions which are not subject to change or clotting on standing, particularly as a result of further opening of the fibers on aging, a safety factor excess of agent is generally provided such as on the order of 25 to 100% or even more of the theoretical requirement. With such adequate excess, the suitable colloidal dispersions are formed and in such condition the disseminated fibers take on and retain a gelatinous character.

In the production of paper pulp or such dispersions wherein the paper-making slurry generally has an approximate ⅛ to ⅞ solids content, in order to maintain the colloidally dispersed condition of the fibers it is necessary to provide adequate agent in the water, inasmuch as excess dilution of the agent in the aqueous phase of the originally produced concentrated colloidal dispersion causes clotting of the asbestos fibers. However, by observing adequate precautions, as pointed out in my Patent No. 2,675,745, this colloidally dispersed condition may be maintained and paper formed therefrom on a paper wire.

On the other hand, if upon dilution for paper making there is not sufficient excess amount of dispersing agent in the concentrated dispersion, or if no dispersing agent is added to the water of dilution, the colloidal dispersion becomes clotted in the form of relatively large gobs and long strings, apparently due to formation of a precipitated layer of fine asbestos fibers about a viscous mass of still colloidally dispersed fibers. If one were to attempt to employ such material for paper making, these large clots could only be broken up with much difficulty and excessive beating for the purpose of smoothing them out so as to result in shortening of the fibers and the loss of the advantage of the fibrous character of the asbestos which is desired. Also, any excess of dispersing agent beyond that adsorbed on the fiber is likely to produce foam during beating or paper-forming, which is usually intolerable.

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For other than specialized purposes, attempts to introduce adequate dispersing agent in the aqueous phase to maintain the asbestos fibers in colloidally dispersed condition is uneconomical, such as for the purpose of the present invention which pertains to the production of products which are essentially or principally composed of cellulose fibers and which for economic and other reasons cannot tolerate the large amounts of wetting agent which would be required for maintaining the asbestos fibers in colloidally dispersed condition.

However, it was unexpectedly found, in accordance with the present invention, that if the asbestos fibers were treated with an amount of the aforesaid colloidizing agent, just adequate to form a colloidal dispersion containing a majority of the fibers in colloidal dispersion, but with an insufficient amount of agent to keep the asbestos in such colloidal dispersion for an appreciable length of time, this would cause a reversion of what is herein defined as "minimal" clotted condition and wherein the surfaces of fibers were no longer of their former jellylike, water-holding character.

As pointed out in my Patent No. 2,626,213 the amount of agent for maintaining the dispersed condition varies in a straight line with the amount of asbestos, in addition to a dispersion maintaining component. Thus, an originally colloidally dispersed body of asbestos fibers becomes a clotted suspension in the aqueous body when the dispersion becomes broken or when there is an in situ reversion. In the latter case there is only a minor degree of very uniform clotting wherein the fibers are of a nongelatinous character.

Such minimal clotted asbestos fiber body may then be readily diluted to any desired degree in the paper-making process and added at a point in the beater where the paper-making adjuvants, such as alum, sizing, and the like are introduced. This procedure permits these asbestos fibers to be incorporated with a minimum of beating and as a consequence retention in their substantially original length, to thereby exert their full effect in the end product. However, the exact time when the asbestos is added is a matter of choice and depends on the particular beating cycle and end product.

It will be understood that the minimal clotted condition obtained as herein described is sharply distinguished from fibers which have been subjected to opening and dispersing in the manner described in my Patent No. 2,626,213, and as further distinguished from the character of a colloidal dispersion which has been formed with an excess of dispersing agent in the aqueous phase so as to maintain the colloidal dispersion in storage-stable condition to the extent where the agent in the liquid will support or satisfy all of the fibers which can or will open on standing for appreciable periods of time.

On the other hand, the minimal clotted suspension employed in accordance with the practice of the present invention is also stable once the clotting condition is brought about, so that it can be added to the paper beater at a desired time. The minimal clotted fiber asbestos employed in the present invention can be very readily disseminated in the paper pulp, with the result that paper formed from these slurries containing minimal clotted asbestos fibers is characterized by an asbestos fiber content of fine, well-distributed character which, in addition, has appreciable fiber length.

In preparing the minimal clotted asbestos pulp of this invention, the dispersing and opening agent can be added gradually, in increments, or all at once to the asbestos fiber while the fibers are suspended in water in a conventional beater, to a proportion under that required for a fully stable colloidal dispersion. Conversely, the fibers can be similarly added to water containing the said agent and proportions.

As an example, 10 pounds of 5R Canadian chrysotile asbestos (a paper-making grade) was added to 140 pounds of water in a beater, and the beater was run

with the beater roll in mixing position and not in contact with the bed plate. The rate of travel of the beater contents was observed, as well as the condition of the slurry, as increments of Aerosol OT were added, as follows:

Time, min.	Total Aerosol OT (Percent wt. of Asbestos)	Condition of Slurry	Speed of Travel of Beater Contents
	0	Heavy, coarsely clotted	Moderate.
5	1	Very heavy, coarsely clotted	Very slow.
10	2	do	Do.
15	2½	Thin, smooth and partly colloidal for 3 min.	Moderate.
		Then heavier and medium clots.	Do.
23	3	Thin, smooth and partly colloidal for 8 min.	Faster.
		Then heavier and medium clots.	Moderate.
35	3½	Thin, smooth and colloidal for 15 min.	Faster.
		Then heavier and medium clots.	Moderate.
55	4	Smooth and colloidal for 60 min.	Faster.
		Not as heavy as previously, and changed gradually to small clots with complete clotting in 60 min. longer.	Moderate.

The in situ clotted product, even after the 3% addition of Aerosol OT was fine and readily mixed with added water to form a smooth slurry of small, fluffy clots of fiber. During any of the colloidal periods, some or much of the fiber on dilution with water took on the form of strings or clots of jellylike character. The greatest openness and uniformity was observed in the 4% OT content material which, of course, contained the most fully opened fiber of the foregoing table. When another 1% of Aerosol OT was added (total 5% on fiber by weight) the colloidal dispersion was stable for weeks on remixing.

The level in the beater tended to rise during the colloidal fiber periods and fall back during the clotted fiber periods. However, there was no harmful or uncontrollable foaming during the beating.

During the evanescent colloidal periods it was possible to clean the fibers by screening, straining, centrifuging, etc., to remove undesirable oversize or foreign particle material content, and then allow the slurry to break on further standing or mixing. Thus, these clotted fine fiber slurries may be precleaned to the same extent as stable colloidal slurries. This makes it possible to sheet on a paper machine, asbestos paper or board of the minimal clotted fiber type, of a cleanliness and fineness hitherto unavailable for conventional clotted fiber, without great destruction of the fiber length. This sheeted pulp provides a dry residue of the minimal clotted unit fiber in easily transported form which can be used as a base for colloidal dispersions by the addition of small amounts of dispersing agent to its slurry in water, or for the purposes of cellulose paper making. Furthermore, this fiber which carries an adsorbed layer of wetting agent has a hydrophobic surface which releases water on filtration and compression much more readily and safely than ordinary asbestos fiber, which is hydrophilic and slimy in water, is difficult to dry by compression, and has a tendency to crush. This property even with its fineness improves the paper making quality of this novel material.

Another advantage of the method of producing the minimal clotted fine asbestos fiber described herein is that powdered materials such as pigments, fillers, resins or other modifying agents may be added before or during the final colloidal period so that the powdered particles become thoroughly distributed among the fine fibers, and when subsequent clotting occurs these particles will remain entangled securely within the clots. It is well known that retention of powders added in pulp slurries for paper making is generally quite poor because these powders tend to be carried out of the fibrous pulp during its initial formation into a sheet by filtration on a foraminated carrier. If, however, the powder is first entangled in a fibrous clot, the retention of which is good, the

powder retention is also good. For example, using equal weight of fine asbestos and titanium dioxide prepared in this manner, I have improved TiO_2 retention in a sulphite sheet by at least 50% over simply adding TiO_2 to the sulphite pulp in the standard way.

I have also observed that the minimal clotted asbestos unit fiber itself will attract and entangle filler and pigment particles. Thus, when this fiber in slurry form is mixed with TiO_2 pigment, the pigment is strongly attracted to the fiber and the water becomes clear. While the entanglement of pigment is probably not as effective, this is another method by which pigment may be carried by the asbestos fiber with improvement of retention, where the associated pigment, fiber structure, is made a part of a cellulose fiber slurry.

As another advantage, the presence of the multitude of fine asbestos fibers in a cellulose: fine asbestos fiber slurry of this type serves in itself to trap and retain small pigment and filler particles which otherwise would pass readily through the interstices of the much larger cellulose fibers during the first stages of the paper forming process. Thus, the presence of this asbestos in itself is an aid to the retention of fillers in a paper containing it.

While I have described the use of 5% asbestos, a paper making grade, it is desirable in some cases to use longer fiber such as 4T, a shingle grade, or 3R, a spinning grade for specific purposes and products, for example, to increase the clot size, or to provide greater paper strength, or to carry in suspension larger particles of filler, such as, for example, abrasive grains or flake mica, etc. Also where the cellulose paper structure is to be very close and tight, even shorter fiber such as #6 fiber, may be used.

Also, since asbestos is variable in its affinity for wetting agent and ability to open under their influence depending on its geographical source and even its location within a simple deposit, the optimum amount of wetting agent required for the satisfaction of the fiber surface available will also vary. However, the determination of the correct proportions is readily made for any selected fiber or for any selected wetting agent by observation of clotted versus dispersed condition of the slurry. For example, asbestos from the Cassiar mine in British Columbia takes less Aerosol OT than Thetford, Quebec, asbestos, and Southern Rhodesian fiber less than Cassiar to achieve best results.

As an example of the practice of the present invention, 30 pounds of an aqueous solution containing 25% by weight of Aerosol OT was added to and dissolved in one thousand gallons of water. Then 200 pounds of 3R spinning grade chrysotile asbestos fibers was added which on stirring for four hours produced a slurry of 2½ concentration, characterized by the fact that this body took on the character of a true colloidal dispersion with a majority of its fibers of colloidal diameter, since there was initially adequate amount of dispersing agent to maintain the saturated fibers in colloidal dispersion. This was stable for about 45 minutes, during which time it was screened to fiber out undesirable oversize, unopenable, and foreign particle material.

On further agitation and standing remaining fiber multiples or bundles additionally opened up and exposed added surfaces which adsorbed wetting agent from the solution until a condition was reached where there was insufficient agent in the solution and the colloidal dispersion broke and reverted to what is herein described as a "minimal" clotted condition. Of itself the resultant body was substantially uniform and composed of my minimal clotted fibers suspended in the aqueous vehicle. This suspended condition was substantially self-sustained and required but little agitation to keep the fibers in disseminated condition.

This body of fibers can thereafter be added to the beater of a paper-making machine containing cellulose fibers and admixed with the cellulose fibers in the proportion of 10% by weight of the cellulose fibers, the cellulose fibers being in a ⅛% slurry.

Such slurry formed into paper on a Fourdrinier wire and dried on a Yankee drying drum from which the paper is recovered as tissue, the paper remaining at the same time very soft and of a drapelike character, as distinguished from the converse rigidifying character which might have resulted had the cellulose fibers been in adhesive contact during drying instead of in this case being separated by the fine asbestos fiber and thus prevented from adhering.

It is known that the firmness of paper made from cellulose fibers is due to adhesive contact of the water-swollen cellulose fibers during drying. The greater the hydration of the cellulose fibers, the more shrinkage and adhesion between the fibers on drying, and the more tightly bonded and harsher is the paper. Asbestos in the form described herein serves to reduce this cellulose fiber-to-fiber contact, and depending on the amount incorporated reduces the bonding and harshness to any desired extent. The asbestos fibers alone have an extremely soft and suedelike feel in sheet form because of their uniformity and fineness. The combination of reduction in cellulose fiber-to-fiber contact and the natural softness of these asbestos fibers cooperate to produce the soft sheet of the example described.

I claim:

1. The method of forming a slurry of unit asbestos fiber water dilutable to a smooth paper making slurry without the clots of fiber characteristic of a water-dilution broken colloidal dispersion of asbestos fibers, which comprises mixing chrysotile asbestos fiber agglomerates with an aqueous solution of chrysotile asbestos colloidizing agent in an amount just sufficient to open said agglomerates and to form an evanescent colloidal dispersion of unit asbestos fibers, and continuing the mixing until said colloidal dispersion reverts in situ to a minimal clotted unit fiber condition and adding it to a cellulose fiber paper-making slurry together with paper-making pigment and filler particles.

2. The method of forming a noncolloidal slurry of unit fiber asbestos, which comprises mixing chrysotile asbestos agglomerates with an aqueous solution of chrysotile asbestos colloidizing agent in an amount sufficient to substantially subdivide said agglomerates to unit fibers and to temporarily form therefrom a colloidal dispersion, the amount of said agent being less than sufficient to maintain said dispersion in stable condition upon subsequent in situ separation of new unit fibers and resultant development of new fiber surfaces adsorptive of substantially all of said colloidizing agent, upon further mixing and standing the aforesaid initially formed colloidal dispersion becomes converted in the aforesaid manner to a minimal clotted condition and thereafter mixing and entangling particle material with said minimally clotted fibers.

3. The method of forming a noncolloidal slurry of unit fiber asbestos, which comprises mixing chrysotile asbestos agglomerates with an aqueous solution of chrysotile asbestos colloidizing agent in an amount sufficient to substantially subdivide said agglomerates to unit fibers and to temporarily form therefrom a colloidal dispersion, the amount of said agent being less than sufficient to maintain said dispersion in stable condition upon subsequent in situ separation of new unit fibers and resultant development of new fiber surfaces adsorptive of substantially all of said colloidizing agent, adding particle material to said colloidal dispersion, upon further mixing and standing the aforesaid initially formed colloidal dispersion becomes converted in the aforesaid manner to a minimal clotted condition and said particle material becomes substantially entangled in the resulting fiber clots.

4. An aqueous slurry of minimal clotted unit fiber asbestos and powdered particle material distributed and entangled therewith resulting from mixing chrysotile asbestos fiber agglomerates and powdered particle material

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with an aqueous solution of organic chrysotile asbestos colloidizing agent in an amount just sufficient to open said agglomerates and to form an evanescent colloidal dispersion of unit asbestos fibers and by continuing the mixing until said colloidal dispersion reverts in situ to a minimal clotted unit fiber condition.

5. The slurry of claim 4 including paper making pigment.

6. The dried residue of the slurry of claim 4.

References Cited in the file of this patent

UNITED STATES PATENTS

1,907,617	Tucker	May 9, 1933
2,068,219	Badollet	Jan. 19, 1937
2,407,581	Smith et al.	Sept. 10, 1946
2,626,213	Novak	Jan. 20, 1953
2,675,745	Novak	Apr. 20, 1954
2,769,713	Wilson	Nov. 6, 1956
2,930,106	Wrotnowski	Mar. 29, 1960