June 24, 1947. L. C. PHARO 2,422,980

ASBESTOS SPINNING FIBER

Filed Feb. 2, 1944 2 Sheets-Sheet 1

Fig. 1.

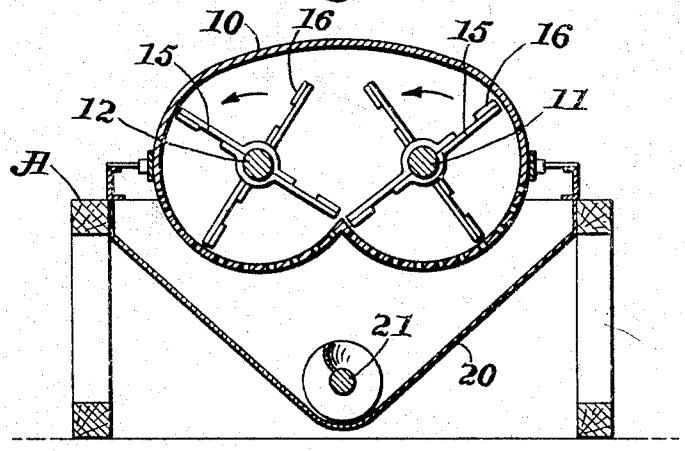
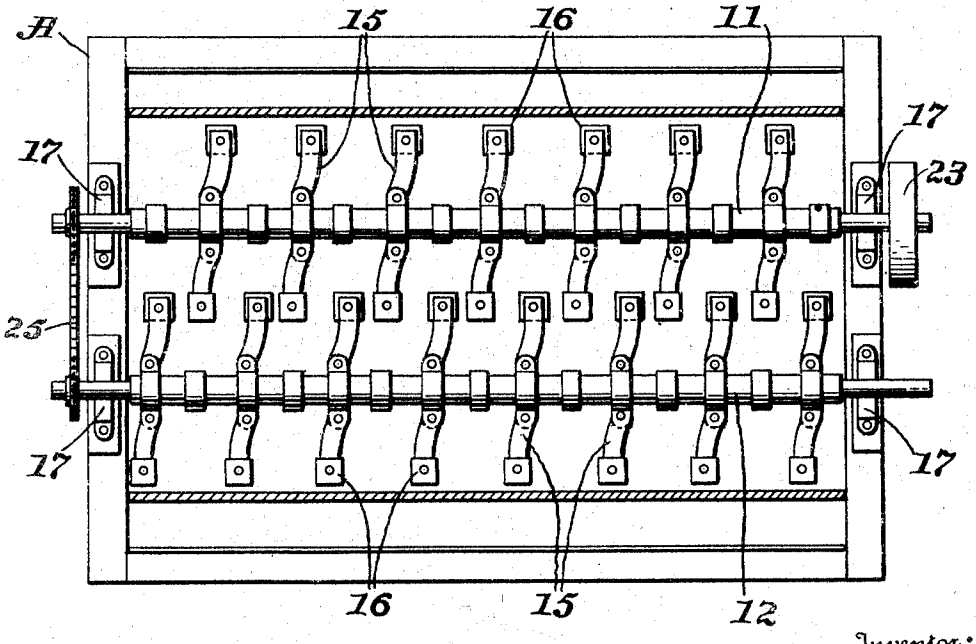


Fig. 3.



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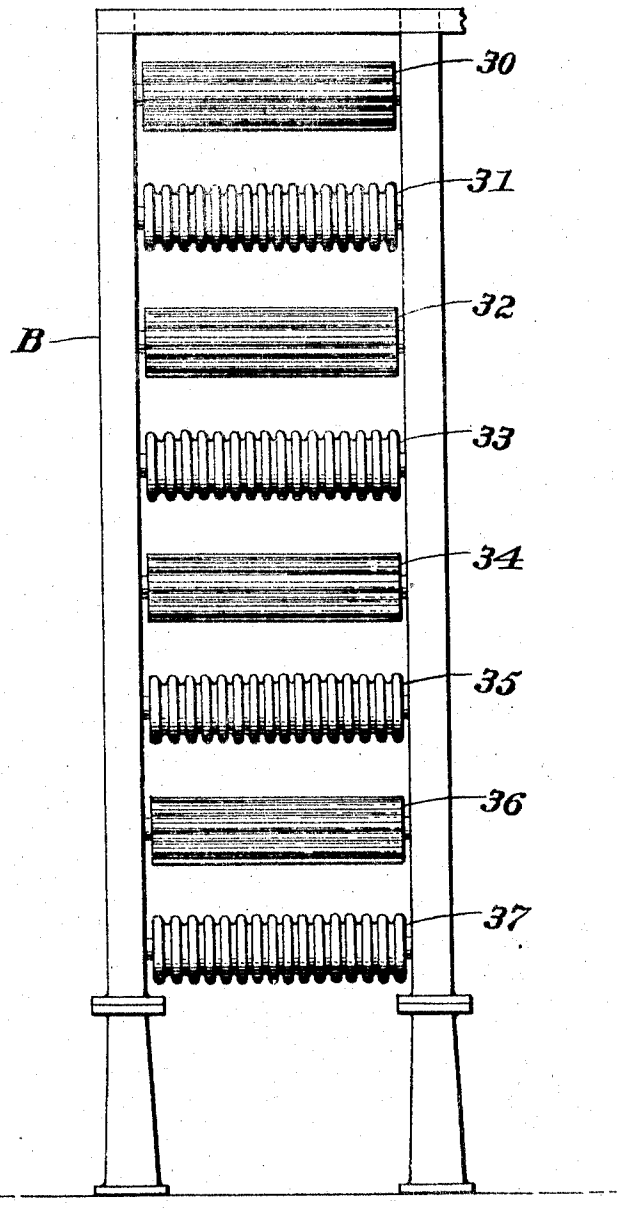
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Fig. 2.



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Patented June 24, 1947

2,422,980

UNITED STATES PATENT OFFICE

2,422,980

ASBESTOS SPINNING FIBER

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Application February 2, 1944, Serial No. 520,802

4 Claims. (Cl. 19—65)

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Introduction

This invention relates to the treatment of asbestos.

It is a principal object of the invention to provide an improved spinning fiber. It is a further object of the invention to provide an improved method of treating asbestos.

Asbestos is recovered from the rock in which it occurs in masses containing long and short fibers. In current practice, the attempt is to treat the entire mass so as to liberate all the fibers as completely as possible to form masses of liberated fibers of the best spinning qualities and other qualities. There has been an impression in the trade that the longer the fibers, the better the spinning qualities and that a relatively large proportion of long fibers is necessary for adequacy in textile uses, for example, yarn formation.

The Invention

The applicant has developed a new textile asbestos in which the staple length is substantially uniform as compared with the asbestos textile fibers as produced today and in which this average length may be relatively short, that is, shorter than previously considered necessary for a high grade spinning fiber. A relatively large proportion of the fibers are close to the longest staple length and are substantially completely liberated and the balance of the fiber contains a proportion of relatively harsh fiber.

Asbestos of this type is produced by first subjecting the masses of starting fiber (usually milled fiber) to a classification step in which the longest and shortest fibers are removed, then to a fiberizing step and finally to a liberation step in which a major proportion of the fibers, usually the longer fibers, are substantially completely liberated and the balance left in the relatively harsh state.

This method and the resulting product will now be described, in certain specific embodiments, in more detail. The description will be facilitated by reference to the accompanying drawings illustrating preferred apparatus employable in the preferred method, and in which,

Figure 1 is a diagrammatic end elevation partly in section of an apparatus employed for classification of the masses of asbestos and also for subsequent partial liberation of the fibers therefrom.

Figure 2 is a diagrammatic elevation of an apparatus employable for fiberizing the asbestos.

Figure 3 is a plan view of the apparatus shown in Figure 1, with the top housing removed.

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Preferred Method

Primary treatment and classification

The following is a preferred method of producing a fiber from a mass of standard Canadian asbestos. After primarily crushing and drying of the ore containing the asbestos, the asbestos is processed on a screen having openings preferably of about 5/8" diameter. The "throughs" separated, by the screen, from the longest fibers are then run over an additional screen at the end of which the fiber is removed by suction. The asbestos thus removed constitutes the mass from which is produced the special spinning fiber according to the present invention.

This mass is treated as follows in a special machine described in U. S. patent application S. N. 506,000, filed October 12, 1943, now Patent No. 2,386,715, October 9, 1945. The machine is represented diagrammatically in vertical transverse cross section in Figure 1 and in plan view with the housing removed in Figure 3. The machine includes a frame A on which is mounted a housing 10 forming an elongated horizontal passageway for the fiber and of which the bottom half is perforated to constitute a screen. In this passage-way are operated a pair of horizontal shafts 11 and 12 on which are mounted beater arms 15 having special blades 16 which are inclined in such a way as to drive the material forward. The device is also provided with a hopper 20 for catching fines falling through the housing 10 and a conveyor 21 for carrying away these fines. The shafts 11 and 12 are mounted on the frame A through bracket 17. The shaft 11 is driven through a pulley 23 mounted at one end and a chain 25 affords a drive connection from a sprocket on the shaft 11 to a sprocket on the shaft 12. The device is driven from a suitable source of power so as to rotate the shafts in the same direction. The blades overlap and pass each other in opposite directions as the shafts revolve in the same direction. The ends of the blades 16 just clear the housing 10 so that the latter is kept free from asbestos.

This device is operated at a relatively low speed, preferably the equivalent of a range from between about 150 to about 250 R. P. M. in a device in which the beater arms have a length of about 25 inches from the axes of the shafts to the tips of the blades. This has a combing or teasing effect which separates the longer fibers and practically holds them in suspension while the short fibers, sand and other foreign matter fall through the perforated bottom half of the housing and are

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carried away by the conveyor 21. At the same time, injury to the long fibers is avoided to a maximum degree.

The nature of the treatment in this classification step for eliminating "shorts" is important. In prior art methods known to the applicant, an attempt to screen out shorts so as to achieve a classification such as is accomplished in the present invention would result in such damage to the fiber that "shorts" would be produced as fast as they were screened out.

Fiberization

The fiber is then passed through fiberizing rolls such as, for instance, those described in U. S. Patent No. 2,219,077, so as to fiberize or soften the spicules. B represents the frame of the machine. 30, 31, 32, 33, 34, 35, 36 and 37 represent respective pairs of grooved rolls, the rolls having the even numbers having the grooves running in the direction of the axis of the rolls and those having the odd numbers having the grooves running circumferentially. All the rolls employed are preferably of dimensions such that the straight line distance between corrugations, that is to say, between the apices of adjacent rolls is about 1 inch. The function of the rolls is to fiberize the spicules by flexing them. The product resulting is fiberized asbestos. The rolls are illustrated schematically in Figure 2.

Liberation

The material after being fiberized as in the previous step is then subjected to a screening operation to remove "shorts" and also to fluff out, i. e. "liberate" a proportion of the fibers, by passing through several, preferably four, stages of the mixing and screening machine shown in Figures 1 and 3 of the drawings using screens with about $\frac{3}{16}$" diameter round holes. In a proportion of the spicules, usually the shorter ones, the fibers are not liberated due to the special action of the machine, but remain in the "harsh" state i. e. in small unliberated bundles. In a sense, therefore, the mass is heterogeneous, i. e. contains both liberated and unliberated fibers. The resultant fiber is ready for carding.

Results of process

The process results in improved masses of fiber. The result of the treatment is that the fiber is not liberated throughout the entire mass as in previous methods, but comprises fibers substantially completely liberated and bundles of fibers in the harsh state. Usually it is the longer fibers which are liberated and the shorter bundles which remain in the harsh state. Exceptionally long and exceptionally short fibers are preferably removed in the processing so as to make the mass as uniform as possible. The process is regulated so that sufficient of the harsh bundles remain in the mass to prevent blocking the card clothing in the subsequent textile treatment.

In the general run of Canadian chrysotile asbestos, usually the average fiber length is about ¾", but this average is the component of fibers ranging from about 1½ inches to about 2 inches down to fibers ranging from about ⅛ inch to about ¼ inch. By the present method, the extremely long and extremely short fiber is eliminated so that the fiber length of the resulting mass is exceptionally uniform. Then this uniform mass is treated in such a way that most of the fiber is completely liberated, i. e. opened and fluffed while the balance is fiberized, but remains in the form of relatively harsh, fiberized but unopened bundles of adherent fibers.

Preferred products

Preferably the treated mass is made up of fibers which all approximate ¾" in length. Of this mass, 75% of the fibers are completely liberated, while sufficient of the remainder to prevent blocking the card clothing is in the harsh state. The amount remaining in the harsh state is usually from about 2% to about 10% of the total by weight, the applicant preferring to have between about 2% and about 4% in the harsh state. The limitation in achieving these results is, of course, the nature of the starting asbestos as it comes from the mine considered in conjunction with the difficulty of handling asbestos without injury thereto. Theoretically, a mass containing assorted lengths could be treated in several stages to size all the fiber so as to approximate the optimum average length, but this would result in injury to the fibers which are thoroughly fiberized and a tremendous fiber loss in the treatment. An aim of the present process is to bring the uniformity of the fiber length substantially to a maximum commensurate with the potentialities of the starting fiber and commensurate with reducing injury to the fiber substantially to a minimum. In conjunction with this attempt is the substantially complete liberation of the greater proportion of the fibers while leaving in the substantially harsh condition sufficient harsh material to prevent blocking of the card clothing.

More specifically, it is possible from a characteristic mass of Canadian fiber of a type which would normally be milled, by treatment according to the invention, to produce a mass of fiber having an average staple length ranging from about ⅝ inch to about ⅞ inch with all the fibers in the mass being close to this average and an upper length close to ⅞ inch. Actually, it is possible, by eliminating over-long and over-short fibers according to the invention, to bring the average quite close to the preferred ¾ inch. With such a mass treated according to the invention, the fibers remaining in the harsh state would represent the shortest spicules, i. e. those passing through a one-quarter inch mesh screen. It should be explained that these spicules contain fibers which are more than one-quarter inch in length and the only reason they pass through the screens is that they are in spicule form. When these spicules receive textile treatment on pickers or cards they are often brought up close to the average length of the fiber in the mass. The concentration of this harsh material should be sufficient to prevent blocking the card clothing during carding, but should be insufficient to cause breakage of the roving likely to occur during textile operations, i. e. usually below about 10% and preferably in the neighbourhood of about 2% to about 4% by weight of the total mass.

The long and short fibers which are removed from the mass treated according to the present invention are passed into the treatment circuit for asbestos being employed for other uses. For instance, the longer fibers may be used in other types of asbestos used for spinning. The "shorts" may be returned to the circuit to produce shingle fiber and paper stock and so forth.

EXAMPLES

In order that the invention may be still more clearly understood, specific examples will be

given. These are only illustrative and should not be considered in a limiting sense.

Example 1

One hundred pounds of asbestos were passed through the screening and fiberizing procedure as described in general above.

On screen analysis it was found that it had been possible to keep the minus ¼ inch asbestos in the harsh state. The remainder was substantially completely liberated.

A mass of fiber treated as described in the example was carded and spun. It was found to produce excellent yarn. The fiber was substantially equal in spinning qualities to "18 cut" with the addition of only about 8% to about 10% cotton.

Example 2

The following example is taken from the records of a large spinner in the United States.

There was used 200 pounds of fiber made according to the invention as defined above, of which the average staple length is about ¾ inch and the longest and exceptionally shortest fibers have been eliminated so that about 25% of the fibers are under about ⅝ inch and the remainder over about ⅝ inch. About 3% of the fiber remained in the substantially harsh state.

This material was run directly, without cleaning, from the bag onto the card in the mix for the high grade yarn, substantially no loss being taken in the preparation.

In the other test, the fiber was run alone and directly from the bags as a substitute for a high grade of spinning fiber making "18 cut" yarn. Carding conditions were entirely satisfactory. The burn-out test was satisfactory. The fly loss was normal. The spinning qualities and tensile strength were in every respect equal to those of the yarn made from the standard mix in which Canadian crudes were used.

ADVANTAGES

An advantage of fiber produced according to this invention is that it has very high grade spinning and other textile qualities. With the addition of relatively small amounts of cotton, the new fiber, according to the invention (derived from fiber which would normally be classed as milled fiber), can be spun equivalently to fiber in which up to now crudes have necessarily been used. This unusual result is believed to flow mainly from the fact that the fibers are as close as possible to uniform length and also to the fact that the shorter spicules are in harsh condition and thus prevent the fiber from blocking the card clothing.

DEFINITIONS

In view of the special nature of asbestos in its various conditions, the following definitions are given to clarify further the foregoing description.

(*a*) "Spicule" is intended to describe the condition of an unfiberized piece of asbestos in which the fibers are still held quite firmly together in substantially "match-stick" condition. "Spicules" are sometimes called "pencils."

(*b*) "Fiberized" means asbestos in the state in which the individual fibers in the spicules have been loosened one from the other but not completely separated, as for instance by subjection of the spicules to flexure.

(*c*) "Liberated" denotes the condition of fiberized asbestos which has been subjected to beating or other agitation, the process sometimes referred to in this and other arts as "teasing" or "fluffing" to separate the loosened fibers one from the other so as to bring them up into a fluffy condition.

(*d*) "Harsh" is intended to indicate the state of fiberized spicules or small bundles of fiber in which, although the individual fibers have been loosened from one another by fiberizing, they have not been "liberated."

(*e*) "Masses" is generally used to indicate asbestos in commercial quantities.

It will be understood that, without departing from the spirit of the invention or the scope of the claims, various modifications may be made in the specific expedients described. The latter are illustrative only and not offered in a restricting sense, it being desired that only such limitations shall be placed thereon as may be required by the state of the prior art.

The sub-titles used throughout the specification are merely to simplify reference thereto and should otherwise be disregarded.

I claim:

1. A process of treating asbestos, which comprises the steps of, eliminating from asbestos masses the longest and shortest fibers whereby the average fiber length of the masses is in the range from about ⅝ inch to about ⅞ inch and the greater portion of the fibers exceeding ⅝ inch, fiberizing the masses, liberating from about 90% to about 98% of the fibers in the masses substantially completely and allowing the remainder of the masses to retain a substantially harsh condition.

2. Asbestos spinning fiber in a condition ready for carding, characterized by high spinning qualities, the average staple length being within the range from about ⅝ inch to about ⅞ inch, the greater portion of the fibers exceeding ⅝ inch, from about 2% to about 10% of the fiber being in the substantially harsh state and the remainder of the fiber being substantially completely liberated, said fiber being made in accordance with the process of claim 1.

3. A process of treating asbestos, which comprises the steps of; screening crushed and dried asbestos ore to eliminate the rock and the spicules containing the longest fiber thereby to obtain the masses free from the longest fiber; subjecting said free masses to a classification step substantially equivalent to that which comprises feeding the asbestos masses into one end of a closed unobstructed substantially horizontal passage having a perforated area to allow the escape of extremely short fiber by gravitation, moving said masses through the passage by subjecting them to the action of a succession of intermeshing rotating beating arms extending throughout the passage and inclined with respect to the longitudinal axis thereof in a direction to advance the masses continuously through the passage, passing the beating arms closely adjacent to one another while rotating them in intermeshing relation for agitation and advancing the mass thereby to cause the long fiber to be liberated and the extremely short fiber to escape by gravitation, the beating arms being moved at a slow speed effective to maintain the long fiber in suspension and cause the undesirable short fiber to gravitate and to reduce injury to the long fiber substantially to a minimum, subjecting the masses thus obtained to a fiberizing operation, and subjecting the masses to a screening step to remove shorts and to fluff out the fiber.

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4. A process of treating asbestos, which comprises the steps of; screening crushed and dried asbestos ore to eliminate the rock and the spicules containing the longest fiber thereby to obtain the masses free from the longest fiber; subjecting said free masses to a classification step substantially equivalent to that which comprises feeding the asbestos masses into one end of a closed unobstructed substantially horizontal passage having a perforated area to allow the escape of extremely short fiber by gravitation, moving said masses through the passage by subjecting them to the action of a succession of intermeshing rotating beating arms extending throughout the passage and inclined with respect to the longitudinal axis thereof in a direction to advance the masses continuously through the passage, passing the beating arms closely adjacent to one another while rotating them in intermeshing relation for agitating and advancing the mass thereby to cause the long fiber to be liberated and the extremely short fiber to escape by gravitation, the beating arms being moved at a slow speed equivalent to the speed at which arms about one foot long would intermesh with each

other between about 150 to about 250 times per minute, said speed being effective to maintain the long fiber in suspension and cause the undesirable short fiber to gravitate and to reduce injury to the long fiber substantially to a minimum, subjecting the masses thus obtained to a fiberizing operation, and subjecting the masses to a screening step to remove shorts and to fluff out the fiber.

LEE COLLIN PHARO.

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