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[54] **METHOD OF AND APPARATUS FOR FORMING METAL FIBER TEXTILE BLEND AND METAL FIBER TEXTILE PRODUCT**

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[52] **U.S. Cl.** .....**57/50,** 19/.58, 19/145.5, 19/145.7, 57/140 BL, 57/156

[51] **Int. Cl.** **D01g 1/06,** D01g 13/00

[58] **Field of Search** .....57/50, 156, 140 BL, 139, 2, 57/157; 19/.3–.64, 66, 145.5, 145.7

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[57] **ABSTRACT**

A method of and apparatus for blending conductive metal filament material with nonconductive textile material wherein the textile material is partially carded and the metal filament is delivered to the partially carded material and subsequently carded with said material to break the filament into short metal fibers and blend the metal fibers substantially uniformly with the conductive textile material.

15 Claims, 2 Drawing Figures

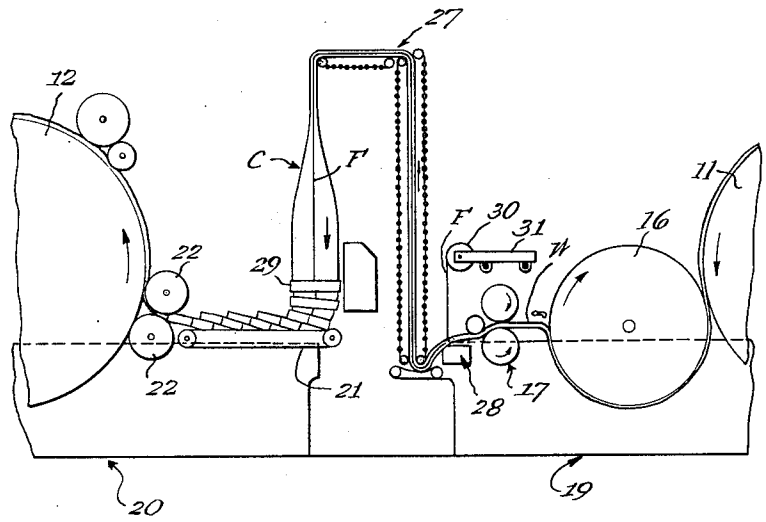


Fig. 1

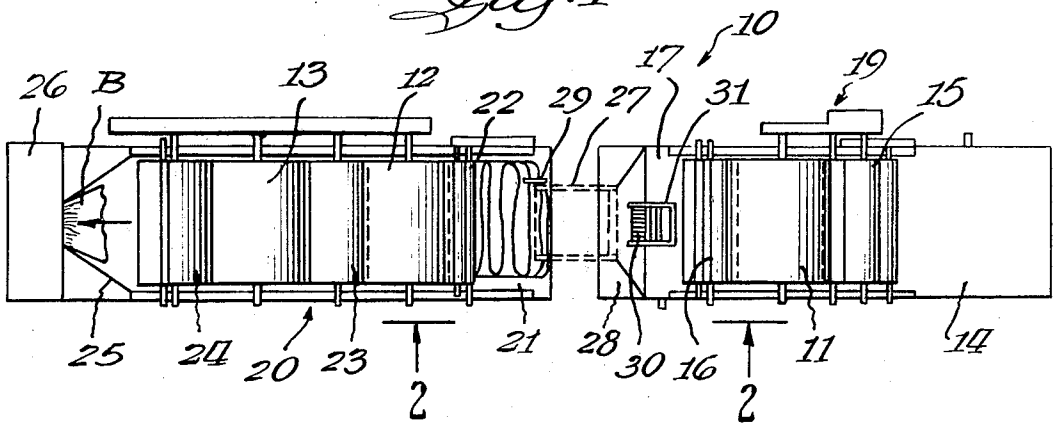
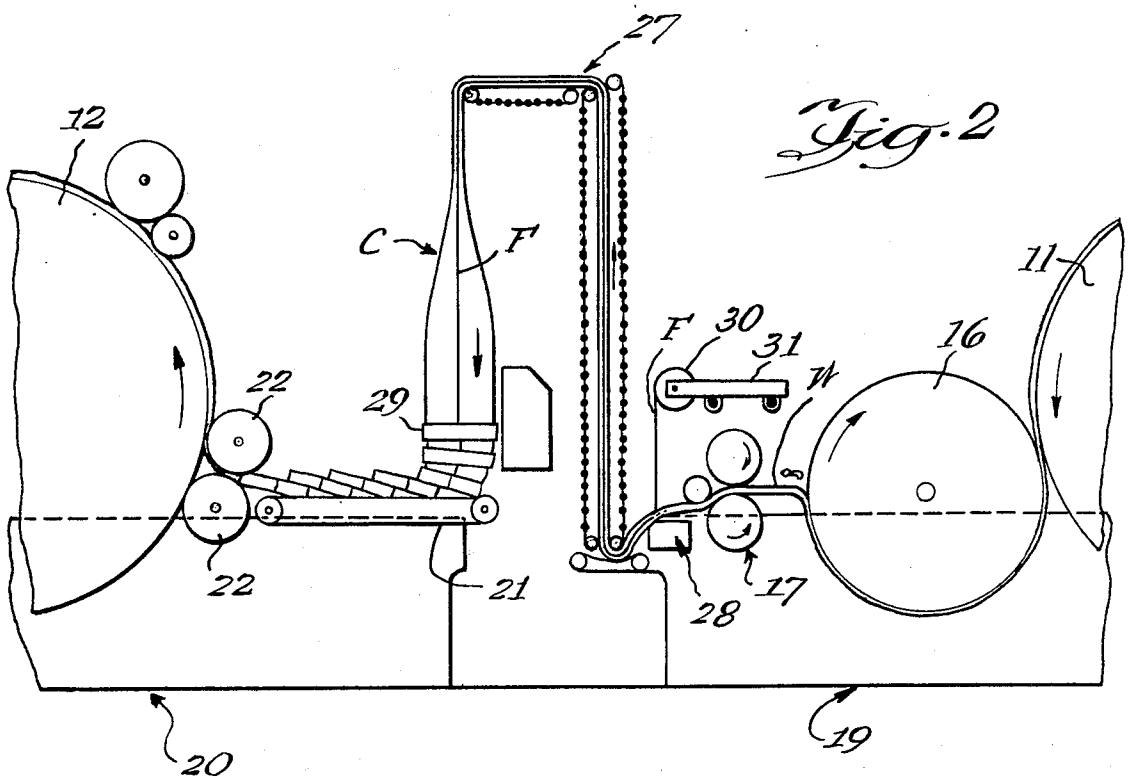


Fig. 2



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METHOD OF AND APPARATUS FOR FORMING METAL FIBER TEXTILE BLEND AND METAL FIBER TEXTILE PRODUCT

This application is a division of application of copending application, Ser. No. 643,983, filed on June 6, 1967.

This invention relates to the forming of antistatic textile material and in particular to the forming of such material wherein metal filaments are dispersed in nonconductive textile material to render the blend antistatic.

It has been found that a textile structure formed of nonconductive materials, such as organic fibers and the like, may be made antistatic by blending therein a small percentage of conductive metal filaments. The assignee hereof has developed a process for manufacturing very small diameter metal filaments which have proven imminently practicable for use in such blends. More specifically, such metal filaments may comprise stainless steel filaments having a diameter of approximately 12 microns or less. It has been found that to provide desirable uniformity of antistatic characteristics the metal filaments are preferably dispersed in the blend in the form of short fibers in relatively small percentages of metal to organic fiber by weight.

The present invention comprehends an improved method of and apparatus for providing such a desirable uniform dispersion or distribution of such short metal fibers in organic textile fibers to provide an improved economical antistatic blend. More specifically, the invention comprehends an improved forming of such a blended yarn for use in carpeting and the like.

Thus, a principal feature of the present invention is the provision of a new and improved method of and apparatus for forming an antistatic yarn.

Another feature of the invention is the provision of such a method of forming such an antistatic yarn wherein conductive metal filaments are introduced into the organic material during the processing thereof into yarn and caused to be broken up into desirable short lengths and concurrently uniformly distributed therein.

A further feature of the invention is the provision of such a method of forming an antistatic yarn wherein the conductive metal material is introduced in the form of conductive metal filaments and is broken into short length fibers and concurrently distributed in the organic textile material in the processing thereof into yarn.

Still another feature of the invention is the provision of such an apparatus for forming an antistatic yarn comprising means for forming a mass of nonconductive yarn-forming fibers, means for delivering continuous electrically conductive filament material to the mass to form a composite, means for working the composite to break the filament material into short lengths and substantially uniformly distribute the lengths in the composite to form a blend, and means for forming the blend into a yarn.

Yet another feature of the invention is the provision of such a method of forming an antistatic yarn comprising the steps of forming a partially carded web of electrically conductive fibers, moving the web longitudinally through a zone, continuously delivering cardable electrically conductive filament material to the web at the zone whereby the conductive filament material extends longitudinally of the web and forms therewith a composite web, and carding the composite web to break the continuous filament material into short electrically conductive fibers and blend the short conductive fibers with the nonconductive fibers to form a carded substantially uniformly blended web, and forming the blended web into a yarn.

In summary, the invention comprehends an improved method of and apparatus for forming an antistatic yarn wherein continuous electrically conductive filamentary material is delivered to a mass of nonconductive fibers and subsequently processed therewith to break the filamentary material into short lengths and substantially uniformly distribute the short lengths in the nonconductive material to form an antistatic blend material.

Other features and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawing wherein:

FIG. 1 is a top plan view of a yarn-forming apparatus for practicing the method of forming an antistatic yarn embodying the invention; and

FIG. 2 is a fragmentary side elevation thereof.

In the exemplary embodiment of the invention as disclosed in the drawing, an apparatus generally designated **10** for forming an antistatic textile yarn is shown to comprise a three-cylinder carding machine including a first carding cylinder **11**, a second carding cylinder **12**, and a third carding cylinder **13**. Thus, illustratively, apparatus **10** may comprise a standard set of woolen cards. The apparatus may include a feeder **14** which may comprise a conventional Bramwell feeder, a breast roller **15**, a card cylinder **11**, a doffer roller **16**, and a Peralta, or burr crushing device **17**, effectively defining a breaker portion, generally designated **19** of the apparatus **10**. A finisher portion generally designated **20** includes an intermediate feed table **21**, feed rolls **22**, card **12**, a doffer cylinder **23**, card **13**, a doffer cylinder **24**, and a tape condenser **25** for feeding the carded web to a conventional winding frame **26**. The partially carded web is transferred from the breaker portion **19** to the finisher portion **20** by suitable web feed device **27**, herein illustratively comprising a center draw, broad band intermediate feed, receiving the partially carded web from a condensing apron **28** and delivering it onto the feed table **21** by means of a laterally reciprocating traveler **29**.

As best seen in FIG. 2, the web W of partially carded, electrically nonconductive fibers is delivered from the doffer cylinder **16** through the crushing device **17** and the condenser **28** to the web feed apparatus **27**. The present invention comprehends the delivering of electrically conductive filament material to the web W as it passes to the feed **27**. As shown in FIG. 2, the filament material F may be fed onto the web W from a spool **30** carried on a suitable bracket **31** mounted above the crushing device **17**, whereby the filament material F may be delivered onto the web at the center thereof for delivery with the web through the center feed **27**, traveler **29**, table **21** and feed roll **22** to the card **12**. The filament material F thus forms with the web W a composite web C. The filament material F comprises a cardable filament material such as a tow of very small diameter continuous metal filaments. For example, the tow may comprise 300 stainless steel filaments each having a diameter of less than 0.001 inch and herein having a diameter of approximately 8 microns. The diameter of the individual filaments is preferably small enough so that the filaments are readily broken in the carding process to define short length fibers. Illustratively, the carded fibers may have a length of under approximately 2 inches. Concurrently, the fibers are substantially uniformly dispersed in the nonconductive material of the composite web to define a blended web B which is condensed and delivered to the yarn-forming winding frame **26** to define a blended antistatic yarn.

Thus, broadly, the invention comprehends the forming of a blended yarn wherein conductive fibers are substantially uniformly dispersed in relatively small percentages to provide an antistatic material by introducing the conductive material as continuous filaments which are broken and distributed in the nonconductive textile material by conventional textile processing steps. In the illustrative embodiment, the breaking of the filament material and distribution thereof in the nonconductive textile material is effected by a conventional carding step after the filament is delivered into association with the partially carded nonconductive textile web. While the disclosed embodiment is thus directed to woolen system processing, in the broad aspect the invention comprehends providing continuous electrically conductive filamentary material to a mass of nonconductive yarn-forming fibers and suitably processing the resulting composite to break the filamentary material into short lengths and concurrently, substantially uniformly distribute these lengths in the composite to form a substantially uniform blend which may be then suitably

spun into antistatic yarn. Thus, low percentages of conductive fibers may be uniformly distributed in the nonconductive material to provide desired antistatic characteristics. Illustratively, highly efficient antistatic blends having conductive fiber to nonconductive fiber ratios under 1 percent may be provided. Alternatively, where higher percentages are desired, the process may be employed for producing blends where the conductive material may be present in greater ratios and, illustratively, may comprise the major component of the blend. The invention further comprehends the provision of the filamentary material F in tow or sliver form as desired. In the illustrative embodiment, the filamentary material F is delivered to the web W at the condenser **28**. If desired, the delivery of the filamentary material F may selectively be made prior to the delivery of the web W to the condenser, or subsequent thereto. The filamentary material may be provided as a single end of tow or, if desired, may be provided in the form of multiple ends of tow as by providing a plurality of spools **30** carried on suitable brackets **31**, as desired. Further, if desired, the delivery of the filamentary material F to the web W may be other than to the center of the web. It has been found to be preferable that the filamentary material can be delivered to the web W subsequent to the crusher **17**.

While the filamentary material F may be introduced, as in the illustrative embodiment, from overhead onto the web W, the material may alternatively be delivered laterally from a side feed position as desired. It is preferable that the filamentary material be removed from the spool **30** by being drawn from the side thereof rather than over the end thereof to avoid undesirable twisting for facilitated subsequent carding of the composite C.

The disclosed method and apparatus provides the highly desirable advantage of permitting the use of conventional textile processing apparatus in forming an antistatic blend yarn having a wide range of conductive to nonconductive fiber ratios including a small ratio such as under 1 percent, while providing the conductive fibers in a substantially uniform distribution in the nonconductive material. Thus, the method may produce excellent antistatic yarn for use in applications such as carpeting. Broadly, however, the process may be utilized to blend any suitable workable filamentary material, including electrically nonconductive filamentary material, with the web material as desired.

While we have shown and described one embodiment of our invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as defined in the appended claims.

We claim:

1. A method of forming an anti-static yarn comprising the steps of:

forming a composite web by continuously combining a tow of cardable electrically conductive filament material with a web formed of electrically non-conductive staple fibers;

carding said composite web thereby breaking and blending said tow into conductive fibers with said non-conductive fibers to form a substantially uniform blended carded web; and

forming said blended web into yarn.

2. The method of claim **1** wherein said filament material comprises continuous filaments.

3. The method of claim **1** further including the step of condensing said composite web prior to said carding step.

4. The method of claim **1** further including the step of condensing said partially carded web concurrently with the delivery of said filament material thereto.

5. The method of claim **1** further including the step of condensing said partially carded web prior to delivery of said filament material thereto.

6. The method of claim **1** wherein said filament material comprises a single end tow.

7. The method of claim **1** wherein said filament material is delivered to said partially carded web substantially at the center line thereof.

8. The method of claim **1** further including the step of burr crushing said partially carded web prior to delivery of said filament material thereto.

9. The method of claim **1** wherein each filament of the tow has a diameter of less than 0.001 inch.

10. The method of claim **1** wherein said carding of the composite web causes said conductive filaments are in staple form.

11. The method of claim **1** wherein the proportion of said conductive material to said nonconductive fibers in said yarn is less than 1 percent.

12. The method of claim **1** wherein said filament material is provided in the form of a spool of tow and is delivered from the side of the spool to said partially carded web to preclude twisting thereof as an incident of the delivery.

13. The method of claim **1** wherein said filament material comprises a tow of over 100 substantially continuous filaments.

14. The method of claim **1** wherein said conductive material comprises metal material.

15. An apparatus for forming a composite web including a carding machine having two carding cylinders and a condenser located therebetween in combination with means for introducing and maintaining under tension a tow of continuous filaments at the condenser of said carding machine.

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