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METHOD OF BLENDING CERAMIC AND CARRIER FIBERS

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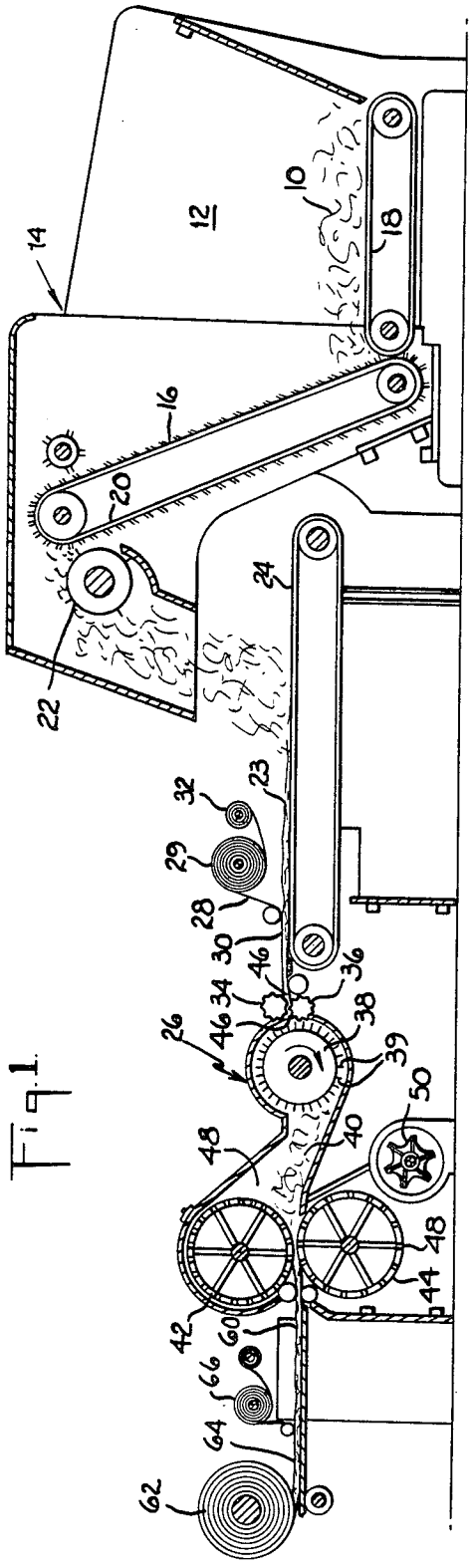


Fig. 1.

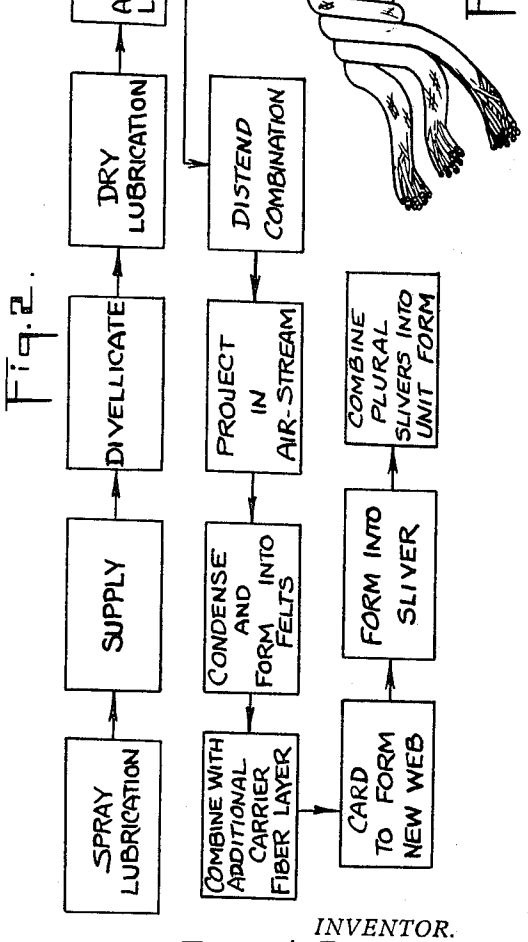


Fig. 2.

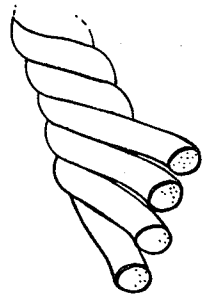


Fig. 3

Fig. 4

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METHOD OF BLENDING CERAMIC AND CARRIER FIBERS

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ABSTRACT OF THE DISCLOSURE

A process for producing a blended sliver of ceramic and non-ceramic carrier fibers requiring a minimum of carrier fibers while simultaneously avoiding the problems associated with brittle and delicate ceramic fibers.

This invention relates to a method for producing an intimate blend of ceramic and carrier fibers. More particularly, the invention relates to improved techniques for processing ceramic and carrier fibers to obtain a homogeneous blend with a minimum of breaking up of the ceramic fibers.

The brittle and delicate characteristics of as-produced ceramic fibers is recognized in the art (U.S. Patent 3,012,289). However, because of these characteristics, it has been deemed essential that the ceramic fibers receive a minimum of handling and working when effecting a blend with carrier fibers. Consequently, the initial blending of ceramic fibers with carrier fibers in a ceramic/carrier fiber blending process has been conducted during the final carding step, which step produces the web of blended fibers from which a roving is formed.

Such blends of ceramic and carrier fibers have found particular utility in the formation of rovings from which high temperature resistant gaskets, packings, and other products can be made. The ceramic/carrier fiber blended rovings used in making gaskets and packings, in addition to high temperature resistance, should possess other significant characteristics. In the heat treating industry there are furnaces and other equipment which include doors and/or other covers which are repeatedly opened and closed. It is highly desirable to provide a seal which will not only serve as a thermal barrier but one which will maintain a comparatively high degree of resiliency and without any "channeling" effect. Channeling occurs when a portion of the gasket or packing burns out and leaves a passage through which the medium being sealed escapes.

Ceramic/carrier fiber blends provided in the past have been deficient in certain respects. These blends have been generally formed by depositing individual masses or tufts of ceramic fibers upon a carded web of carrier fibers; the web layer with the tufts of ceramic fibers is fed to a carding machine where the initial and final blending of the ceramic and carrier fibers is performed to produce a web from which the yarn can be formed. The card combs the tops of ceramic fibers to effect a parallelism with the linear extent of the web. There is little or no change in the lateral orientation (direction transverse to linear extent of web). Thus, the tufts remain as "combed out" inclusions within a web of carrier fibers. As an attempt to attain a relatively uniform blend, as many as four sets of carrier webs and ceramic tuft laminates are stacked prior to being blended in a carding machine. Seals which include packings or gaskets fabricated from blends having "combed out" inclusions are deficient in that the carrier fibers "burn out" and discontinuous phases or channels in the seal occur.

Accordingly, it is a primary object of this invention to

provide a method for producing a more intimate and homogeneous blend of ceramic/carrier fibers.

It is another object of this invention to provide a method for producing a web of ceramic and carrier fibers, within which web the ceramic and carrier fibers are randomly dispersed in respect to each other.

It is a further object of this invention to provide a method whereby a minimum of laminates of ceramic and carrier fibers are required to attain a relatively uniform blend.

Briefly, the objects are accomplished according to the present invention by:

(1) divellicating a supply of ceramic fiber agglomerates;
(2) depositing the divellicated ceramic fibers on an extended surface, preferably in a somewhat continuous phase;
(3) depositing carrier fibers in juxtaposition with said divellicated ceramic fibers, preferably superimposing already carded carrier fibers in web form onto said ceramic fibers, to form a composite web of ceramic and carrier fibers;
(4) distending the composite web and projecting the fibers in an air stream;
(5) condensing the airborne fibers to form a new felt wherein the ceramic and carrier fibers are homogeneously dispersed and randomly blended in respect to each other and to the longitudinal extent of the new felt; and
(6) carding the new felt to form a new web from which a sliver may be formed.

Optionally, and preferably, the new felt produced in step **5** described above may be rolled together with an additional web of carded carrier fibers to form a laminate prior to the carding step **6** described above.

The term "ceramic fiber" as employed throughout this specification and the appended claims is intended to include any fibers which are produced from non-metallic inorganic materials and which are capable of withstanding relatively high temperatures (those in excess of 1800° F.). Aluminum silicates are exemplary of such ceramic fibers. Likewise, the term "carrier fiber" is intended to include any of the fibrous materials which have the requisite length, strength, flexibility, and surface characteristics to enable the fibrous material to be carded into a self-supporting web. Rayon fibers may be considered exemplary of carrier fibers.

The nature of the invention and further objects and advantages thereof will appear more fully from the following description particularly when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a schematic side elevational view of apparatus which may be employed to divellicate, distend, and regroup the fibers in accordance with the present invention;

FIG. 2 is a schematic flow diagram of the primary steps of the present invention for forming a sliver from a combination of carrier and ceramic fibers;

FIG. 3 is a view of a fragmentary rope portion formed of slivers made in accordance with this invention; and

FIG. 4 is a view of a fragmentary rope portion formed of twisted rovings made in accordance with the prior art teachings.

With reference to FIG. 1, an embodiment of the process of this invention will now be described. A supply of ceramic fibers **10** in a hopper **12** of feeder **14** is transferred onto a pin lifting apron **16** by traveling apron **18**. Adjacent the upper portion of return flight **20**, of the lifting apron **16**, is positioned doffer **22** to discharge the ceramic fiber onto conveyor **24** leading to a picking and forming machine **26**. The pins of the lifting apron **16** and

of the doffer 22 serve to divellicate the agglomerates of ceramic fibers. The machine 26 is preferably a modified, common commercial cotton picker type. A separate web 28 of carrier fibers from roll 29 is deposited in juxtaposition with the divellicated ceramic fibers 23 on conveyor 24 so as to form a composite web 30 of ceramic and carrier fibers. A plastic liner 31, used between adjacent convolutions of web 28 on roll 29, may be wound as roll 32. A pair of rolls 34 and 36 feed the composite web 30 to pin beater 38. The rolls 34 and 36 in a conventional cotton picker machine are usually corrugated and arranged so that the corrugations on one roll bottom, or closely approach bottoming, the roots of the corrugations of the opposite roll. The picker machine 26 as employed in the instant invention is modified to the extent that the feed rolls 34 and 36 are sufficiently spaced to avoid crushing the ceramic fibers. The rolls 34 and 36 feed the composite web 30 to pin beater 38. The beater 38 is driven by suitable means (not shown) in a manner so that the fibers are drawn downward by the pins and thrown upward into an air stream in chamber 40. The air stream directs the fibers onto perforated condenser rolls 42 and 44. The picking and condensing steps serve to completely intersperse and reorient in random fashion the ceramic and carrier fibers in respect to each other and in respect to the longitudinal extent of the new web being formed.

Except for the inlet 46 at rolls 34 and 36, the perforations 48 in condenser rolls 42 and 44, the chamber 40 is substantially air tight so that a preferred air stream may be defined. Air is suitably exhausted into the perforations 48 by fan 50 and controlled to produce a felt 60 of the desired density. The felt 60 is advanced for winding into roll 62. Optionally, an additional layer of carrier fibers 64 may be fed from roll 66 onto felt 60. The addition of an extra layer 64 of carrier fibers increases the handleability of newly formed felt and facilitates feeding into the final carding operation.

After the roll of felt 62 is removed from the wind-up position at the end of the machine 26, it is transferred to a conventional carding machine to form a new web wherein the ceramic and carrier fibers are intimately blended. The newly formed web is preferably removed from the carding machine in the form of a sliver (a loose rope form of fibers) having a weight of 110 to 205 grains per yard. In a more preferred embodiment, this sliver has a weight of 140 to 160 grains per yard. The sliver may be suitably collected in a conventional coiling can. The slivers may then be individually twisted, in either an S or a Z direction, at 15 to 20 turns per foot.

In order to make a strand form suitable for use as a packing or gasket, a plurality of the slivers are combined in a conventional forming machine where the slivers are grouped together and a small amount of twist is applied to retain the slivers in a unit form. The twist applied to the grouped slivers is preferably in a direction opposite to that applied to the individual slivers, i.e., if an S twist is applied to the individual slivers then a Z twist is applied to the group. Since the slivers are relatively uncondensed and uncompressed, they retain a resilient characteristic and may be packed into a sealing channel and readily fill the entire cavity. In contrast, the strand formed by conventional, prior art processes, involve the application of a rubbing action, or false twist, to the fibers as they leave the final carding step to form a yarn. Several of the yarns are then plied together to make a single strand and several of the strands are combined to make up the single unit form, in much the same manner as wire cables are produced. These prior art forms are relatively compressed and hence when they are placed within a packing or sealing channel, they do not readily conform to the shape of the channel.

Most preferably, the "raw" refractory fiber is treated during the production thereof, with a lubricating agent of a sprayable type to treat and envelope the individual fibers. Such agent may be of the alkylamine acetate family exemplified by the product commercially known as Armac T. Other such agents may be those of the silicone family. When the treated fiber agglomerates are at least partially distended or opened, they are preferably further treated with dry lubricating and anti-static agents, to facilitate the further processing of the fibers. Such agents are preferably applied prior to entry into the machine 26. An essentially pure hydrous magnesium silicate, commercially available as Miston Vapor, has been found satisfactory to function both as a dry lubricant and as a static reducing agent. Other lubricants that may be employed include graphite, aluminum flakes, kaolin, and materials of similar nature.

Having provided a complete description of the invention in such a manner as to distinguish it from other inventions and from what is old and having provided a description of the preferred steps needed in order to carry out the invention, the scope of the patent to be granted is to be determined by the following claims.

What I claim is:

1. The method of blending ceramic fibers with carrier fibers comprising:
   (a) divellicating a supply of ceramic fiber agglomerates;
   (b) placing the divellicated ceramic fibers in juxtaposition with a supply of carrier fibers to form at least one composite web of ceramic and non-ceramic carrier fibers; and
   (c) distending the composite web and projecting the fibers in an air stream and forming a new felt wherein the ceramic and carrier fibers are randomly blended in respect to each other and to the longitudinal extent of the new felt.

2. The method as described in claim 1, which further comprises:
   (a) carding the new felt to form a new web; and
   (b) combining and condensing the new web into a sliver.

3. The method as described in claim 1, which further comprises:
   (a) placing the blended felt in juxtaposition with a carded web of carrier fibers to form a laminate; and
   (b) carding the laminate to form a new web wherein the ceramic and carrier fibers are intimately blended.

4. The method as described in claim 1, which further comprises:
   spraying a lubricant onto said fibers of said supply.

5. The method as described in claim 1, which further comprises:
   applying a dry lubricant to the divellicated fibers prior to the step of distending the composite web.

6. The method as described in claim 1, which further comprises:
   applying a static reducing agent to said ceramic fibers prior to the step of distending the composite web.

7. The method as described in claim 2, which further comprises:
   combining a plurality of said slivers into a unit rope form.

8. The method as described in claim 2, which further comprises:
   (a) applying twist in a first direction to said sliver;
   (b) combining a plurality of twisted slivers into a unit form; and
   (c) applying twist to said slivers as a unit form in a direction opposite to said first direction.

9. In the method of blending ceramic fibers with carrier fibers, the improvement which comprises:
   (a) distending unblended composite body of ceramic and non-ceramic carrier fibers;
   (b) projecting the distended fibers in an air stream; and

(c) condensing the fibers in a layer wherein the ceramic and carrier fibers are randomly blended in respect to each other and to the longitudinal extent of the layer.

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