United States Patent

Archambault

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[54] **DRAFTING COT ASSEMBLY**

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[73] Assignee: **North American Rockwell Corporation,** Pittsburgh, Pa.

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[52] **U.S. Cl.** **57/58.91,** 19/258, 57/36

[51] **Int. Cl.** **D01h 1/12**

[58] **Field of Search**.....57/36, 58.89, 58.91, 58.93, 57/58.95; 29/116 R, 123, 125, 129; 19/258

[56] **References Cited**

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3,411,284	11/1968	Corbaz et al.	57/58.91
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534,276	9/1931	Germany	29/116

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Attorney—John R. Bronaugh, Floyd S. Levison, E. Dennis O'Connor and Richard A. Speer

[57] **ABSTRACT**

An improved drafting cot assembly for use in conjunction with an open end electrostatic spinning apparatus. The assembly is comprised of a rotatably mounted cot roll having rotary, fiber advancing surface and smooth, rounded shields adjacent the ends of the roll to prevent stray fiber accumulation adjacent the fiber advancing surface.

2 Claims, 2 Drawing Figures

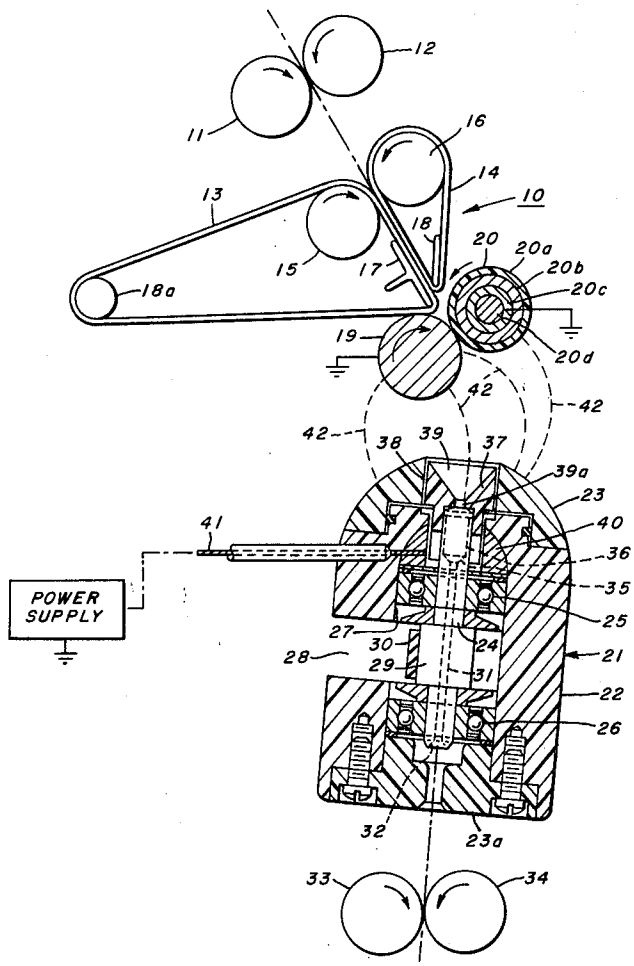

FIG. 1.

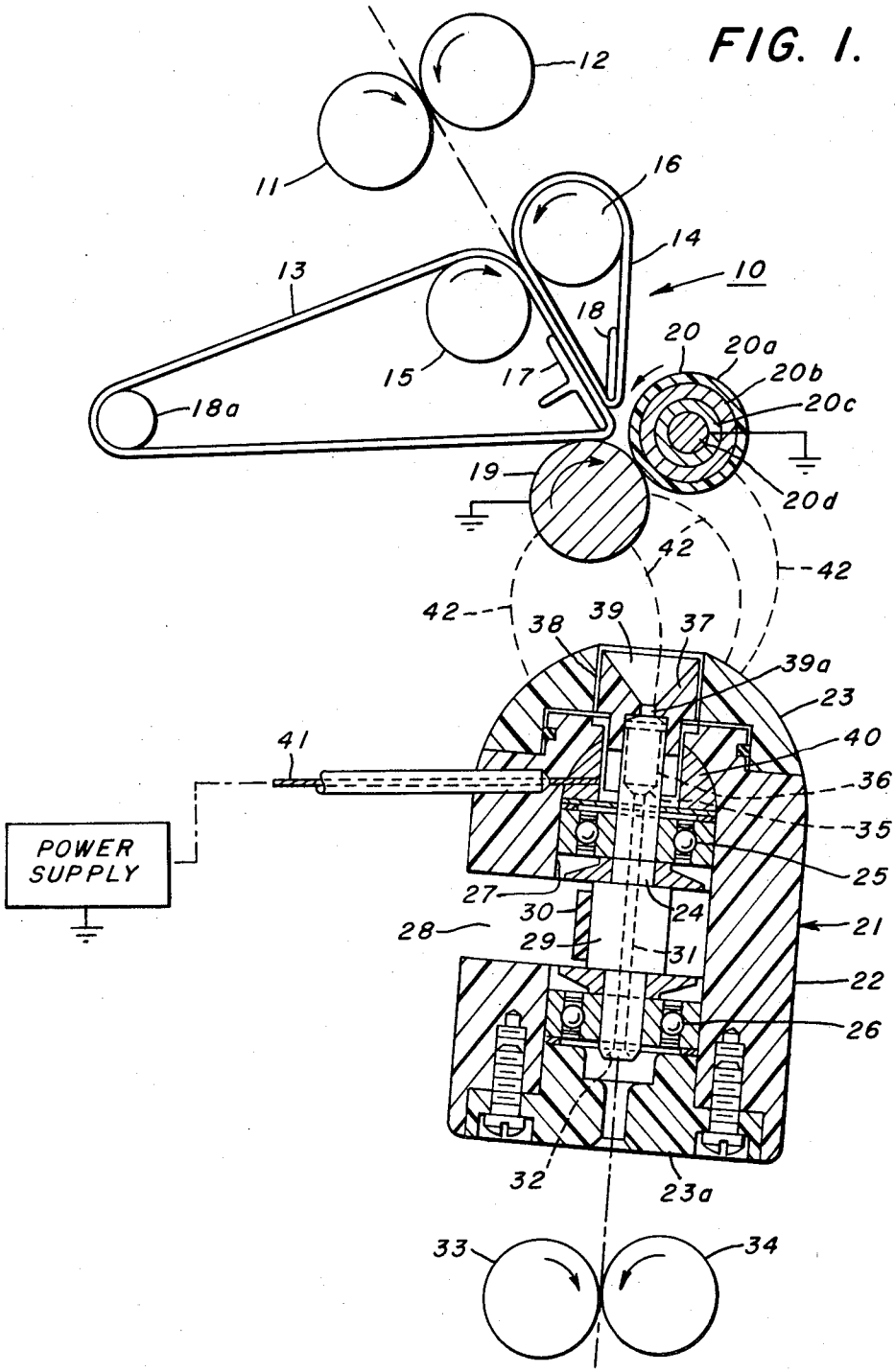
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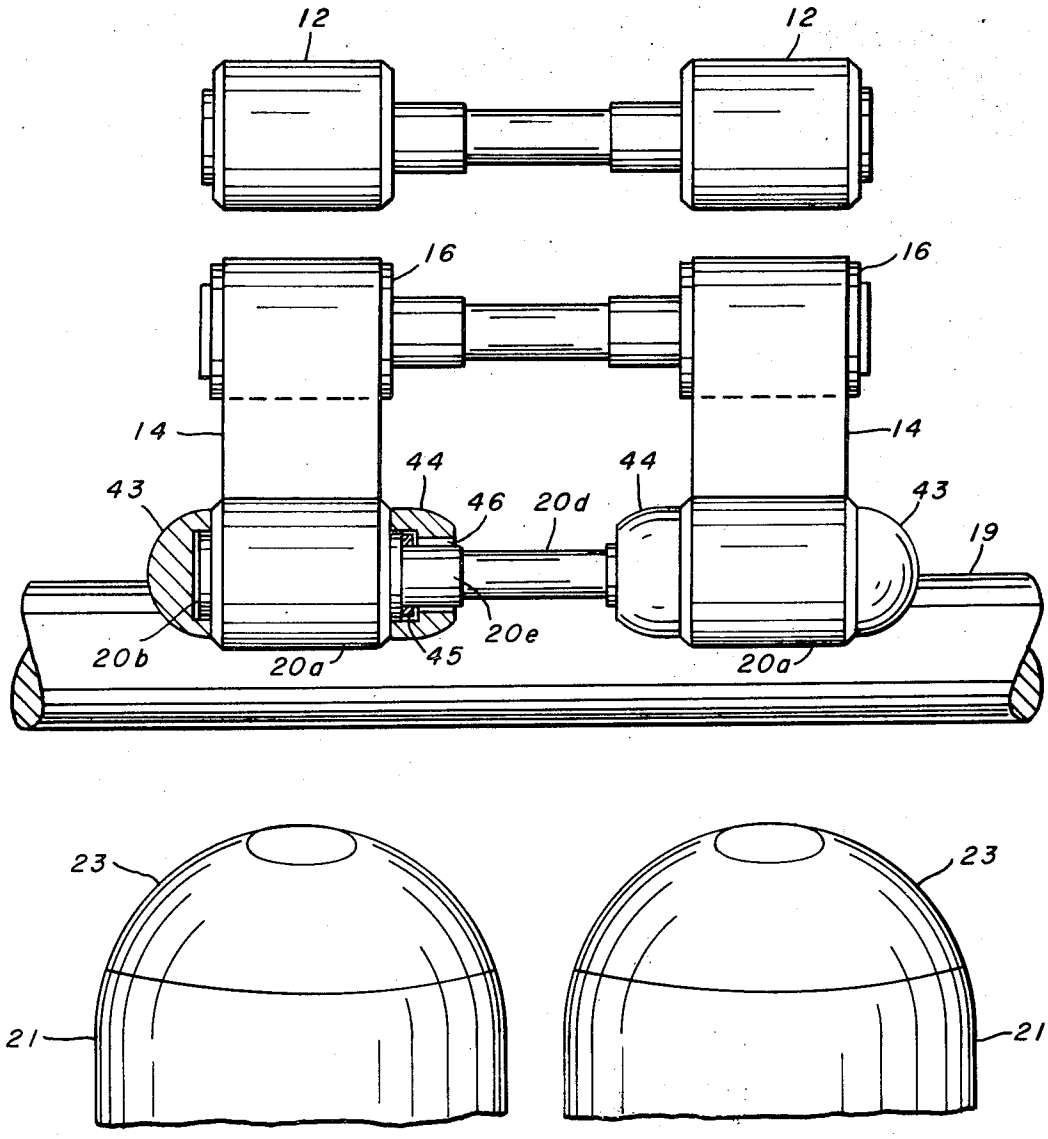
FIG. 2.



DRAFTING COT ASSEMBLY

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

This invention relates to improvements in drafting cot assemblies used with electrostatic spinning apparatus that enhance the effective strength of the electrostatic field and control textile fiber waste adjacent a rotating fiber feeding surface of the cot roll to prevent the accumulation of ballooning waste which could otherwise be attracted into the spinning zone and cause a process failure.

In conventional electrostatic spinning devices, an electrostatic field extends across an air gap or transport zone between a drafting system, which mechanically advances the fiber into the field, and a spinning head which collects and twists or spins the fibers into yarn. The fibers are supplied to the drafting system in the form of roving or sliver and advantageously, are discharged from the drafting system as a stream of discrete fibers into the electrostatic field which field is effective to align the fibers and move them across the air gap to the spinning head.

Reliability of spinning fibers by the electrostatic spinning process is dependent among other things on maintaining a fairly uniform continuous stream of separate fibers into the electrostatic field.

In operation, the fibers entering the electrostatic field are given an electrical charge by a first electrode, which may conveniently be the drafting rolls that discharge the fibers into the transport zone. Once delivered in a charged condition to the transport zone most fiber follows the normal path of flow into a twisting device located within the spinning head. Attraction to the spinning head results from the second electrode, which is charged oppositely to the first electrode and which normally is located as a functional part of the spinning head. Unfortunately, some of the fibers come to rest on a stationary dome portion of the spinning head having the same charge as the twisting device within the spinning head. These stray fibers reverse charge and are attracted back towards the oppositely charged drafting rolls. One of these rolls, referred to as a cot roll, comprises a rotating grounded inner metallic sleeve having an outer dielectric sleeve mounted over it. The inner metallic sleeve is in turn rotating about a grounded stationary metallic axle. Because the sleeves do not extend over the entire length of the stationary metallic axle some of the charged stray fibers tend to accumulate on grounded exposed side portions of the positively charged metallic sleeve because of electrostatic adhesion at the side portions where the field forces are the weakest, while other stray fibers tend to accumulate around the stationary lubricated axle due to mechanical adhesion forces. The individual fibers are similar to bar magnets in that they have a positive and negative charge at opposite ends with the overall charge being polarized. Oppositely charged fiber ends of discrete fibers are attracted to each other and tend to link together to form a continuous chain. Thus stray fibers tend to accumulate and balloon into waste which eventually is thrown off the side portions of the rotating sleeve after a period of time and becomes attracted into the transport zone. Entrance of this waste into the spinning head in an unwanted fiber clump which is not individually separated and discrete causes the spinning device to be clogged resulting in a process failure. This ballooning waste problem causes expensive down time to unclog the spinning head and remove accumulated waste clinging to the sides of the cot roll.

SUMMARY OF THE INVENTION

Smooth surfaced conductive shield means are mounted to overlie the charged side portions of the rotating metallic sleeve. The shield means provides a stronger and more uniform field strength on its conductive surface than the field strength generated at the side portions, thereby acting to quickly neutralize or reverse the stray fiber charge, causing the fibers to be attracted back into the spinning zone before fiber waste accumulation can occur.

The configuration of the rotating shield means is such that the aerodynamic effect of the smooth large diameter shield combines with air friction and centrifugal force to throw off the stray fibers attracted to the shield.

By forming a shield in the form of a protective sleeve to extend over the exposed stationary axle portion, stray fibers can no longer come into contact with the lubricant on the axle.

It is the general object of the present invention to provide an improved electrostatic spinning apparatus having a shielding means adjacent the exposed charged metallic sleeve portions of the fiber feeding roll and the lubricated axle which reduces the electrostatic adherence attraction and prevents contact with the lubricated axle.

A more specific object of the invention is to provide a shield means which improves the field strength of the electrostatic field adjacent the metallic sleeve side portions.

Another specific object of the invention is to provide a smooth rotating shield surface which uses centrifugal force to quickly throw off stray fibers before ballooning can occur.

These and other objects of the present invention will become more fully apparent by reference to the appended claims and to the following detailed description.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a partially schematic side view (partly in section) of a portion of an electrostatic spinning apparatus according to the present invention.

FIG. **2** is a front view (partly in section) portion of the electrostatic spinning apparatus shown in FIG. **1**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The spinning apparatus shown embodies a drafting system **10**. This drafting system comprises a pair of power driven inlet drafting rolls **11** and **12** between which roving or sliver is fed. A pair of power driven intermediate drafting belts **13** and **14** are entrained respectively about drive rolls **15** and **16** and nose bars **17** and **18** and an idler roll **18***a* which guide and position the belts **13** and **14** so as to direct the fibers being advanced therebetween to a pair of fiber discharge drafting rolls in the form of fiber delivery roll **19** and

cot roll **20**. The draft of system **10** is sufficiently high that the discharge from rolls **19** and **20** is a stream of discrete fibers. Drafting roll **19** is of a conductive material, such as metal, and is grounded as indicated. Roll **19** is a drive roll which can serve several spindle heads **21** aligned as shown in FIG. **2**. Cot roll **20** has a fiber advancing surface in the form of outer dielectric sleeve **20***a* in rolling contact with roll **19** as shown. Dielectric sleeve **20***a* is mounted on metallic sleeve **20***b* which is grounded. Metallic sleeve **20***b* fits over a bushing insert **20***c* having sealed in ball bearings (not shown). Inside metallic sleeve **20***b* is a retainer clip ring (not shown) which engages an inside annular recess of an end of bushing insert **20***c* whereby the metallic sleeve and the bushing rotate together. Bushing insert **20***c* in turn rotates with respect to stationary lubricated roller support axle **20***d* which is also grounded. Separate rollers **20** are used to feed each spinning head as shown in FIG. **2**. Axle **20***d* is held by spring biased arms (not shown) which biases the cot roller towards drive roll **19**.

Assembly **21** includes a normally stationary body **22** and end caps **23** and **23***a* mounted respectively on the upper and lower ends of the body **22**.

A twisting device in the form of spindle **24** is journaled in the body **22** by axially spaced aligned antifriction bearings **25** and **26** fixed within the central through bore **27** of the body **22**. Body **22** has a laterally extending side opening **28** to the enlarged central portion **29** of the spindle **24** which is frictionally driven by an endless belt **30** extending through opening **28** and continuously rotated by a drive portion of the spinning apparatus (not shown).

Spindle **24** has an axial through bore **31**, the lower end of which defines a yarn discharge opening **32** from which spun yarn (not shown) is drawn by take-up or drawing rolls **33** and **34**.

The upper end of the spindle is counterbored at **35** to receive a gripper **36** into which fibers (not shown) are directed to be twisted and spun into yarn. Gripper **36** may, for example, be one of the types illustrated in U.S. Pat. No. 3,372,537, issued Mar. 12, 1968 to M. Poull et al. for "Radially Clamping Grips."

The upper end of the spindle **24** has an extension **37** defining a conical fiber inlet opening. This extension is made of a dielectric material and is positioned for rotation within a centrally disposed through opening **38** in the cap **23**.

The fiber receiving end of extension **37** has a funnel-shaped aperture **39** terminating in a cylindrical opening **39***a* in axial alignment with and substantially equal in diameter to the inlet end of the gripper **36**. A yarn tail extends through opening **39**a from gripper **36** into the aperture **39** and fibers from rolls **19** and **20** are captured and presented to the yarn tail as it rotates through the maximum field where the tail is maintained.

The annular metallic electrode **40** of the electrostatic system is fixed within the body **22** of the spinning head **21** in axially aligned surrounding relation to the spindle **24** below the cap **23**. Electrode **40** is connected by a lead **41** to a terminal of a high voltage electrostatic power supply, the other terminal of which is grounded. The upper external surface of electrode **40** is a segment of a sphere for maximum field focusing strength.

The configuration of the electrostatic field is represented by dotted lines **42** as it extends from the outer dielectric surface of the cap **23** to the metallic portions of the rolls **19** and **20** that provide the ground for the electrostatic field. Cap **23** is annular, coaxial with spindle **24** and has an external surface which is a segment of a sphere substantially concentric with the center of the spherical surface of the electrode **40** so that its exposed dielectric surface is approximately normal to the field lines.

In operation fibers entering the electrostatic field are given a charge by passing over the rotating fiber advancing surface of cot roller **20** and fiber delivery roll **19**. A few of these charged fibers stray from the normal path of flow into the twisting device **24** located within the spinning head **21** and instead comes to rest on the charged surface of sphere cap **23**. These stray fibers then reverse charge and are attracted back towards the oppositely charged drafting rolls.

To prevent accumulation of the fibers about the side portions of charged metallic sleeve **20***b* and to further prevent the stray fibers from coming into contact with lubricant on stationary axle **20**smooth surfaced conductive shields in the form of metallic dome cap shield **43** and metallic sleeve shield **44** are fixed to overlie each end of metallic sleeve **20***b* which is slightly longer than dielectric outer sleeve **20***a* as shown in FIG. **2**. A stationary slinger shield **45** is mounted on an enlarged portion **20***e* of the fixed axle **20***d* for the purpose of keeping lubricant in bushing **20***c* and fibers out. Sleeve shield **44** has an axial through bore **46** with an enlarged end portion which is fixed on the outer surface end of metallic sleeve **20***b*. Slinger shield **45** fits within the enlarged end portion of the through bore **46**.

The smooth surfaced conductive shields **43** and **44** are mounted to overlie the charged side portions of the rotating metallic sleeve **20***b*. By using these shields sudden cross sectional changes are avoided resulting in a stronger and more uniform field strength being generated about roll **20** than the field strength generated at the side portions of metallic sleeve **20***b*. A stronger field acts to quickly neutralize or reverse the stray fiber charge, causing the stray fibers to be attracted back into the spinning zone before fiber ballooning can occur.

The configuration of the shields are such that the aerodynamic effect of the smooth large diameter shields combine with air friction and centrifugal force of rotation to easily throw off stray fibers attracted to the shields.

Thus it can be seen that by using smooth surfaced rotating shields the electrostatic and mechanical lubricant adhesive forces are effectively prevented from accumulating ballooning waste fibers.

It is to be understood that the above detailed description of the present invention is intended to disclose an embodiment thereof to those skilled in the art, but that the invention is not to be construed as limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of being practiced and carried out in various ways without departing from the spirit of the invention. The language used in the specification relating to the operation and function of the elements of the invention is employed for purposes of

description and not of limitation, and it is not intended to limit the scope of the following claims beyond the requirements of the prior art.

What is claimed is:

1. An improved drafting front roll unit which includes a cot assembly and a fiber delivery roll for use with an open end spinning apparatus of the electrostatic type in which the cot assembly forms part of the electrode system creating the electrostatic field, said cot assembly comprising:

a. a cot roll having a fiber advancing surface;

b. electrically conductive means supporting said cot roll for rotation in operable contact with said fiber delivery roll; and

c. electrically conductive generally dome shaped shield means adjacent said fiber advancing surface and mounted for rotation therewith, said shield means having a smooth surface off of which stray fibers will readily slip and acting to strengthen the electrostatic field adjacent said fiber advancing surface.

2. An apparatus as defined in claim 1 wherein said shaped shield means has a generally hemispherical configuration.

* * * * *

Dedication

3,699,766.—*Roger J. Archambault*, Blackstone, Mass. DRAFTING COT ASSEMBLY. Patent dated Oct. 24, 1972. Dedication filed Mar. 23, 1977, by the assignee, *Electrospin Corporation.*

Hereby dedicates to the Public the entire term of said patent.

[*Official Gazette May 10, 1977.*]