United States Patent

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[54] **METHOD OF REPRESENTING THE DIAL SETTINGS OF AN ELECTRONIC YARN SMOOTHER**
7 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **33/1**
[51] **Int. Cl.** **G06g 1/00**
[50] **Field of Search** ..... 33/1 (C), 1 (S), 1.5 (D); 28/(Inquired); 73/160, (Inquired); 235/89, (Inquired)

[56] **References Cited**

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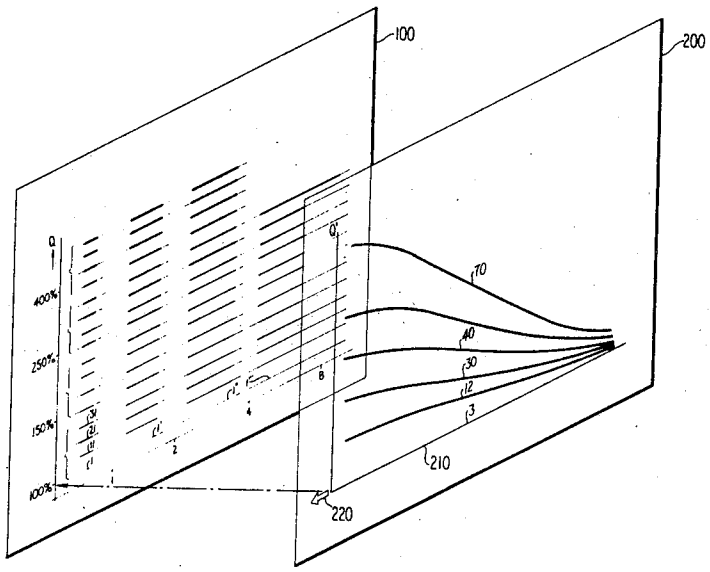
ABSTRACT: The dial settings of a yarn smoother, required to remove a preselected field of flaws, are determined by plotting a field of yarn flaws in a coordinate system; plotting a family of limit curves, each representing the locus of the flaws extracted by the yarn smoother when set at a preselected fixed reference length dial setting; placing the family of limit curves over the field of flaws; and shifting the limit curves, while maintaining coincidence of the ordinate axes of the field of flaws and the limit curves, to align one of said limit curves, as nearly as possible, with the flaws to be extracted. After a single limit curve is properly aligned with the flaws to be extracted, the proper dial settings are (1) the reference length corresponding to the aligned limit curve and (2) the value of the ordinate of the field of flaws graph intersected by the origin of the limit curve graph.



3 Sheets-Sheet 1

FIG. 1

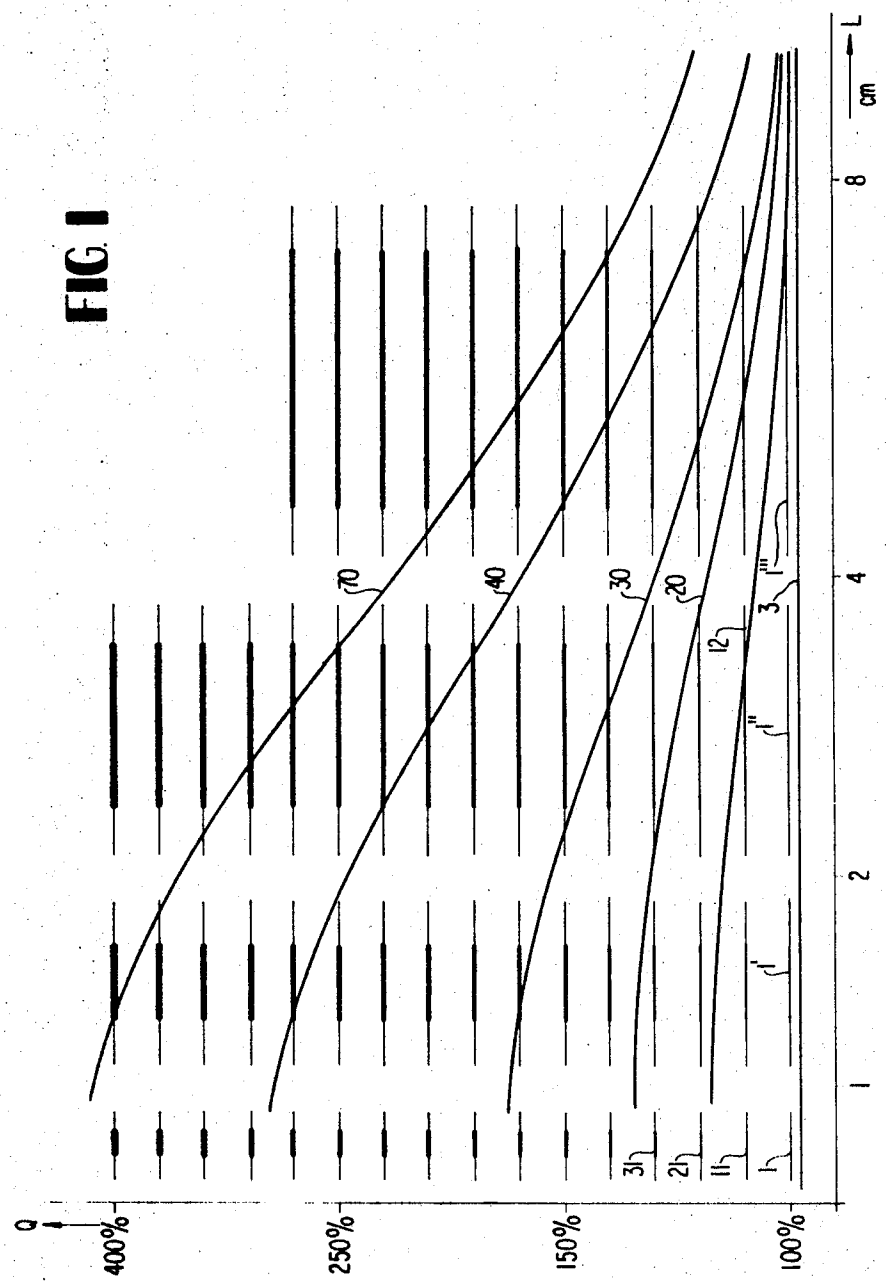
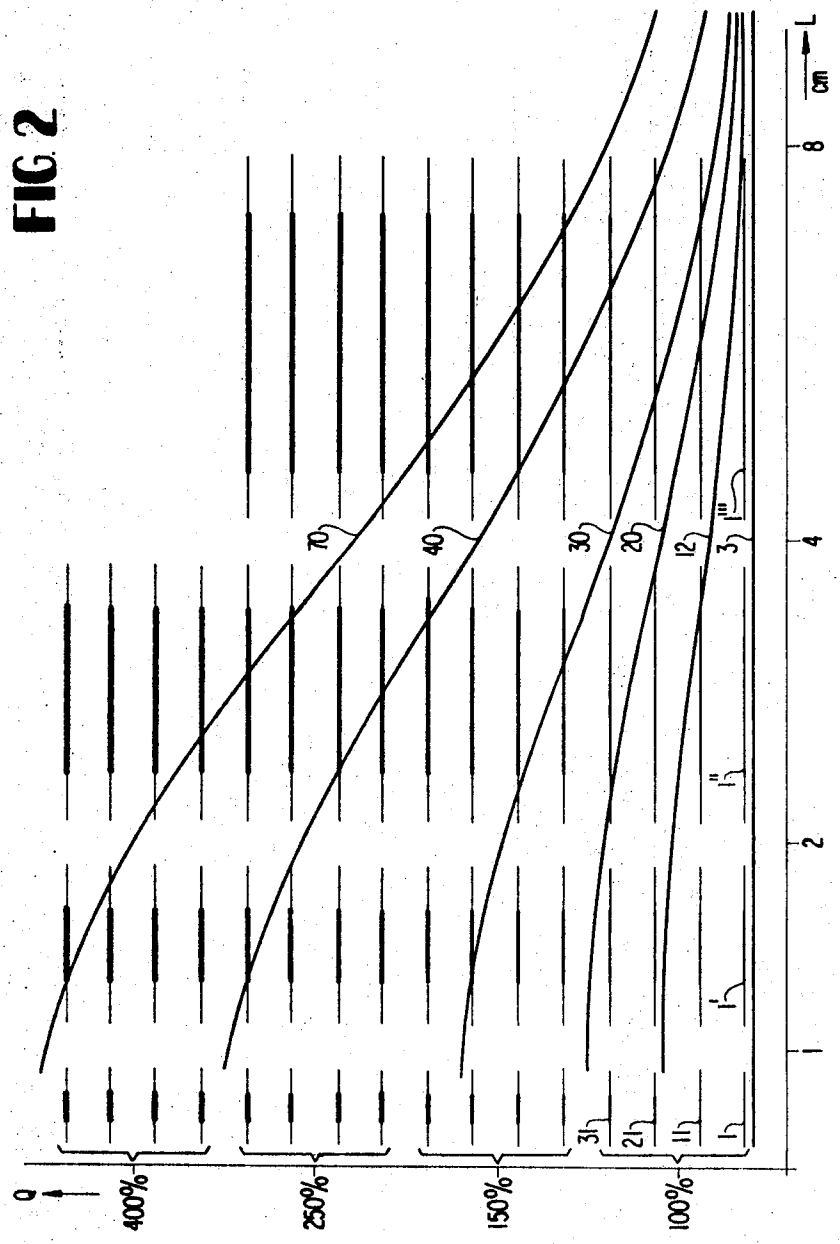


FIG. 2



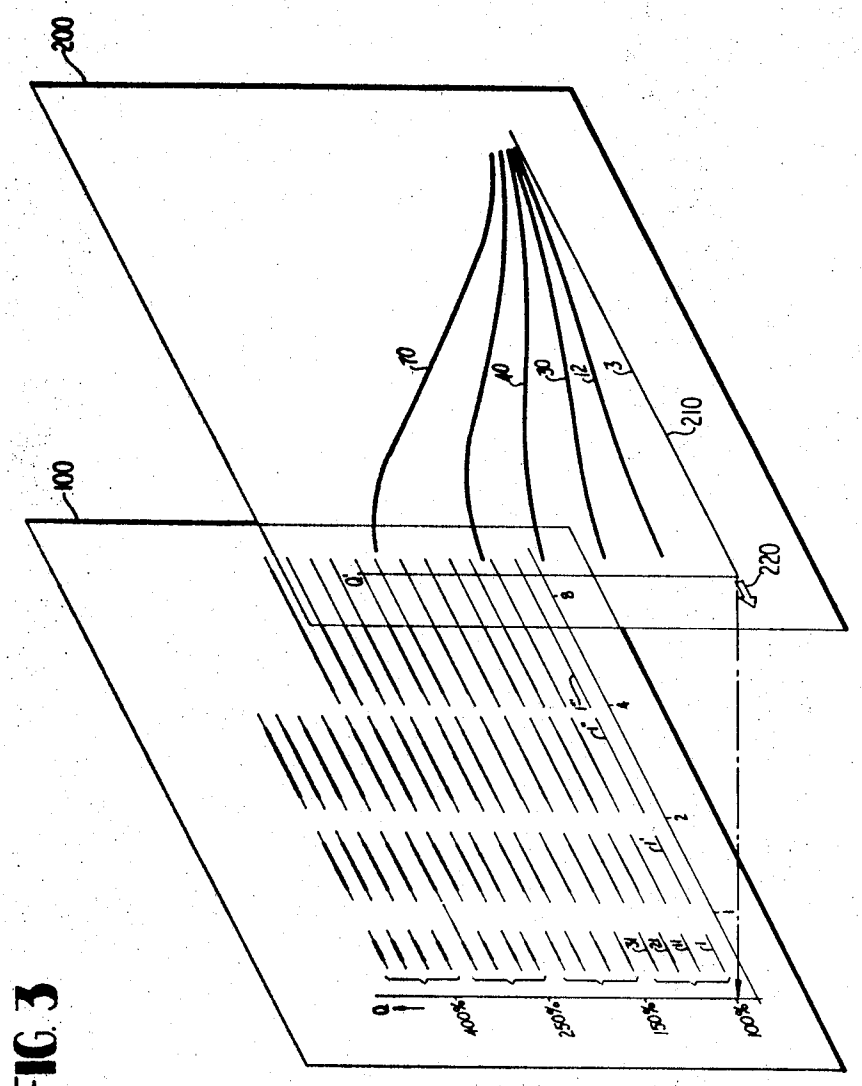


FIG. 3

METHOD OF REPRESENTING THE DIAL SETTINGS OF AN ELECTRONIC YARN SMOOTHER

BACKGROUND OF THE INVENTION

This invention relates to electronic yarn smoothers and, more particularly, to a method of and apparatus for representing the relationship between the yarn smoother dial settings and the size of the longitudinal and cross-sectional flaws removed thereby.

Electronic yarn smoothers or clearers are constructed so that they detect and remove certain cross-sectional and longitudinal flaws or imperfections in a yarn. However, it is economically unfeasible to employ such yarn smoothers to remove all of the defects present in any given yarn. Thus, although the quality of the yarn is determined by the presence or absence of flaws or imperfections, it becomes necessary to draw a line between the size and number of cross-sectional and longitudinal flaws which are permissible, and the number of smoothing steps (i.e., the number of effectively removed yarn flaws) which will impair the operational effectiveness of production.

Conventional electronic yarn smoothers exhibit at least two dial settings or setting elements; one may be for selecting the sensitivity (which may correspond to the permissible flaw cross section), and the other for selecting the permissible reference length (which may correspond to the longitudinal extent of a flaw). In this connection, these two parameters exhibit a certain interdependency, thereby making precise separation of yarn flaws with respect to the cross section and length thereof difficult to accomplish. Often, this separation is approximated by introducing an RC circuit into the yarn smoother. However, although the inclusion of an RC circuit may satisfy the smoothing requirement, the operating personnel must meet high standards of skill and experience so as to be able to correctly adjust the yarn smoother dial or setting elements. Moreover, since it is difficult to express the appearance of yarn flaws in terms of numerical values, and since the flaw characteristics of cross section and length are somewhat dependent upon each other, even with the inclusion of an RC circuit in a yarn smoother, a feasible dial setting program can be obtained only with great difficulty; often requiring extensive experimentation over prolonged periods of time.

SUMMARY OF THE INVENTION

Therefore it is an object of the present invention to provide new and improved methods of and apparatus for avoiding the disadvantages inherent in the prior yarn smoothing techniques.

It is another object of this invention to provide a process and apparatus for representing the relationship between the dial settings of an electronic yarn smoother and the size of the longitudinal and cross-sectional imperfections to be removed thereby.

It is still another object of this invention to provide an apparatus for graphically representing the relationship between the dial settings of an electronic yarn smoother and the size of the imperfections to be removed thereby, and to provide a simple and effective method of employing the apparatus provided therefor.

In accordance with the present invention, these and other objects are accomplished by employing a picture illustration of one or more yarn flaws or imperfections, in increasing orders of magnitude, on a field of flaw graph, and by depicting, on a second graph, movable relative to the field of flaw graph, a family of limit curves corresponding to all of the imperfections detected by the yarn smoother when set at predetermined reference dial settings thereof.

The limit curves are derived from the characteristic properties of the yarn smoother, and from the mutual dependency between the length and cross section of the yarn imperfections detected thereby such that the imperfections or faults which lie above a given limit curve are detected and removed by the yarn smoother, whereas the imperfections lying below a given limit curve remain in the yarn.

Advantageously, the picture illustration of the imperfections is transferred into a coordinate system wherein increasing flaw lengths are plotted along the abscissa axis, and increasing flaw cross sections are plotted along the ordinate axis. Of course, the axes may be reversed so that flaw lengths are plotted along the ordinate axis. An additional advantage of the present invention is obtained when at least one flaw characteristic is classified into size classes, thus making it possible to clearly distinguish between adjacent flaw size classifications. The picture representation of the imperfections may also employ a logarithmic scale along at least one coordinate axis direction so as to present a condensed pictorial arrangement capable of facile handling. This makes it possible to shift the limit curves, having a logarithmic scale along the corresponding axis direction, along the logarithmic axis of the field of flaw graph in any desired manner, whereby the flaw characteristic of the other axis direction is taken into account in the correct proportion.

In order to put this limit curve shift into practice, the limit curves are advantageously drawn on a transparent medium or picture carrier which may then be placed over the field of flaw graph containing the picture representation of the imperfections. In this connection, since the field of flaw graph remains the same for only a relatively narrow range of counts (yarn sizes), a plurality of picture representations, each having a corresponding family of limit curves, must be employed when varying yarn sizes are to be smoothed.

BRIEF DESCRIPTION OF THE DRAWING

The invention will be more fully understood by reference to the following detailed description of specific embodiments thereof taken in conjunction with the drawing wherein:

FIG. 1 is a schematic view of a graph containing a plurality of limit curves and having flaw characteristics of continuously increasing magnitude plotted along the ordinate and abscissa axes thereof;

FIG. 2 is a schematic view of a graph containing a plurality of limit curves and having flaw characteristics combined into cross-sectional classes; and

FIG. 3 is a perspective view of a graph having a photographically reproduced field of flaws and a group of limit curves plotted on a separate transparent picture carrier for movement relative to the field of flaws, in accordance with the principles embodied in the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawing, FIG. 1 depicts a coordinate system having L- and Q-axes, wherein L corresponds to the flaw length and Q to flaw cross sections. Along the abscissa, L, yarn imperfections or flaws are shown, wherein the thin lines **10** represent the yarn, while the thickened lines **1**, **1'**, **1''** and **1'''** represent idealized flaws, i.e., flaws having a rectangular profile of a given length and cross section. Along the ordinate, Q, flaw cross sections **1**, **11**, **21**, and **31** are illustrated in groups or classes, wherein the length of each class of flaws is constant despite an increase in cross-sectional dimension thereof.

The scale marked along the abscissa is a length graduation, preferably indicating the length of the imperfection in centimeters. The ordinate, in turn, is marked with a graduation expressing the respective cross section of the imperfections in percent of the cross section of the flawless yarn. Thus, for example, a flaw cross section of 100 percent is indicative of a flaw having a cross section twice that of the mean yarn cross section. Advantageously, the scale of the Q axis is selected to be nonlinear, preferably logarithmical, so that a condensed arrangement between the length of the flaws and the cross section thereof exists. This permits a relatively large field of flaws to be depicted in a relatively small space and simplifies a limit curve shift along the Q-axis of the field of flaws graph to represent the relationship between a relatively large number of cross-sectional and longitudinal flaws.

Also depicted in FIG. 1 is a family of limit curves 3, 12, 20, 30, 40 and 70 which are drawn into the field of the graphically represented yarn flaws. Each of these limit curves is derived from the characteristics of the yarn smoother and each represents the locus of the flaws extracted from the yarn by the yarn smoother, when set at a predetermined reference length dial setting, (not shown) and a reference sensitivity dial setting (also not shown). In addition, these limit curves make it possible to determine the setting of the sensitivity or flaw cross section dial of the yarn smoother corresponding to the predetermined reference length dial setting of the limit curve necessary to extract the flaws which lie above a given limit curve.

In order to determine the sensitivity dial setting of the yarn smoother, it is first necessary to decide which of the various lengths of flaws (1, 1', 1'' and 1''') and which of the various cross sections of flaws (1, 11, 21, and 31) are permissible, and which must be extracted from the yarn. This is done with the aid of the picture representation of the idealized field of flaws.

Then, as illustrated in FIG. 3, the limit curves 210 (3, 12, 20, 30, 40 and 70), plotted on a transparent medium 200, are placed over the field of flaws graph 100, so that Q'-axis of the transparent medium 200 coincides with the Q-axes of the field of flaws graph 100. The limit curves 210 are then shifted, while maintaining coincidence of the Q- and Q'-axes, until the single limit curve which mostly approximates the flaws to be extracted is aligned thereover. This single curve represents the clearing limit of the yarn smoother wherein the flaw or flaws lying above this curve are extracted, while those lying below the curve remain.

Actually, it is conceivable that the graduations of the yarn smoother dials or setting elements may be directly numbered with digits 12 ... 70 and 100 percent ... 400 percent. Thus, for example, if the particular limit curve numbered 12 overlies the flaws to be extracted when the marker 220 at the origin of the Q'-axis coincides with a Q-axis value of 150 percent, it means that the yarn smoother sensitivity or cross section dial should be set at 150 percent, while the reference length dial should be set at 12. However, since still other parameters must be taken into account — especially the feeding speed of the yarn — the scale of each dial or setting element is often provided with a different graduation from that provided on the ordinate and abscissa axes of the field of flaws graph, so that the determination of the dial settings may be conducted with the aid of a conventional calibration table of curve.

The flaws 1... 1''' and 1... 31 in the field of flaws graph will advantageously be depicted by a photographic reproduction of typical yarn imperfections. However, since the appearance of the yarn flaws — even with the physical properties remaining uniform — is very different, and since the appearance thereof depends strongly on subjective influences, it is advantageous to combine such flaws into classes not only with respect to their length but also with respect to their cross sections. In this connection, FIG. 2 depicts a field of flaws wherein four yarn imperfections of equally large cross section and length are combined into one flaw classification. In such a case, the judgement necessary to determine the class to which a certain yarn flaw belongs is made considerably easier. Conversely, the decision regarding the size class of permissible flaws is extensively facilitated. In addition, it is also readily possible with the aid of the scale graduation along the Q-axis, to approximate by interpolation those sizes of flaws which range in between the illustrated representations of each class.

It is to be understood that the above described embodiments are simply illustrative of the principles of the present invention. Thus, although the invention has been described in connection with representing the relationship between the dial settings of an electronic yarn smoother and the cross-sectional and longitudinal flaws extracted thereby, it is to be understood that its use is not so limited, and that it may be employed whenever a discernable relationship exists between a machine dial setting and the function performed by the machine. Various other modifications and changes may be devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

I claim:

1. A method of representing the required dial settings of a yarn smoother in accordance with the size of the longitudinal and cross-sectional flaws to be extracted thereby, which comprises:

illustrating a field of flaws in a coordinate system, wherein increasing flaw lengths are illustrated along a first axis and increasing flaw cross sections are illustrated along the second axis;

plotting a limit curve in a coordinate system, said limit curve being derived from the operating characteristics of the yarn smoother and representing the locus with respect to the field of the flaws extracted by said yarn smoother when set at a predetermined fixed dial setting;

placing said limit curve over said field of flaws so that the ordinate axis of said limit curve is coincident with said second axis of said field of flaws; and

shifting said limit curve relative to said field of flaws, while maintaining coincidence of said ordinate and said second axes, to align said limit curve as nearly as possible with the longitudinal and cross-sectional flaws which are to be extracted, whereby the yarn smoother dial settings are represented by the reference dial settings corresponding to the aligned limit curve and the value of the cross-sectional flaw intersected by the origin of the coordinate system of the limit curve.

2. A method according to claim 1, wherein said first axis is the abscissa axis, wherein said second axis is the ordinate axis, and wherein said predetermined fixed reference dial setting corresponds to the reference length of the longitudinal flaws.

3. The method according to claim 2, wherein at least one flaw characteristic is classified according to size.

4. A method according to claim 3, wherein at least one axis in the coordinate system of said field of flaws is in the logarithmical scale.

5. A method according to claim 4, wherein a family of limit curves are plotted in a coordinate system, each curve being derived from the operating characteristics of said yarn smoother and each of said limit curves representing the locus of the flaws extracted by said yarn smoother when set at a different predetermined fixed reference length dial setting.

6. A method according to claim 5, wherein at least one limit curve is plotted on a transparent medium.

7. A method according to claim 6, wherein a predetermined field of flaws and a predetermined family of limit curves are employed for each of a predetermined range of yarn sizes.