United States Patent [19]

Vaughan

[11] **3,761,210**

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[54] **APPARATUS FOR PRODUCING FIBERS**

[75] Inventor: **Raymond C. Vaughan,** Buffalo, N.Y.

[73] Assignee: **The Carborundum Company,** Niagara Falls, N.Y.

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[52] **U.S. Cl.** ..... **425/72,** 242/18 G, 242/54 R, 425/436

[51] **Int. Cl.** **B29c 25/00,** B65h 54/02

[58] **Field of Search** ..... 242/54 R, 18 G, 18 AA; 57/55.5; 264/176 F; 425/72

[56] **References Cited**

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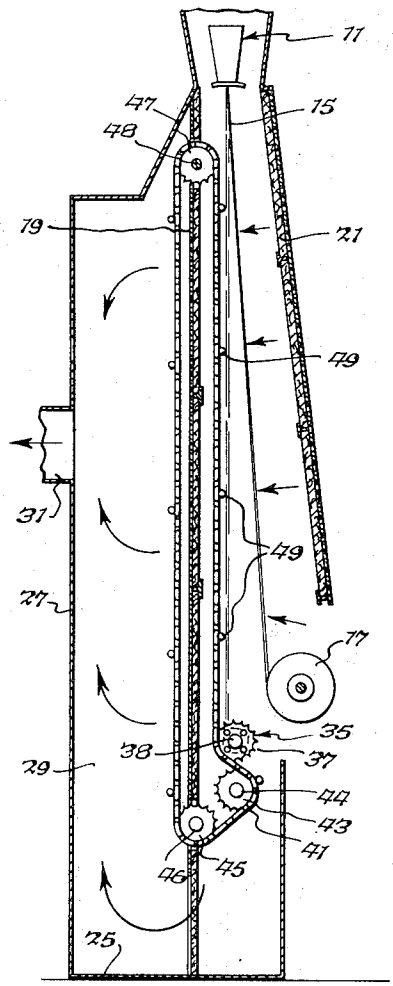
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Primary Examiner—George F. Mautz
Assistant Examiner—Edward J. McCarthy
Attorney—David E. Dougherty et al.

[57] **ABSTRACT**

In an apparatus for the production of continuous fibers from a fiberizable material, a bushing with a plurality of orifices supplies streams of fiberizable material which are attenuated in the form of continuous fibers. The fibers are collected on a spool spaced from the bushing. An induced draft zone between the bushing and the collection spool is provided for flowing air evenly across the fibers so that broken fibers are removed from the collection area.

7 Claims, 4 Drawing Figures



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SHEET 1 OF 2

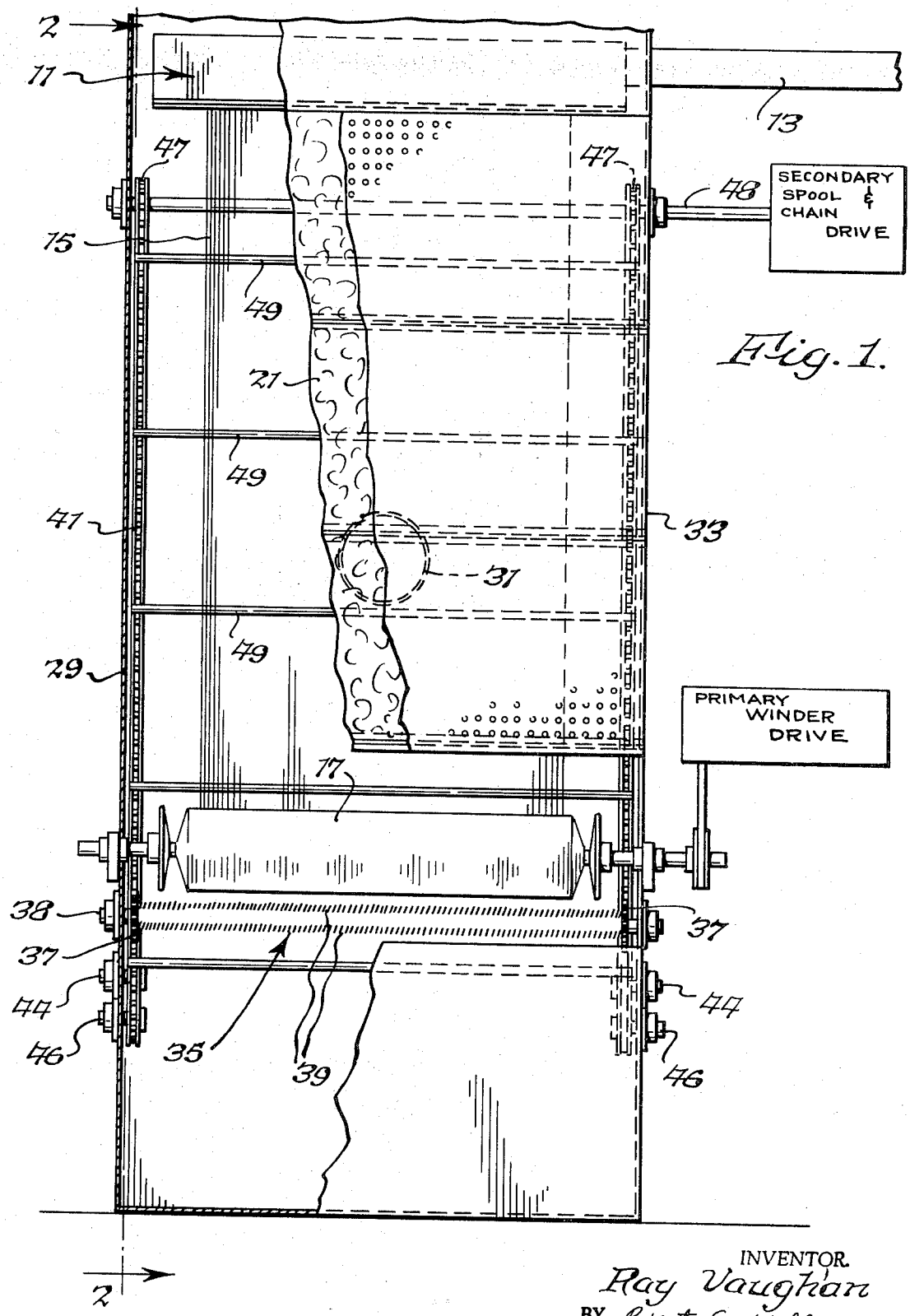


Fig. 1.

INVENTOR.
Ray Vaughan
BY Robert E. Walter
David E. Vaughan
ATTORNEY.

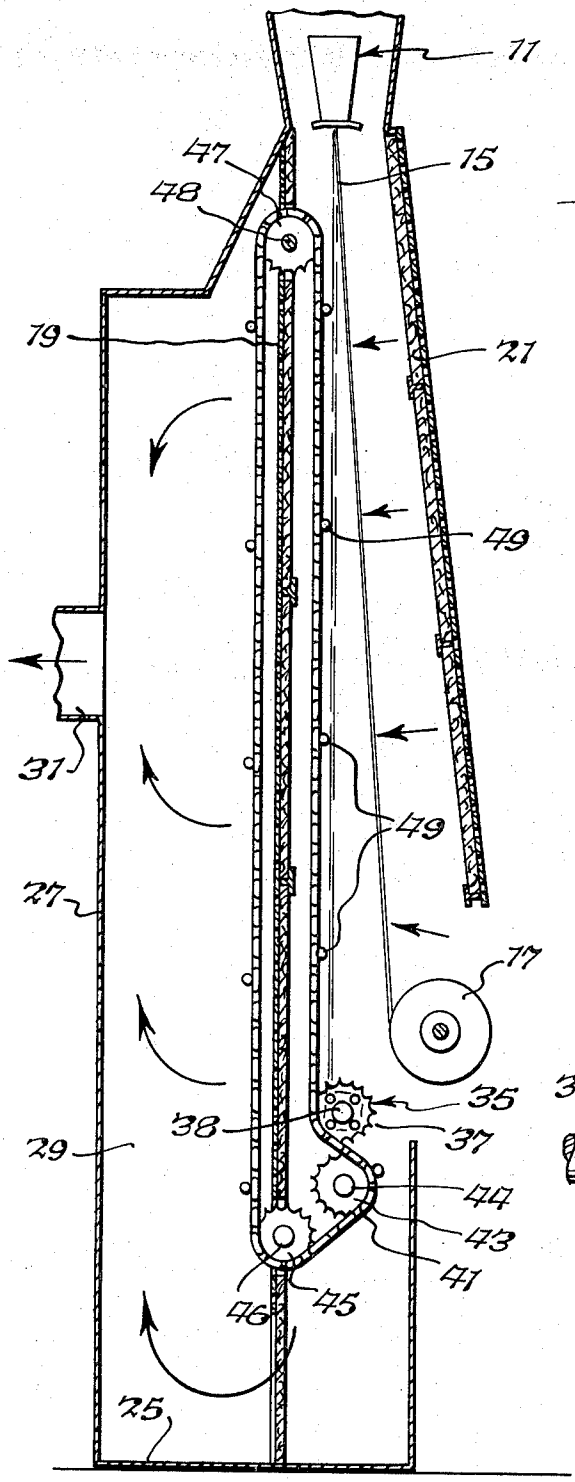


Fig. 2.

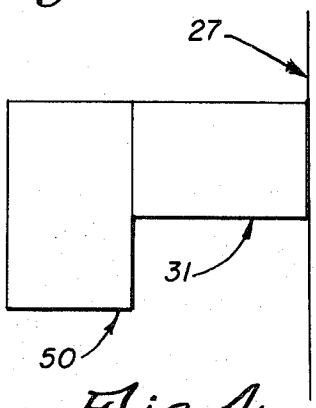
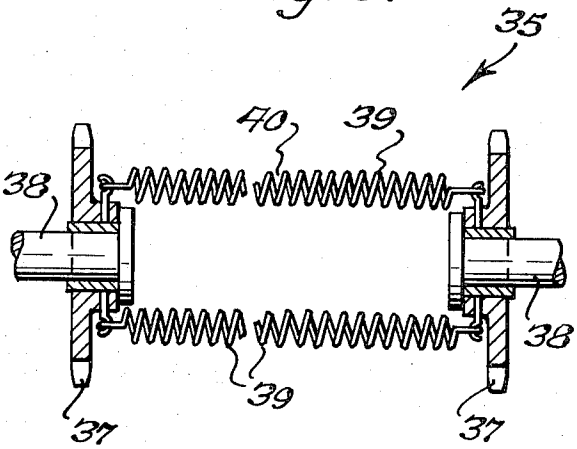


Fig. 4

Fig. 3.



INVENTOR.
Ray Vaughan
BY Robert E. Walter
David E. Dougherty
ATTORNEY.

APPARATUS FOR PRODUCING FIBERS

BACKGROUND OF THE INVENTION

Continuous fibers are produced from a viscous material which is attenuated and solidifies in the form of continuous fibers. Generally, the fibers are drawn from streams flowing through orifices in a bushing. An attenuation unit and a collection unit (or a combined attenuation - collection unit) are conveniently located a sufficient distance below the bushing to allow the filaments drawn from the streams of viscous fiberizable material to solidify into distinct uniform fibers.

The drawing operation is delicate in nature, especially when fine-diameter fibers are being produced. The fibers are under tension as they are drawn towards the attenuation unit, from the viscous streams at the bushing. Between the bushing and attenuation unit they are subject to breakage due to internal defects such as bubbles or dirt particles and external disturbances such as air currents, particles and droplets in the air, mechanical interference from the attenuation unit, and other fibers which have already broken.

When a drawing fiber breaks, the stream of fiberizable material continues to flow through the bushing orifice, but is no longer drawn off from below as a fiber. The material accumulates at the orifice until it has sufficient weight to fall as a droplet or bead. Such a bead will usually pull down a fiber behind it, but when the bead has stopped falling the fiber ceases to be pulled, and the fiberizable material again accumulates at the orifice. This intermittent reformation of beads will continue until the fiberizable material flowing through the orifice is drawn off continuously as a fiber.

A falling bead interferes with fiber production since it often comes in contact with and breaks several drawing fibers.

In addition, if a drawing fiber breaks at or near the attenuation unit, the fine filament which may be several feet in length will remain suspended from the bushing orifice during the time the bead is forming. This length of fiber will float or drift around with the slightest air currents, which cannot be completely eliminated in a fiber drawing area. These drifting broken fibers will often come in contact with and break several drawing fibers. Therefore, it is desirable to remove broken fibers from the drawing area and to prevent the continual reformation of beads from an orifice where the fiber is broken.

SUMMARY OF THE INVENTION

In an apparatus for the production of continuous fibers from a fiberizable material, a bushing from which fibers are drawn supplies continuous streams of fiberizable material. Intermediate the bushing and a fiber drawing means there is provided a means for flowing air evenly across the fibers so that broken fibers are removed from the drawing fibers. Also, a collecting means is provided for drawing the broken fibers to prevent the reformation of beads.

The present invention obviates many of the deficiencies of prior art fiber producing apparatus by providing a controlled draft of clean air across the fibers so as to remove a broken fiber from the drawing area. As a result, fiber breakage is reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevational view of the apparatus of the present invention with portions shown in section;

FIG. 2 is a sectional view along line 2—2 of FIG. 1; and

FIG. 3 is a detailed view of the secondary spool.

FIG. 4 is a diagramatic view of the blower means

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

In more detail, a bushing **11** is supplied with a fiberizable material from a source **13.** Material at the desired viscosity flows as streams from orifices, in the bushing **11.** The orifices are formed in rows in the bottom of the trough-like bushing **11.** The fiberizable material may be any material of suitable viscosity for forming fibers **15.** The present invention is particularly suited for drawing fibers which have very little strength due to their thinness or composition.

The terms upper, lower, inner, outer and the like as hereinafter used are applied only for convenience of description and should not be taken as limiting the scope of this invention.

The fibers **15** are collected or gathered a sufficient distance below the bushing **11** to allow the fibers **15** to cool. A winder **17** draws and collects the fibers **15.** The winder **17** is positioned below the bushing **11** and preferably offset thereto so that broken fibers and beads will not fall directly on the winder **17.** In a zone which is intermediate the bushing **11** and winder **17,** an induced unidirectional draft flows evenly across the fibers **15.** This draft is generally horizontal and substantially perpendicular to the drawing fibers **15,** and the direction of flow is such that it carries broken fibers and beads away from the offset winder **17.** The draft is created between an inner wall **19** which faces the fibers **15** and an outer wall **21.** The inner wall **19** lies in a plane substantially parallel to the plane formed by the plurality of fibers **15** and is spaced therefrom. The inner wall **19** which is porous or perforated may be made from a suitable air filter material so as to distribute the air flow evenly over the fibers **15.** The inner wall **19** forms a chamber **25** with a solid rear wall **27** and side walls **29.** An outlet **31** in the rear wall **27** is connected to the low pressure side of a fan or blower **(50)** for maintaining the chamber **25** under reduced pressure. The side of the inner wall **19** exterior to or facing away from the fibers **15** is under a reduced pressure so as to create an induced draft through the inner wall **19.** A steady flow of air (arrows) across the fibers overcomes tendencies for uncontrolled air flows and eddies.

The outer wall **21** which is spaced forward the fibers **15** extends longitudinally for substantially the length of the drawing fibers **15.** Side walls **33** are formed between the outer wall **21** and the inner wall **19** so as to prevent disturbances exterior to the drawing apparatus from interfering with production. The side walls **33** are preferably transparent so that the fiber winding process may be easily observed. The lower end of the outer wall **21** is above the winder **17** permitting access to the winder **17.** The outer wall **21** has perforations over the entire surface for creating an even air flow. The inner wall **19** and the outer wall **21** are preferably formed of matted filter media such as conventional furnace filters which are held in place by racks. The filter media

serves to remove undesirable contaminants which might cause fiber breakage. The induced air flow tends to carry a broken fiber inwardly and away from the fibers **15** being wound. In conventional apparatus, a broken fiber which is suspended in the drawing area is at the mercy of random air currents and it can rub or contact other fibers being wound and cause further fiber breakage. In accordance with the principles of the present invention, the steady flow of air transverse to the fibers causes a broken fiber to move inwardly away from the drawing fibers.

A means for gathering broken fibers and preventing bead reformation is provided between the fibers **15** being drawn and the inner wall **19.** This includes secondary spool **35** located directly below the bushing **11** so that a bead tends to drop directly thereon and the fiber drawn behind the bead tends to wind thereabout. The speed of the secondary spool **35** may be adjusted at a high enough speed to prevent the reformation of beads but at a low enough speed to keep the fibers **15** which are being collected thereupon from breaking and interfering again with the drawing fibers **15.** Fiber winding may be restarted on the winder or primary spool **17** by removing the fiber from the secondary spool **35** by hand or other means and restarting the fiber on the primary spool **17.**

The secondary winder or spool **35** which is shown in detail in FIG. **3** includes a pair of spaced sprockets **37** each mounted on a stub shaft **38.** A plurality of slightly stretched springs **39** are connected between the sprockets **37** in a direction parallel to the alignment of the orifices in the bushing **11.** A broken fiber contacting the spool **35** is wound thereon. Each sprocket **37** is connected to an endless chain **41** which passes inside and under the secondary spool **35.** The chains **41** pass over one pair of sprockets **43** each mounted on a stub shaft **44** located forward of the secondary spool **35.** The chains **41** then pass under another pair of sprockets **45** each mounted on a stub shaft **46** located beneath and behind the secondary spool **35.** The chains **41** are vertically disposed and pass over a pair of drive sprockets **47** mounted on a drive shaft **48** spaced substantially below the bushing **11.**

Disposed between the two chains **41** and connected thereto are a plurality of spaced bars **49.** The bars **49** remove broken fibers which are drawn onto the inner wall **19** by the induced draft. As the rods **49** move downwardly and pass under the secondary spool **35,** broken fibers attached to the rods **49** are contacted with the secondary spool **35** which collects the fibers for secondary winding. The coils of the slightly stretched springs **39** act as teeth which catch the broken fibers and attached beads in the narrow gaps or notches between the coils. Additionally, the springs can be easily removed for disposal of the fibers and beads which have collected thereupon.

The chains **41** are vertically aligned and horizontally spaced so as to form a conveyor which catches a broken fiber and contacts the fiber with the spool **35** to start a secondary winding. Horizontally connected between the chains **41** are the plurality of rods **49** which are spaced in the vertical direction. The conveyor system extends longitudinally in the path of air flow and directly behind the strands being wound. The secondary spool **35** is driven by the chains **41,** which in turn are driven by the sprockets **47** on shaft **48.** The drive shaft **48** is connected to a suitable drive means which is schematically illustrated in the drawings. The primary winder **17** is driven by suitable drive means also schematically illustrated.

While preferred embodiments of this invention have been described and illustrated, it is to be recognized that modifications and variations thereof may be made without departing from the spirit and scope of this invention as described in the appended claims.

What is claimed is:

1. An apparatus for producing continuous fibers comprising a bushing for supplying a plurality of streams of fiberizable material, means for drawing said material in the form of continuous fibers, said drawing means being spaced from said bushing, means separate from said drawing means for collecting broken fibers, said collecting means includes a spool for winding broken fibers, means for carrying broken fibers toward said collecting means, said carrying means including means for evenly flowing air in a direction transverse to the direction of movement of the drawing fibers.

2. An apparatus according to claim **1** wherein said air flow means includes a first wall on one side of said fibers, a second wall spaced from said first wall on the other side of said fibers, said first and second wall being porous to permit the flow of air therethrough, and means for creating a low pressure area adjacent said first wall.

3. Apparatus according to claim **2** wherein said means for creating a low pressure area comprises a chamber connected to said first wall, an outlet in said chamber, a blower means having the low pressure side connected to said outlet.

4. An apparatus according to claim **1** including a plurality of springs forming a peripheral surface of said spool.

5. An apparatus according to claim **1** including means moving continuously toward said spool for attaching broken fibers thereto.

6. An apparatus according to claim **5** wherein said attaching means comprises a conveyor assembly in the path of air flow.

7. An apparatus according to claim **6** wherein said conveyor assembly comprises a pair of endless chains, a plurality of rods horizontally disposed and vertically spaced between said chains.

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