

Nov. 3, 1970

M. MAYER, JR

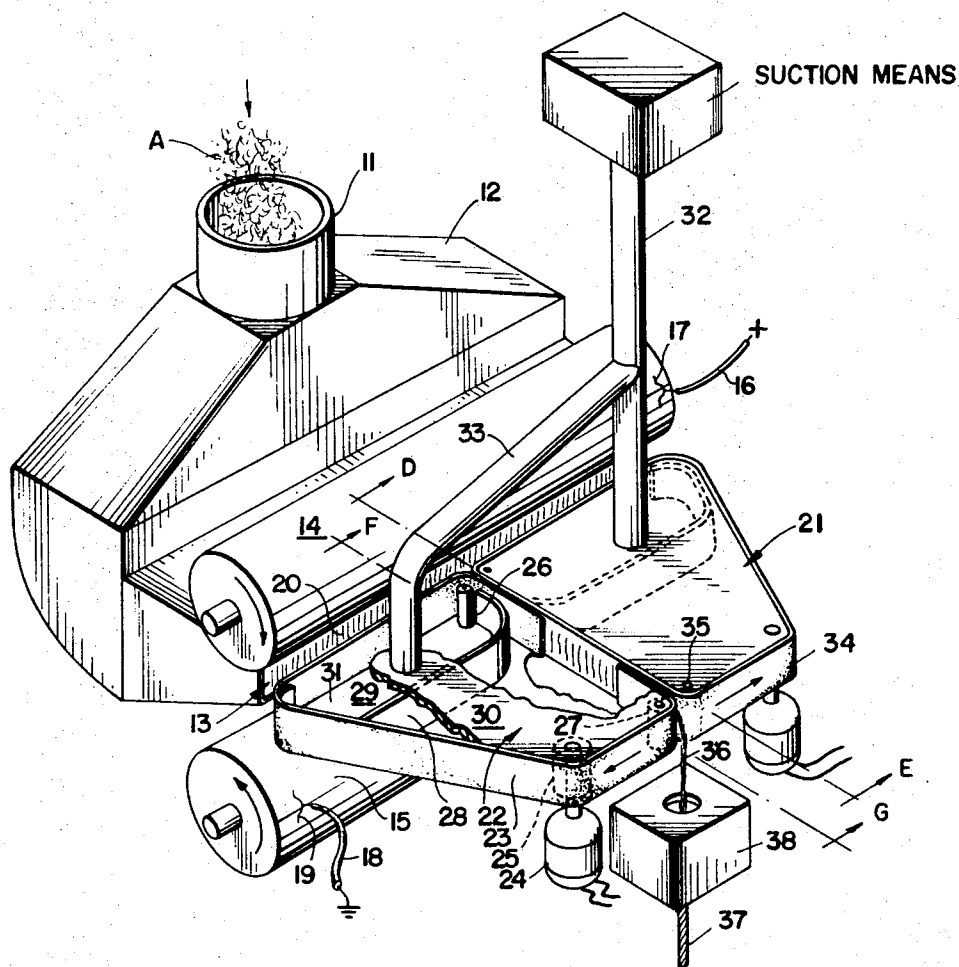
3,537,249

PROCESS AND APPARATUS FOR MAKING A TEXTILE STRAND

Filed July 28, 1969

3 Sheets-Sheet 1

FIG. 1



INVENTOR
MAYER MAYER, JR

BY

R. Hoffman
ATTORNEY

Nov. 3, 1970

M. MAYER, JR

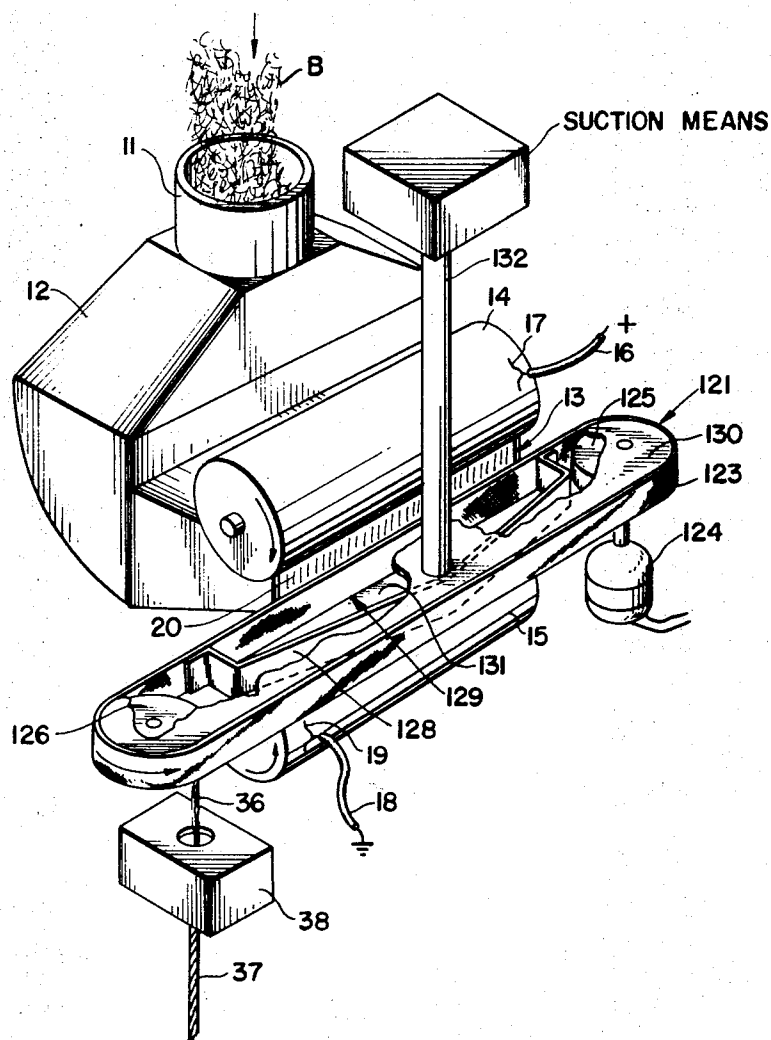
3,537,249

PROCESS AND APPARATUS FOR MAKING A TEXTILE STRAND

Filed July 28, 1969

3 Sheets-Sheet 2

FIG. 2



INVENTOR
MAYER MAYER, JR.

BY

R. Hoffman
ATTORNEY

Nov. 3, 1970

M. MAYER, JR

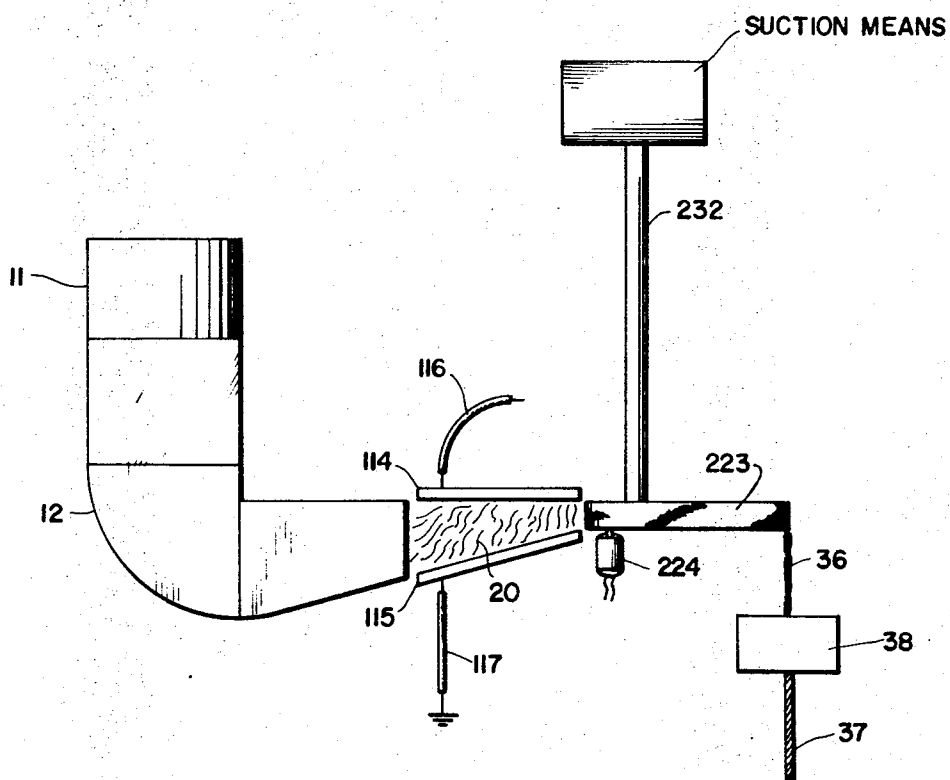
3,537,249

PROCESS AND APPARATUS FOR MAKING A TEXTILE STRAND

Filed July 28, 1969

3 Sheets-Sheet 3

FIG. 3



INVENTOR
MAYER MAYER, JR.

BY

R. Hoffmann
ATTORNEY

1

3,537,249

PROCESS AND APPARATUS FOR MAKING A TEXTILE STRAND

Mayer Mayer, Jr., New Orleans, La., assignor to the
United States of America as represented by the Secretary of Agriculture

Filed July 28, 1969, Ser. No. 854,340

Int. Cl. D01h 1/12

U.S. Cl. 57—58.89

2 Claims

ABSTRACT OF THE DISCLOSURE

This invention relates to a process and apparatus for making a highly parallelized textile strand. More particularly this invention relates to a process and apparatus for electrostatically aligning fibers, removing them from the electrostatic field in an aligned state and forming a textile strand.

A nonexclusive, irrevocable, royalty-free license in the invention herein described, throughout the world for all purposes of the United States Government, with the power to grant sublicenses for such purposes, is hereby granted to the Government of the United States of America.

This invention relates to a process and apparatus for making a highly parallelized textile strand.

More specifically, it relates to a method and apparatus for making a textile strand from raw material within a single machine.

Still more specifically, it relates to a method and apparatus for electrostatically aligning fibers, removing them from the electrostatic field in an aligned state and forming a textile strand.

In the past the processing of fibers into a strand required numerous machines to open, clean and align the fibers prior to spinning or strand forming. This system is very costly and requires the handling and transporting of fibers in various stages from process to process. In an attempt to reduce handling and processing costs the art is presently mechanically coupling two or more processes. Further cost reductions are being obtained by increasing machine speeds to obtain higher production rates. In spite of these recent trends toward higher production, the low production textile card is still a "processing bottleneck." Those experienced in the art are well aware of the great need for a simplified processing system which would eliminate the textile card and reduce the number of processing steps.

The method and apparatus which is the subject of this invention comprises a single processing machine for untangling, individualizing and aligning fibers, and forming said fibers into a textile strand.

The apparatus comprises any suitable means for uniformly introducing loose masses of relatively untangled, individualized fibers into an electrostatic field. The electrostatic field may have uniform and/or nonuniform field gradients and may be produced by any suitably shaped and positioned electrodes. Parallel, cylindrical electrodes such as described in U.S. Pat. No. 3,349,902, 1967 by Joseph J. LaFranca, Jr., Mayer Mayer, Jr., and Heber W. Weller, Jr., have been found to produce excellent results. Parallel, flat electrodes also produce good results. The electrostatic field produced by the electrodes causes the fibers to become aligned parallel to the lines of force. The aligned fibers are removed from the electrostatic field in said alignment onto the face of one or more air permeable endless belts. The following will describe two such belts. Said endless belts are positioned such that a portion of the belts' periphery traverses within the electrostatic field with the belts' faces parallel to the lines of force between aforescribed electrodes at or near the highest field

2

potential. Said air permeable endless belts surround plenum chambers maintained below atmospheric pressure for that portion of the belts' periphery within the electrostatic field. Lower than atmospheric air pressure applied to inside surface of endless belts causes the aligned fibers to be sucked onto periphery of belt. It is an important feature of this invention that the alignment of the fibers be maintained while removing them from the electrostatic field. The aligned fibers, held on the surface of the belts by negative air pressure, are conveyed out of the electrostatic field by the traversing action of said endless belts. Once removed from the field the highly aligned fibers may be removed from the belts and formed into a textile strand by any means common to the art.

One, but not the only, embodiment of an apparatus for the practice of my invention is described in the accompanying drawing in which:

FIG. 1 is a pictorial view showing the mechanical features of the embodiment of the invention.

FIG. 2 is a pictorial view showing the mechanical features of another embodiment of the invention with my air permeable belt.

FIG. 3 is a schematic view of an additional embodiment of the invention showing two essentially flat electrodes.

Referring to FIG. 1, masses of tangled, disoriented fibers A are fed through entrance duct 11 into fiber disentangling and individualizing means 12. Said means 12 may contain any means well known to the art for disentangling fiber tufts and producing highly individualized fibers. Said individualized fibers are discharged at opening 13 into the region between electrode elements 14 and 15. Electrode 14 is energized through conductor 16 and slide wire 17 and electrode 15 is energized through conductor 18 and slide wire 19. FIG. 1 shows electrode 15 electrically grounded and electrode 14 above ground; however, equally efficient performance can be obtained with electrode 14 electrically grounded and electrode 15 above ground. The effect of the electrostatic field produced between electrodes 14 and 15 is to cause the individualized fibers 20 discharged at 13 to become aligned parallel to the lines of force between electrodes 14 and 15. The electrodes may be rotated as shown in FIG. 1; however, it should be noted that either electrode may rotate in either direction. It should be further noted that rotation of the electrodes 14 and 15 is not necessary to the invention and in fact said electrodes may be stationary. The individualized and aligned fibers 20 are removed from the electrostatic field by one or more air permeable, endless belt assemblies. For convenience I prefer to use two such air permeable endless belt assemblies, 21 and 22. Belts 23 and 34 of the assemblies traverse within the electrostatic field with at least one peripheral belt surface parallel to the axes of the two electrodes. Assemblies 21 and 22 are symmetrically arranged into two independent groups about an imaginary "centerplane" DEFG. For simplicity, portions of the following description will concern only one assembly on one side of the imaginary "centerplane." It will be understood, however, that the assembly on the opposite side of the imaginary "centerplane" is located and functions as a mirror-image of the assembly being described. Continuously moving endless belt 23 of assembly 22 is driven by any conventional means such as motor 24 and pulley 25. One shape but not the only shape for the periphery of the continuously moving belt 23 shown in FIG. 1 is outlined by pulleys 26 and 25 and 27, and formed surface 28. It should be noted that surface 28 and pulley 26 may be constructed of any nonconductive material. The endless belt 23 may be made of any nonconductive, air permeable material; I prefer to use a woven saran webbing. A flexible belt such as canvas, perforated rubber, Mylar or polyethylene also caused satisfactory results to be obtained.

A plenum chamber 29 maintained under lower than atmospheric air pressure within the belt assembly 22, bounded by top 30, bottom 31, and surface 28 is responsible for the passage of air through that portion of air permeable belt 23 within the region of the electrostatic field. Top 30 and bottom 31 may be constructed of any suitable nonconductive material. The air velocity through the endless belt 23 into plenum chamber 29 is of sufficient force to overcome electrostatic force and consequently pulls the aligned fibers onto the periphery of air permeable, endless belt 23. The partial vacuum within plenum chamber 29 is provided by any suction means common to the art through ducts 32 and 33. It is an important feature of this invention that the said individualized and aligned fibers 20 maintain their alignment when pulled onto endless belt 23. The motion of the endless belt causes the aligned fibers on the belt periphery to move away from the outer edge of the electrodes and electrostatic field into the "centerplane." At this point the fibers on belts 23 of belt assembly 21 meet the fibers on belt 34 of belt assembly 22 where they follow a path along the imaginary "centerplane" DEFG so as to move the aligned fibers 20 out of the electrostatic field. It is important to the function of this invention that there be sufficient pressure, by any conventional means, between belt assemblies 21 and 22 to maintain the original fiber alignment as fibers 20. At 35 where movement of belts 23 and 34 changes from the same direction to opposing direction the aligned fibers 36 are initially removed from the belts 23 and 34 by any method common to the art such as a seeding yarn not shown. Fibers are subsequently made into a textile strand 37 by any means 38 common to the art for compacting or spinning into said strand 37.

Referring to FIG. 2, masses of tangled, disoriented fibers B are fed through entrance duct 11 into fiber disentangling and individualizing means 12.

Said means 12 may contain any means well known to the art for disentangling fiber tufts and producing highly individualized fibers 20. Said individualized fibers 20 are discharged at opening 13 into the region between electrode elements 14 and 15. Electrode 14 is energized through conductor 16 and slide wire 17 and electrode 15 is energized through conductor 18 and slide wire 19. FIG. 2 shows electrode 15 electrically grounded and electrode 14 above ground. However, equally efficient performance can be obtained with electrode 14 electrically ground and electrode 15 above ground. The effect of the electrostatic field produced between electrodes 14 and 15 is to cause the individualized fibers 20 discharged at 13 to become aligned parallel to the lines of force between electrodes 14 and 15. The electrodes may be rotated as shown in FIG. 2; however, it should be noted that either electrode may rotate in either direction. It should be further noted that rotation of the electrodes 14 and 15 is not necessary to the invention and in fact said electrodes may be stationary.

The individualized and aligned fibers 20 are removed from the electrostatic field by the air-permeable, endless belt assembly 121. Belt 123 of the assembly 121 traverses within the electrostatic field with at least one peripheral belt surface parallel to the axes of the two electrodes. Continuously moving endless belt 123 of assembly 121 is driven by any conventional means such as motor 124 and pulley 125. One shape but not the only shape for the periphery of the continuously moving belt 123 shown in FIG. 2 is outlined by pulleys 126 and 125. It should be noted that pulleys 126 and 125 may be constructed of any conductive or nonconductive material. The endless belt 123 may be made of any nonconductive, air-permeable material.

A plenum chamber 129 maintained lower than atmospheric air pressure within the belt assembly 121, bounded by top 130, bottom 131, and surface 128 is responsible for the passage of air through that portion of air-permeable belt 123 within the region of the electrostatic field. Top

130 and bottom 131 may be constructed with any suitable nonconductive material. The air velocity through the endless belt 123 into plenum chamber 129 is of sufficient force to overcome electrostatic force and consequently pulls the aligned fibers onto the periphery of air-permeable, endless belt 123. The partial vacuum within plenum chamber 129 is provided by any suction means common to the art through duct 132. It is an important feature of this invention that the said individualized and aligned fibers 20 maintain their alignment when pulled on endless belt 123. The motion of the endless belt causes the aligned fibers on the belt periphery to move away from the electrodes and electrostatic field. Said aligned fibers 20 removed from said electrostatic field and held in an aligned state on endless belt 123 by partial vacuum within plenum chamber 129 are initially removed from endless belt 123 by any means common to the art such as a seeding yarn not shown. Aligned fibers 36 removed from endless belt 123 are subsequently made into a textile strand 37 by any means 38 common to the art for compacting or spinning into said strand 37.

I claim:

1. An apparatus for removing textile fibers from an electrostatic field as a parallel oriented strand which comprises:

- (a) a first endless nonconductive air-permeable belt and a second endless nonconductive air-permeable belt, said first air-permeable belt and said second air-permeable belt with directionally opposed travel; said belts in combination extending in width between the electrodes of an electrostatic field and said belts with opposed convergent travel moving in a direction parallel to the surface of the electrodes and perpendicular to the lines of force and through the said field;
- (b) said first air-permeable belt traversing the periphery of a nonconductive assembly which assembly provides one substantially flat peripheral side extending in width a portion of the distance between said electrodes located substantially along the region of the highest field intensity and parallel to the lines of force of said field and said first air-permeable belt provided with at least one substantially flat peripheral side directed outwards from the field, with the outside surface of said outwardly directed side operating in surface contact with and moving at the same surface speed as the counterpart portion of said second air-permeable belt of substantially the same width as said first air-permeable belt; said second air-permeable belt traversing the periphery of a nonconductive assembly which assembly provides one substantially flat peripheral side extending in width to cover the remaining portions of said electrodes located substantially along the region of the highest field intensity and parallel to the lines of force of said field;
- (c) means for moving the parallel and oriented fibers within the high field intensity region of the electrostatic field into parallel and oriented contact with and holding said fibers in parallel and oriented condition on the air-permeable belts while said belts move through and out of the region of high field intensity, said means consisting of an air current drawn through said air-permeable belts and into the nonconductive assembly by any conventional air moving device;
- (d) means for driving the endless air-permeable belts around the periphery of the nonconductive assembly in the direction from the peripheral side located between the electrodes toward the peripheral side directed outwards from the field so that fibers held onto said air-permeable belts in parallel and oriented condition are transported outwards from the field perpendicular to the axes of said fibers whereupon said fibers are withdrawn lengthwise from between said air-permeable belts and formed into a textile strand by conventional means.

5

2. An apparatus for removing textile fibers from an electrostatic field as a parallel oriented strand which comprises:

- (a) an endless nonconductive air-permeable belt extending in width between the electrodes of an electrostatic field and said belt moving in a direction parallel to the surface of the electrodes and perpendicular to the lines of force and through the said field;
- (b) said air-permeable belt traversing the periphery of an assembly which assembly provides one substantially flat peripheral side extending in width the distance between said electrodes located substantially along the region of the highest intensity and parallel to the lines of force of said field and said air-permeable belt provided with at least one substantially flat peripheral side directed outwards from the field;
- (c) means for moving the parallel and oriented fibers within the high field intensity region of the electrostatic field into parallel and oriented contact with and holding said fibers in parallel and oriented condition on the air-permeable belt while said belt moves through and out of the region of high field intensity, said means consisting of an air current drawn through said air-permeable belt and into the nonconductive assembly by any conventional air moving device;
- (d) means for driving the endless air-permeable belt

6

around the periphery of the nonconductive assembly in the direction from the peripheral side located between the electrodes toward the peripheral side directed outwards from the field so that fibers held onto said air-permeable belt in parallel and oriented condition are transported outwards from the field perpendicular to the axes of said fibers whereupon said fibers are withdrawn lengthwise from between said air-permeable belt and formed into a textile strand by any conventional means.

References Cited

UNITED STATES PATENTS

2,284,635	6/1942	Campbell	57—77.4
2,294,771	9/1942	Campbell	57—77.4
2,529,674	11/1950	Bluhm et al.	57—58.93
3,003,911	10/1961	Lindstrom et al.	57—58.89 XR

FOREIGN PATENTS

936,628	9/1963	Great Britain.
---------	--------	----------------

JOHN PETRAKES, Primary Examiner

U.S. Cl. X.R.

57—77.4