United States Patent

Goodbar et al.

[15] **3,703,073**

[45] **Nov. 21, 1972**

[54] ANTISTATIC YARN PRODUCTION

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[21] Appl. No.: **63,755**

[52] **U.S. Cl.**.....**57/36,** 19/.37, 57/157 AS

[51] **Int. Cl.**.....**D01g 1/08,** D01h 5/72

[58] **Field of Search**.....57/2, 6, 36, 55.5, 97, 140, 57/140 BY, 156, 157 AS, 34 R; 19/.3, .35, .37, .39, .41, .43, .46, .56; 134/425

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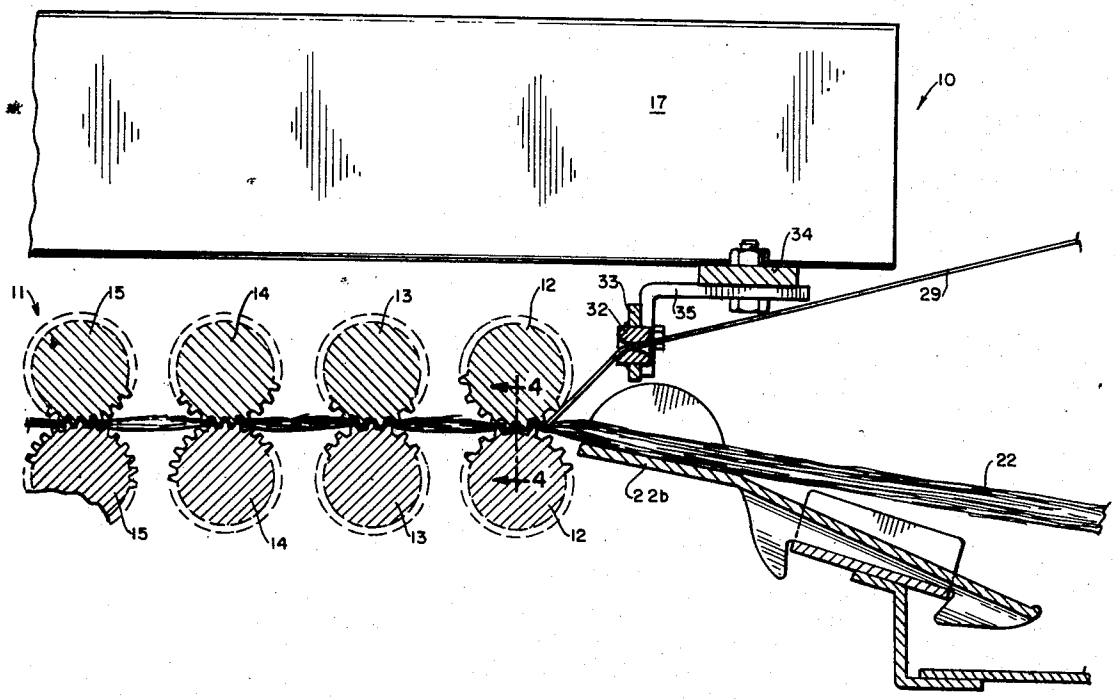
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[57] **ABSTRACT**

There is disclosed a method and apparatus for producing yarn having discontinuous staple lengths of metal filaments uniformly interspersed therein by preventing slubbing of the metal multifilament tow during drawing thereof.

9 Claims, 7 Drawing Figures



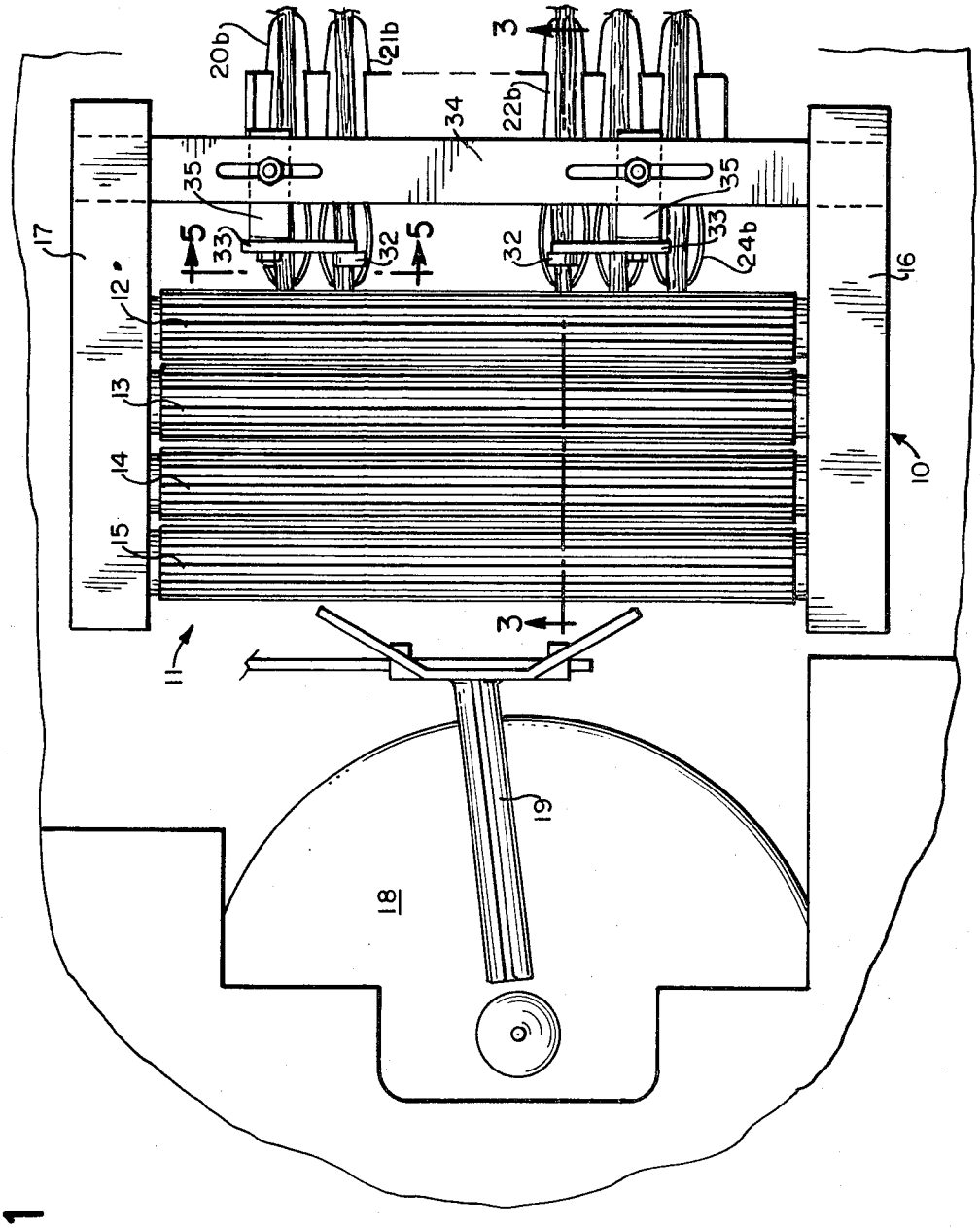


FIG. 1

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FIG. 2

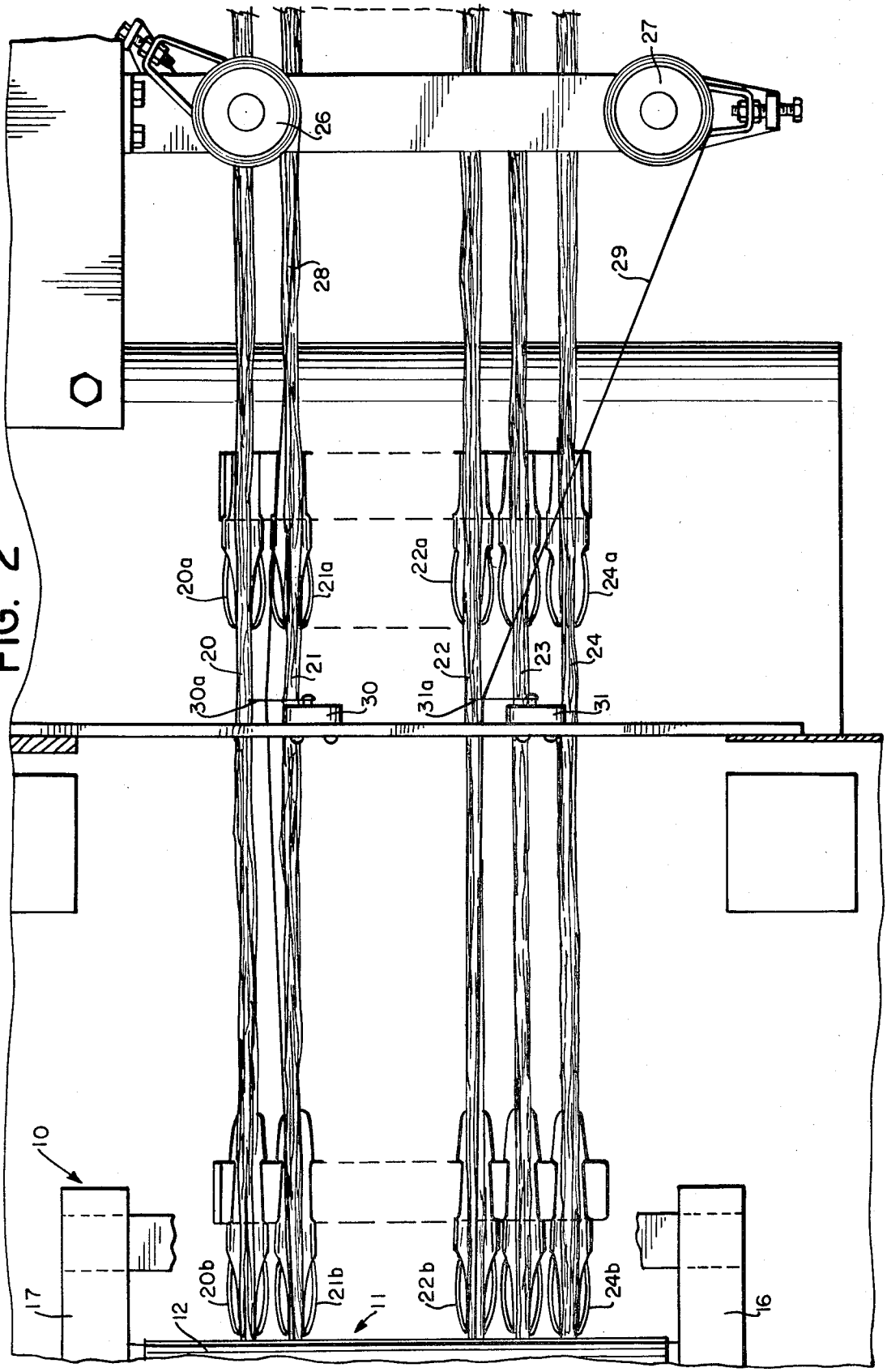

27
26
28
29
20a
21a
22a
24a
20
21
22
23
24
30a
30
31a
31
10
17
12
20b
21b
11
22b
24b
16

FIG. 3

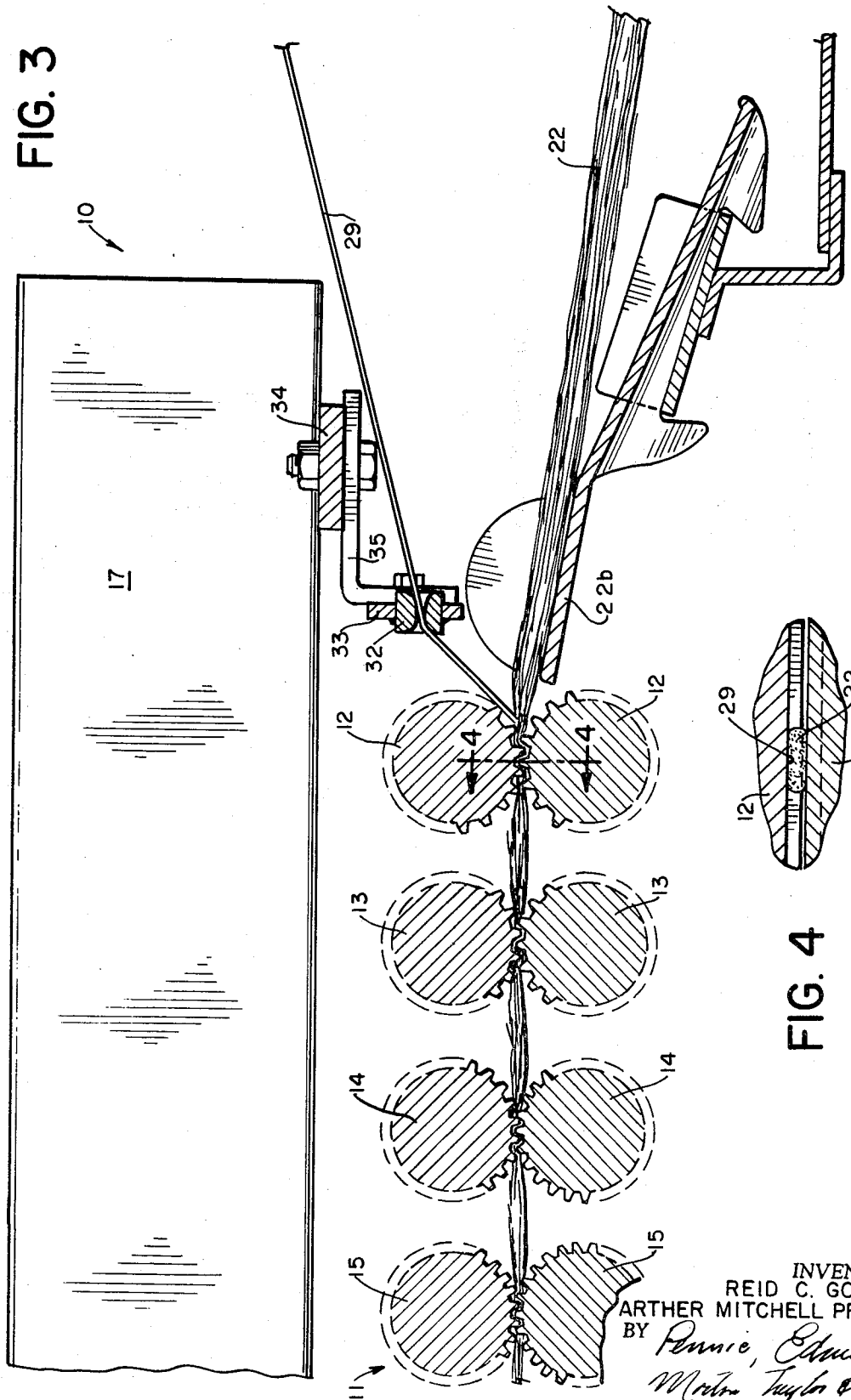


FIG. 4

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FIG. 5

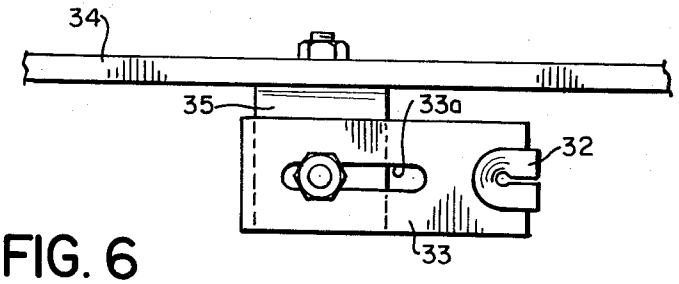


FIG. 6

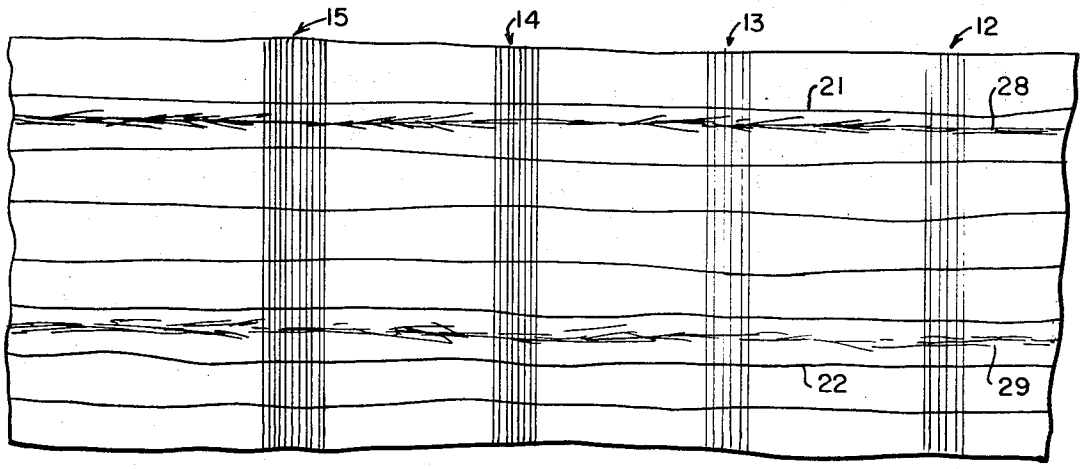
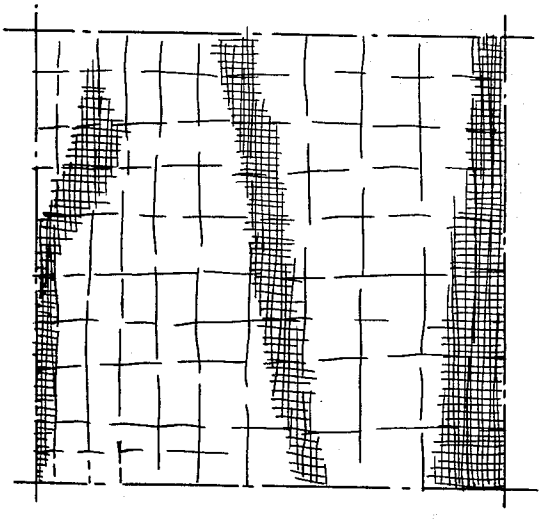


FIG. 7



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ANTISTATIC YARN PRODUCTION

BACKGROUND OF THE INVENTION

In recent years yarns have been developed which when woven into clothing tend to prevent or dissipate electrostatic charges. Such charges are generally the result of friction between fabrics and can be a source of danger or discomfort upon discharge by sparking. It is important for example to prevent electrical discharges in the form of sparks in a hospital operating environment where oxygen in the presence of highly flammable materials is used or when explosive or flammable anesthetic gases are being administered. Computer installations are particularly susceptible to the introduction of "error signals" caused by static discharge. Certain chemical and other processes must be protected from static discharge through sparking. Other obvious examples of situations which should be kept free from static discharges through sparking are explosive handling and fuel handling.

Various textile yarns have been proposed which incorporate a small quantity of metal filament, usually a stainless steel, which runs as a continuous strand throughout a yarn or is interspersed in short staple lengths therein. In either case the conduction of incipient electrostatic charges is expected along such yarns to some point where the charge is dissipated or bled off to ground. One of the problems associated with the production of yarns containing staple lengths of metal filament has been the occurrence of "slubbing." Slubs are a group or bundle of metal filaments caused by incomplete separation of the metal filaments of a breaker-drawn multifilament tow. Each metal tow may contain for example, 300 filaments of 8 microns diameter each and during drawing of the metal tow, slubs have resulted frequently when the initial set of draw rolls cut through the whole of the metal tow instead of causing a gradual attenuation. Such slubs never draw out thereafter notwithstanding several subsequent drawing operations. The final result is nonuniform and poor distribution of the metal filaments throughout the yarn and highly visible grey streaks which will appear in the finished product.

The present invention is concerned with an improved technique for distributing staple lengths of metal filaments throughout yarns more uniformly to *a*) improve the anti-static effect and *b*) enhance the uniformity and appearance of the product. It is believed that the short staple lengths of metal interspersed uniformly as they are, when charged cause local ionization of the adjacent air and a consequent "bleeding off" or neutralization of static charges without depending upon conduction of the charge to ground.

SUMMARY OF THE INVENTION

In accordance with the present invention a method and apparatus have been devised for drawing a combination yarn consisting of textile fiber and metallic filament. Broadly, the method comprises the simultaneous drawing of a textile fiber sliver and a metal filament tow while controlling the tension forces upon the metal filaments in the tow such that gradual breaking of filaments in the tow occurs and the filaments are distributed evenly in staple lengths throughout the textile fiber. In accordance with the invention, as the metal filaments are drawn, they are subjected to the action of

draw rolls in a manner to cushion the engagement of the rolls therewith while controlling the tension forces upon the metal filament tow, thereby breaking the filaments at different points between the first two sets of draw rolls. More specifically the method employs feeding the textile fiber sliver into a first set of draw rolls while simultaneously feeding a metal filament tow thereto which is guided into continuous contact with the textile fiber tow.

BRIEF DESCRIPTION OF THE DRAWING

FIGS. **1** and **2** illustrate in plan view a typical draw frame for carrying out the method of the present invention;

FIG. **3** is a vertical cross-section taken in the direction of arrows **3—3** of FIG. **1**;

FIG. **4** is a cross-section taken in the direction of arrows **4—4** of FIG. **3**;

FIG. **5** is a cross-secton taken in the direction of arrows **5—5** of FIG. **1**;

FIG. **6** is a plan view illustrating the even distribution of metal filament due to the drawing action from respective draw rolls; and

FIG. **7** is a schematic illustration of a woven fabric showing a typical distribution of metal filaments in the warp and filing directions produced by the present invention.

DESCRIPTION OF A PARTICULAR EMBODIMENT

Referring to the drawing, a draw frame **10** modified in accordance with the principles of the present invention has been illustrated. As shown in FIG. **1**, the draw frame **10** includes sets of four, paired draw rolls **11** comprising individual rolls **12–15**. These are journaled in bearings for rotation in frame members **16** and **17**. Rolls **12–15** are driven in the conventional manner by means (not shown). Rolls **13** are driven slightly faster than rolls **12**, rolls **14** faster than **13** and so on to attenuate the sliver as it passes through the sets of rolls. Furthermore, as is conventional, rolls **13** will have a greater number of teeth than rolls **12**, **14** a greater number than **13** and rolls **15** the greatest number of teeth. The separation on centers for example between rolls **12** and **13** in a particular embodiment will be 1 ⅞″, 1 ¾″ will separate rolls **13** and **14** and 1 ⅝″ will separate rolls **14** and **15**. After passing through the sets of rolls **11**, the several slivers (and as will be further described, metal multifilaments dispersed throughout certain slivers) are gathered and enter bin **18** through tube **19**. At this point the respective slivers including those having metal multifilaments have been mixed or blended into a single sliver. Another successive drawing or drawings will then follow until fiber attenuation, orientation and further mixing or blending is completed. It will be understood that the apparatus thus far described is conventional.

In the draw frame **10**, two sets of rolls **11** will be mounted side by side, each set being adapted to receive **8** slivers comprising for example three slivers of cotton and five of polyester fiber. For purposes of clarity, only one set of rolls **11** has been illustrated and only **5** slivers are shown being fed into the draw rolls. The slivers may be individually designated by reference numerals **20–24** with the cotton slivers designated by reference numerals **21** and **22** and the remainder polyester

slivers. Each sliver is guided as it is being fed into the draw rolls by a rearward set of spoons **20***a*—**24***a* and a forward set **20***b*–**24***b* corresponding to slivers **20**–**24**. Spools **26** and **27** contain a quantity of stainless steel in the form of tows **28**, **29**. These may be, for example, an austenitic stainless steel (essentially high grade 18/8 chrome, nickel alloy) such as "Brunsmet-304" which is an **8** micron **300** filament tow marketed by Brunswick Corporation Technical Products Div., Chicago, Ill. By way of example but without limitation, the invention contemplates the use of such filaments in the **4-12** micron range.

The tows **28** and **29** first pass from the spools past cut off switches **30**, **31** whose arms **30a**, **31a** sense the presence of each tow **28** and **29**. It is the function of the switches **30**, **31** to cause the operation of draw rolls **12**–**15** to cease whenever a break in either of tows **28** and **29** occurs. The stainless steel tows **28** and **29** are fed through guides **32** (FIG. **5**) which are mounted to laterally adjustable bracket members **33** secured to frame member **34** by angles **35**. The purpose of guides **32** is to assure the precise positioning of each tow **28**, **29** such that these will be fed directly upon underlying tows **21** and **22**. Lateral adjustment permitted by the elongated slot **33a** in bracket **33** will allow the precise adjustment of this relationship.

As the tows **28**, **29** proceed through rolls **12**–**15**, the stainless steel filaments will break and gradually be drawn together with cotton slivers **21** and **22**. Since the slivers **21** and **22** lie underneath stainless steel tows **28**, **29**, the cotton fibers will act to cushion the engaging effect of the rolls upon the steel filaments such that the rolls will not cut through the steel tow. Rather, as best seen in FIG. **6**, the tows **28** and **29** will be subjected to a gradual attenuation due to the controlled tension placed thereupon by the engagement of adjacent rolls **12** through **15**. Thus, very few breaks will occur at the engaging points of the rolls themselves but rather gradual breakage due to the cushioning action occurs primarily between the respective draw rolls. Because the engaging rolls encounter constantly varying amounts of the steel filaments in combination with varying amounts of textile fiber, which variation helps to prevent a build-up of tension forces at any particular point, the breaking process occurs only a few filaments at a time. As a result, slubs (relatively large bundles of filaments in short staple lengths) only rarely occur and the steel filaments are generally finely dispersed through the lengths of cotton.

Practice has shown that cotton fiber provides a better cushioning effect than polyester fiber perhaps for the reason that the surface friction characteristics of both cotton and the stainless steel filament used are similar. In any event, the juxtaposition of stainless steel and of cotton as shown, very effectively prevents slubbing and causes an even distribution of staple lengths of stainless steel filament throughout the yarn. It has been found that in general, the formation of slubs using the principles of the invention is minimal and that on the average only 200 small slubs may be found in any given sample of 100 linear yards of grey goods. This is in comparison with goods made according to a prior process having about 1300 much larger slubs in 100 linear yards of material. X-ray examination of grey goods produced by the presently disclosed process (FIG. **7**) reveals that combinations of filaments where they occur average no more than four filaments per bundle (4–12 microns) and are invisible to the naked eye. FIG. **7** illustrates a typical distribution of steel filaments (greatly enlarged) in both weft and filling directions.

It will be understood that the foregoing description relates to a particular embodiment of the invention and is therefore representative. In order to appreciate the scope and spirit of the present invention, reference should be made to the appended claims.

What is claimed is:

1. The method of drawing and blending textile fiber and metal filaments while maintaining contact with each other comprising, feeding at least one bundle of fibers of textile material through draw rolls, simultaneously feeding a multifilament metal bundle through said draw rolls, simultaneously feeding a multifilament metal bundle through said draw rolls, guiding said metal bundle relative to said textile bundle to cause the latter continuously to cushion said metal bundle with respect to said draw rolls when passing therethrough while controlling the tension force on said metal filaments, to break limited numbers of said filaments generally continuously during the period of drawing.

2. The method according to claim **1** wherein said bundle of textile material and bundle of multifilament metal are fed into a plurality of successive sets of draw rolls and said metal bundle is guided into the first set of rolls.

3. The method according to claim **2** wherein said draw rolls are arranged horizontally, and a plurality of textile bundles and metal bundles are fed to said rolls, said textile bundles being in side by side relationship and each of said metal bundles overlying one of said textile bundles.

4. The method according to claim **1** wherein said textile bundles and metal bundles have similar surface friction characteristics with respect to said draw rolls.

5. The method according to claim **4** wherein said textile bundle is cotton and said metal bundle is stainless steel.

6. The method according to claim **5** wherein said stainless steel is made of metal filaments in the 4 to 12 micron range.

7. The method according to claim **1** wherein the textile bundles after drawing are passed through a roving and spinning steps to create yarn.

8. Apparatus for simultaneous drawing of bundles of textile fiber and metal filaments comprising, at least one pair of draw rolls, means for feeding at least one bundle of a textile fiber into said draw rolls, means for feeding at least one bundle of metal filaments into draw rolls and means for guiding one of said textile and fiber bundles directly onto the other of said textile and fiber bundles while said textile and fiber bundles are passing through said first pair of draw rolls so that said metal bundle is not brought directly into contact with both draw rolls of said first pair due to the interposition and cushioning of said fiber bundle between said metal bundle and said draw rolls, said guide means further causing the metal and textile bundles to be brought initially into contact with each other without twisting of said textile bundle or envelopment of said metal bundle by said textile bundle immediately prior to passing through said first pair of draw rolls.

9. The apparatus of claim 8 wherein several pairs of draw rolls are arranged sequentially.

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