May 6, 1969 M. M. BRYAN, JR., ET AL 3,441,984

SELF-MONITORING CARD

Filed July 28, 1966

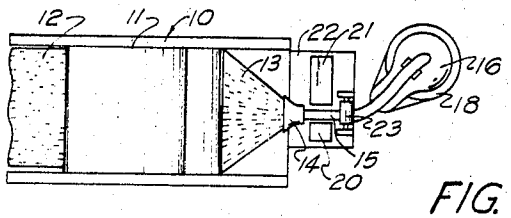
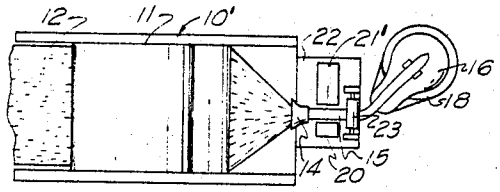


FIG. 1



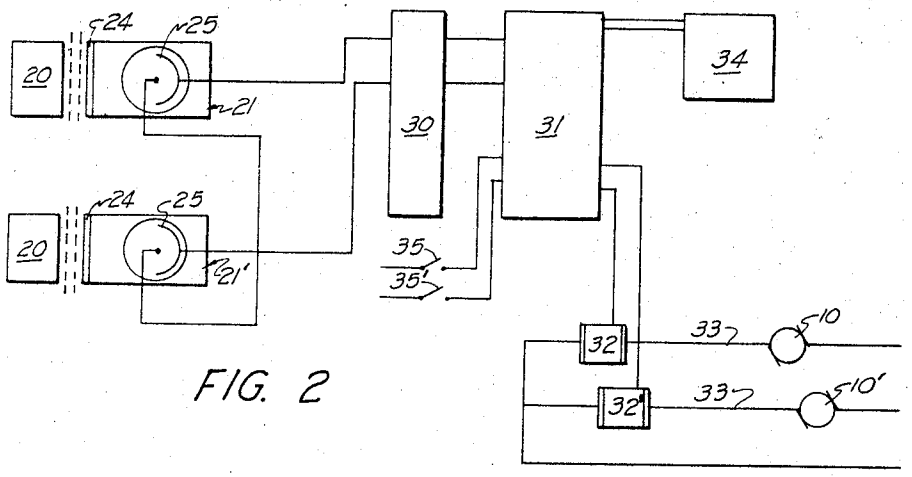


FIG. 2

INVENTORS
MORRIS M. BRYAN, JR.
MORRIS W. ROBERTS

Newton, Hopkins, Jones & Ormsby

ATTORNEYS

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SELF-MONITORING CARD

Morris M. Bryan, Jr., Jefferson, and Morris W. Roberts, Chamblee, Ga., assignors to The Jefferson Mills, Inc., Jefferson, Ga., a corporation of Georgia

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U.S. Cl. 19—.23 2 Claims

ABSTRACT OF THE DISCLOSURE

A carding machine for treating textile fibers wherein the web of fibers is fed through a trumpet to form a sliver, the sliver is monitored to determine its density, and the operation of the carding machine is terminated when the average density of the sliver is not within a predetermined density range for a set length of the sliver.

In the carding of textile fibers, it is a requirement that the resulting card sliver be substantially uniform throughout its length. This is because any lack of uniformity in the card sliver throughout its length causes a corresponding lack of uniformity in yarn produced from the card sliver if the lack of uniformity is not subsequently corrected. This requirement has been difficult to meet with prior art cards because variations in the operation of the card or in the feeding of fiber to the card are difficult to identify and correct.

It is because of the difficulty in meeting this requirement with prior art cards that a plurality of card slivers are customarily combined in a subsequent drawing operation to provide a single drawing frame sliver having improved uniformity because of the drawing and combining of the plurality of card slivers used in the drawings operation. However, this effort to correct the lack of uniformity in card slivers produced by prior art cards has not been entirely satisfactory because of the lack of information concerning the uniformity of the card slivers combined during the drawing operation and because one or more card slivers which lack uniformity to a substantial degree cause a drawing frame sliver to lack uniformity throughout its length in spite of the drawing operation. Moreover, attempts in the prior art to provide information concerning the uniformity of card slivers by the sampling of card slivers have generally been time consuming and wasteful and have frequently not provided accurate information.

The invention disclosed herein overcomes these and other difficulties encountered in the prior art in the carding of textile fibers in that it provides a card sliver having a weight per unit of length which varies only within a predetermined range of weights throughout its total length and having variations in weight per unit of length within this range which are sufficiently small for the card sliver to be substantially uniform and which are readily ascertained for use in the subsequent blending of the card sliver with other card slivers to provide a drawing frame sliver that has even greater uniformity throughout its length. Moreover, where the textile fiber being carded is a synthetic or other fiber which is improved in its characteristics by radiation, the invention provides, as an incident to carding, a card sliver for subsequent processing into a textile fabric having radiation improved characteristics.

These improvements in the carding of textile fibers are provided by a card having a monitoring means for monitoring the weights of unit lengths of a card sliver as the card sliver is produced by the card, a cut-off means responsive to the monitoring means for rendering the card inoperative when the weights of a plurality of successive

unit lengths of the card sliver do not fall within a predetermined range of weights, and an accumulating means responsive to the monitoring means for accumulating the weights of the unit lengths of the card sliver. The monitoring means includes a radiation element and a radiation responsive element positioned on opposite sides of the card sliver to provide a voltage output to the cut-off means and to the accumulating means porportional to the weight of the card sliver passing between the radiation element and the radiation responsive element as determined by the portion of a beta ray beam absorbed by the card sliver.

It is this monitoring means with the cutoff means which provides a card which produces a substantially uniform card sliver. In addition, when the energy level of the beta ray beam is maintained within the appropriate range, the monitoring means serves not only to provide a voltage output representative of the weights of unit lengths of a card sliver but also as a means for improving those characteristics of fibers which are responsive to radiation by improvement.

These and other features and advantages of the invention will be more clearly understood from the following detailed description and the accompanying drawings in which like characters of reference designate corresponding parts throughout and in which:

FIG. 1 is a top plan view of a plurality of cards having the monitoring means of an embodiment of the invention disclosed herein:

FIG. 2 is a schematic circuit diagram showing an embodiment of the invention disclosed herein.

These figures and the following detailed description disclose a specific embodiment of the invention but the invention is not limited to the details disclosed since it may be embodied in other equivalent forms.

The invention disclosed herein may be most easily understood in terms of a conventional card **10** having a main cylinder **11** to which a lap **12** is fed and from which a web **13** passes to a trumpet **14**. A card sliver **15** passes from the trumpet **14** to a coiler **16** which serves to coil the card sliver **15** within a can **18** for subsequent processing. It is because a card embodying the invention disclosed herein is generally conventional in construction and mode of operation that the card **10** is only generally shown and that its other conventional components are not described.

However, unlike conventional cards, a card **10** embodying the invention disclosed herein also includes a radiation element **20** and a radiation responsive element **21** which to gether serve to provide a monitoring means for monitoring the weights of unit lengths of the card sliver **15**. In that embodiment of the invention disclosed herein, the radiation element **20** and the radiation responsive element **21** are positioned on a platform **22** across which the card sliver **15** moves between the trumpet **14** and guide rollers **23** as the card sliver **15** passes from the card **10** to the coiler **16**. Moreover, in that embodiment of the invention disclosed herein, the radiation element **20** is arranged in a conventional manner to provide a beta ray beam through the card sliver **15** and toward the radiation responsive element **21** from a nuclide such as carbon 14, promethium 147, or calcium 45.

The radiation responsive element **21** is a beta scintillation detector and includes a phosphor plate **24** positioned for one side to be impinged upon by that portion of the beta ray beam passing through the card sliver **15**. In addition, the radiation responsive element **21** includes a photoelectric cell **25** positioned on the opposite side of the phosphor plate **24** from that side of the phosphor plate **24** upon which the beta ray beam impinges.

Those skilled in the art will understand that the phosphor plate **24** is rendered luminous by the impinging of

he beta ray beam upon it and that the degree of luminousity of the beta ray beam impinging upon the phosphor plate **24**. With the positioning of the radiation element **20** and the radiation responsive element **20** on opposite sides of the card sliver **15**, the intensity of the beta ray beam impinging upon the phosphor plate **24** is inversely proportional to the weight of the increment of length of the card sliver **15** passing between the radiation element **20** and the radiation responsive element **21** at any given moment. This is because the density of the card sliver **15** determines the portion of the beta ray beam which is absorbed by the card sliver **15** so that it does not impinge upon the phosphor plate **24** and because the density of the card sliver **15** is proportional to its weight.

The photoelectric cell **25** is conventional in that it provides a voltage output which is proportional to the luminousity of the phosphor plate **24**. Therefore, since the luminousity of the phosphor plate **24** is proportional to the weight of the card sliver **15** passing between the radiation element **20** and the radiation responsive element **21**, the voltage output of the photoelectric cell **25** is proportional to the weight of that increment of length of the card sliver **15** between the radiation element **20** and the radiation responsive element **21** at any given moment.

It has been found that energy levels of the radiation element **20** may be as low as one milliroentgen per hour and still provide a beta ray beam which provides a voltage output from the radiation responsive element **21** which is inversely proportional to the weight of the card sliver **15**. However, it has also been found that energy levels of the radiation element **20** may be substantially higher and that at some energy levels, the beta ray beam not only serves to provide a voltage output from the radiation responsive element **21** which is inversely proportional to the weight of the card sliver **15** but also serves as a means for inducing desirable changes in the characteristics of fibers forming the sliver **15**. For example, if the card sliver **15** is formed of certain synthetic fibers and the radiation level properly selected, the monitoring means provided by the radiation element **20** and the radiation responsive element **21** serves to provide a substantially uniform card sliver **15** for subsequent processing into a textile fabric which is grease releasing. The radiation element **20** and the radiation responsive element **21** are not described in greater detail since they are conventional and will be understood by those skilled in the art once the invention disclosed herein is understood.

That embodiment of the invention disclosed herein also includes a conventional integrating network **30** to which the voltage output of the radiation responsive element **21** is continuously fed and which serves to accumulate and integrate the voltage output of the radiation responsive element **21** over a predetermined interval of time as to provide an integrated voltage output having an amplitude inversely proportional to the weight of that unit length of card sliver **15** which passed between the radiation element **20** and the radiation responsive element **21** during the predetermined interval of time. This integrated voltage output from the integrating network **30** is fed at the end of each interval of time to a conventional computer **31** as an analogue input and the computer is programmed in conventional manner to convert each analogue input to a decimal equivalent and to accumulate the decimal equivalents of a plurality of succesesive inputs.

The computer **31** is also programmed in conventional manner to compare each of the plurality of decimal equivalents to a decimal standard and to classify each decimal equivalent in accordance with its deviation from the decimal standard. When a predetermined number of successive deviations are not within a predetermined range of deviations, the computer **31** provides a cutoff pulse to a relay **32** operatively in the main control circuit **33** of the card **10**.

The relay **32** is conventional and in response to the cut-off pulse from the computer **31**, the relay **32** opens the main control circuit **33** of the card **10** so as to render the card **10** inoperative. It will be understood that since each deviation of a decimal equivalent from the decimal standard is representative of the amount by which the weight of a unit length of the card sliver **15** varies from that weight of a unit length of card sliver **15** which corresponds to the decimal standard, the card **10** is rendered inoperative when the weights of a predetermined number of successive unit lengths of card sliver **15** are not within that predetermined range of weights or densities card sliver **15** corresponding to the predetermined range of deviations. It will also be understood that the rendering of the card **10** inoperative when the weights of successive unit lengths of card sliver **15** are not within a range of weights insures that the card sliver **15** produced by the card **10** is always substantially uniform throughout its length and also insures that substantial variations in the operation of the card **10** or in the feeding of cotton to the card **10** are promptly identified for corrective action.

The computer **31** also provides an output to a printer **34** showing the decimal equivalents of the unit lengths of card sliver **15** grouped in terms of their deviations from the decimal standard. Thus, the printer **34** provides a summary of the uniformity of a card sliver **15**, within a range of weights, relative to that weight of a unit length of card sliver **15** which corresponds to the decimal standard. When a plurality of successive unit lengths of card sliver **15** are related to a particular can **18** such as by a manual input from a switch **35** to the computer **31** when cans **18** are changed and the computer **31** provides a corresponding output to the printer **34**, the printer **34** provides an indication of the uniformity of the card sliver **15** in each can **18** and with appropriate computations using the weight of a unit length of card sliver **15** which corresponds to the decimal standard, the printer **34** provides a visual indication of the total weight of the card sliver **15** in each can **18**. The indication of the uniformity of the card sliver **15** in each can **18** permits the card sliver **15** in each can **18** to be appropriately blended in a drawing operation with the card slivers **15** in other cans **18** to provide a drawing frame sliver of even greater uniformity.

It will now be understood that the integrating network **30**, the computer **31**, and the relay **32** serve as a cut-off means for rendering the card **10** inoperative when a plurality of successive unit lengths of card sliver **15** are not within a predetermined range of weights. Similarly, it will be understood that the integrating network **30**, the computer **31**, the printer **34**, and the switch **35** serve as an accumulating means for accumulating the plurality of voltage outputs from the radiation responsive element **22** and for providing an indication of the uniformity of the total length of card sliver **15** in a can **18**.

It will also be understood that not only are the integrating network **30**, computer **31**, and the printer **34** conventional but they are merely representative of a variety of devices suitable to a cut-off means and an accumulating means which will be readily apparent to those skilled in the art once the invention is understood. They have been used to disclose an embodiment of the invention because they do not reqiure a detailed description for understanding of the invention and because of the flexibility provided by a conventional computer.

Moreover, the integrating network **30**, the computer **31**, and the printer **34** have also been used to disclose an embodiment of the invention because they are particularly well adapted to serve with a plurality of relays **32** and **32'** and a plurality of switches **35** and **35'** in a cut-off means and accumulating means for a plurality of cards **10** and **10'**. This is shown in FIG. 2 where it will be seen that the integrating network **30** serves to integrate the voltage outputs from a plurality of radiation responsive elements **21** and **21'** each operatively associated with a card **10** or **10'**. In this embodiment of the invention, the

integrating network **30** provides a separate analogue input to the computer **31** for each card **10** or **10'** and the computer **31** in turn provides a sepaarte cut-off pulse to the appropriate relay **32** or **32'**. In addition, the computer **31** provides an output to the printer **34** for each card **10** and **10'** and with appropriate inputs from a switch **35** and **35'** associated with each card **10** and **10'**, the printer **34** provides an indication of the uniformity and total weight of the card sliver **15** from each card **10** and **10'** in each can **18**.

It will now be understood that regardless of the particular devices used to provide an embodiment of the invention, the invention is a self-monitoring card **10** having a monitoring means to provide a voltage output representative of the weight of the card sliver **15** being produced by the card **10**, a cutoff means responsive to the voltage output for rendering the card **10** inoperative when the weights of a predetermined number of successive unit lengths of card sliver **15** are not within a predetermined range of weights, and an accumulating means responsive to this voltage output for accumulating means responsive to this voltage output for accumulating the voltage over an interval of time to provide a representation of the uniformity of the plurality of unit lengths in card sliver **15**. It is a card **10** having this combination of a monitoring means, a cutoff means, and an accumulating means with its other conventional components which provides a self-monitoring card which avoids the difficulties encountered with prior art cards. This is because a card **10** embodying the invention is rendered inoperative before variations in the operation of the card **10** or in the feeding of fiber to the card **10** result in the card **10** producing card sliver **15** which is not substantially uniform throughout its length. Moreover, the card **10** provides that information with respect to the card sliver **15** produced which permits the card sliver **15** to be blended with other card slivers **15** in the most efficient manner. In addition, the card **10** provides a card sliver **15** for subsequent processing into a textile fabric which has desirable radiation induced characteristics which can not be obtained in any manner with prior art cards.

It will be obvious to those skilled in the art that many variations may be made in the embodiments chosen for

the purpose of illustrating the present invention without departing from the scope thereof as defined by the appended claims.

What is claimed as invention is:

1. A carding machine for treating textile fibers wherein a web of fibers is fed through a trumpet member to form a sliver, the combination therewith of monitoring means including a radiation element and a radiation responsive element responsive to the density of said sliver passing therebetween for providing an output proportional to the density of a length of the sliver, the output being a voltage output inversely proportional to the density of said sliver between said radiation element and radiation responsive element, means for accumulating and integrating said voltage output over each of a plurality of intervals of time corresponding to predetermined unit lengths of said sliver to provide a plurality of integrated voltage outputs and means for receiving and comparing the plurality of integrated voltage outputs of said accumulating and integrating means to a predetermined standard for rendering said carding machine inoperative when a predetermined number of the plurality of integrated voltage outputs are not within said predetermined standard.

2. The carding machine of claim **1** in which said radition element emits a beta ray beam.

References Cited

UNITED STATES PATENTS

2,942,303	6/1960	Bossen et al.	19—240
2,981,986	5/1961	Neil	19—240
2,989,796	6/1961	Ashe	19—.25 XR
3,268,953	8/1966	Burnham	19—.25
3,305,688	2/1967	Lamparter	19—239 XR
3,109,204	11/1963	Linnert et al.	19—241

FOREIGN PATENTS

866,491	4/1961	Great Britain.

DORSEY NEWTON, *Primary Examiner.*

U.S. Cl. X.R.

19—239