Nov. 6, 1962 F. H. BAUGH ETAL 3,063,007

FAULT DETECTION IN MULTIFILAMENT YARNS

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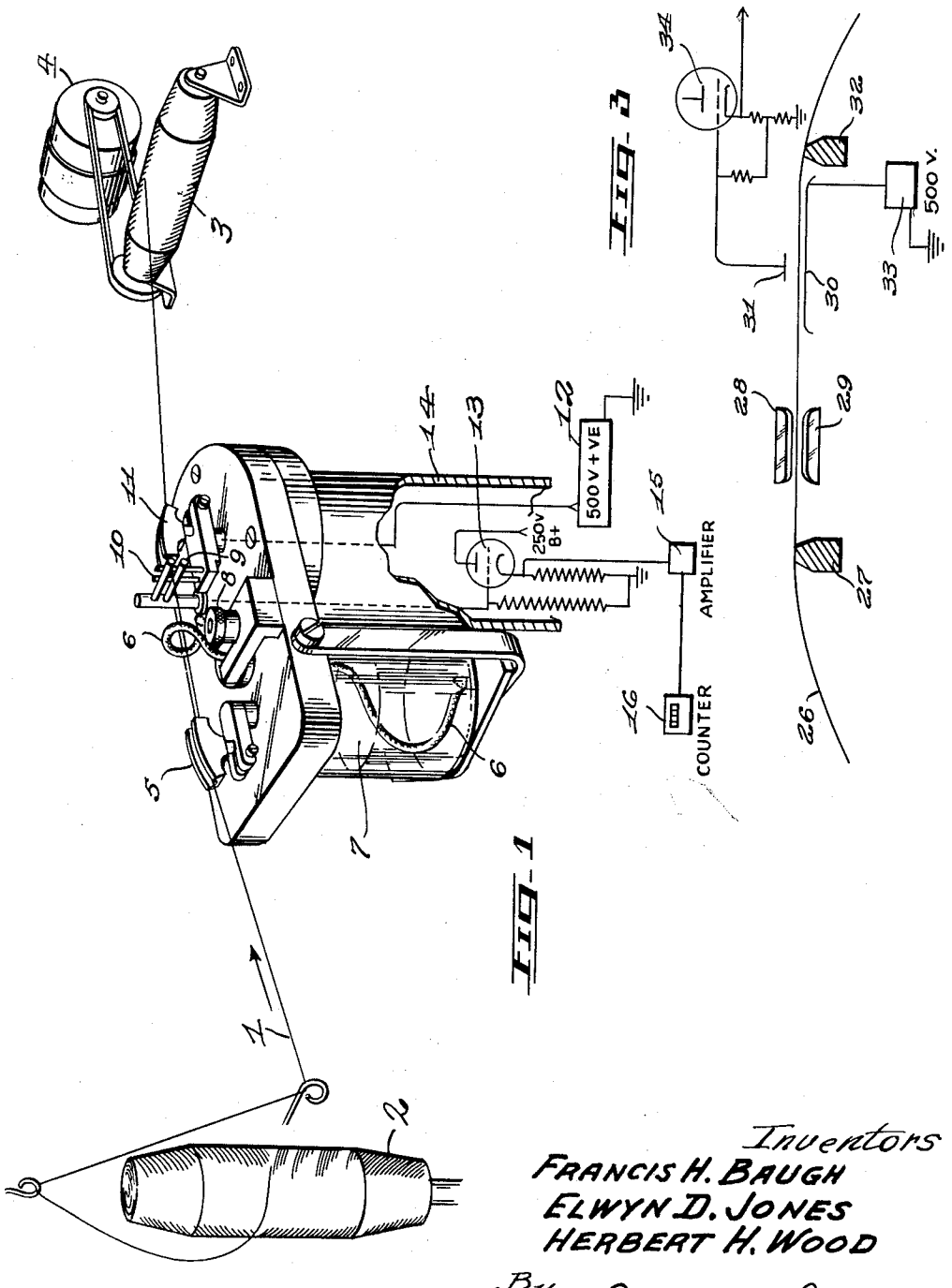


Fig. 1

Fig. 2

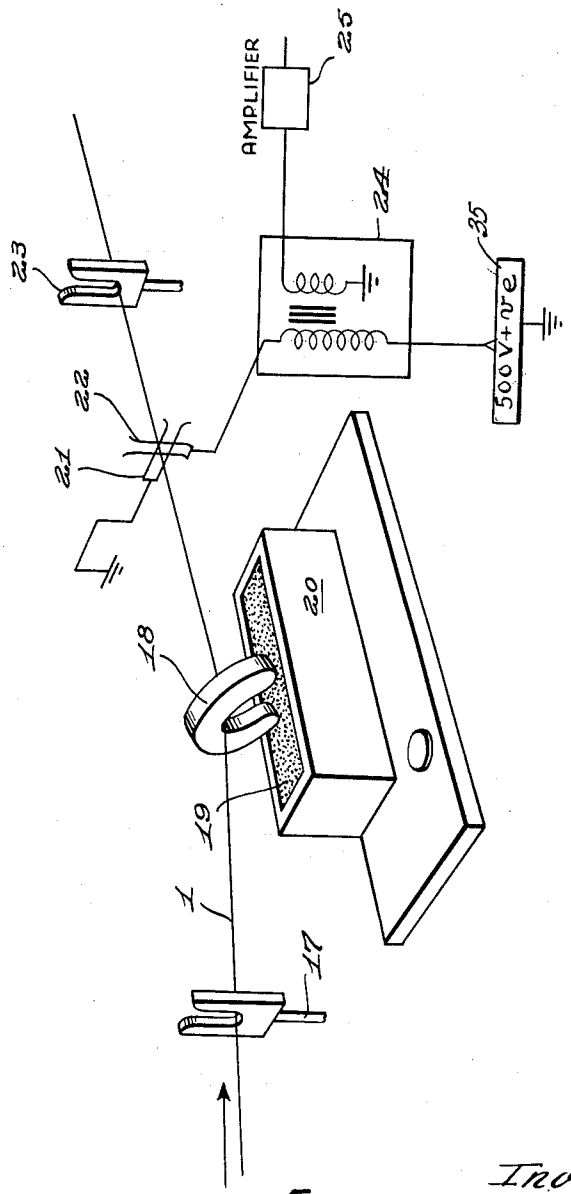
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Fig. 2



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FAULT DETECTION IN MULTIFILAMENT YARNS

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This invention relates to the detection of faults in multifilament textile yarns, and more particularly to the detection of faults in continuous filament synthetic yarns, as well as to multi-end warp inspection of such yarns.

By "continuous filament synthetic yarns" are meant those yarns obtained by bringing together a plurality of fine threads usually produced by extrusion of a molten fibre-forming polymeric material through a spinneret plate containing, for example, thirty to forty holes, the yarn thus consisting of numerous substantially parallel continuous monofilaments. Examples of yarns produced in this manner are polyester and polyamide yarns. Such continuous filament yarns may be contrasted with natural fibres such as cotton or silk, or with synthetic staple fibres, since these fibres are spun into yarns which, although still multifilamentary, consist of a tightly twisted bundle of comparatively short length fibres.

The faults found in continuous filament yarns are generally of three types, namely projecting ends of broken filaments, slubs or knots, and loops of one or more filaments away from the rest of the yarn. The detection of such faults is vitally important before the yarn is processed, for example in modern high-speed tricot knitting machinery, since the synthetic fibres now produced are so strong that these faults may cause the yarn to snag on a guide, break and cause a fault in the fabric produced. In the case of weaker yarns such as natural fibres, the faults are not so serious as the projecting fibres may break off rather than snag. For this reason, the faults that must be detected in continuous filament synthetic yarns are far more important than those in natural fibres. In the latter, all except comparatively gross knots are acceptable, but in the former it has become necessary to detect loops and protruding filaments. The detection of these minute faults is quite beyond the limits of an observer, and optical methods based upon the interruption of a light bath have been equally unsuccessful.

In copending application Serial No. 3,311, filed January 19, 1960, issued as Patent No. 3,037,162 there are disclosed a method and apparatus for detecting and counting these faults in a multifilament textile yarn which are particularly applicable to yarns which either have a natural electrical conductivity or have been treated to receive such conductivity by means, for example, of a finish. In the case of synthetic non-conductive yarns which have not been so treated, there is disclosed in the said copending application the method comprising passing the yarn through a steam bath to provide the necessary conductivity. However, it is not always desirable to use a steam bath since the steam has a deleterious effect on certain fibres and, in addition, the use of such a bath is extremely inconvenient in the case of multi-end warp inspection where a plurality of substantially parallel yarns are entering a weaving machine.

It is an object of this invention to provide a method and sensitive apparatus for detecting faults in multifilament textile yarns. A further object is to provide a method and apparatus for controlling textile machinery using such yarns, both the method and apparatus being useful for non-conductive yarns and also for multi-end warp inspection of such yarns. Other objects will appear hereinafter.

These objects are accomplished, broadly, by passing a multifilament yarn at a point adjacent to a moistened surface, said surface being adjustably spaced from the yarn so as to come into contact only with faults of predetermined size in said yarn, thence passing the yarn between two elements one of which is connected to a voltage source, the said elements being so spaced from each other as to allow passage of electric current between them when the moistened faults in said yarn pass between them, and thus detecting said faults by means of said electric current.

The apparatus for carrying out the aforesaid method comprises essentially, in combination, a moistened surface, a voltage source, two spaced elements one of which is connected to said voltage source, means for passing the yarn at a point adjacent to said surface and thence between said elements, said surface being adjustably spaced from the yarn so as to come into contact only with faults of predetermined size in said yarn and said elements being so spaced from each other as to allow passage of electric current between them when the moistened faults in said yarn pass between them, and means governed by said electric current for recording said faults.

The material of the moistened surface can be any absorbent material capable of holding water, viz a cotton wick, cellulose sponge, woven fibreglass, porous sintered metal, sintered glass or ceramics. Since the moisture of the surface is used merely to impart conductivity to the faults, a smooth surface is desirable in order to prevent snagging. Also a rotating cylinder of non-absorbent material may be used, a portion of the cylinder suitable dipping into a water bath.

The invention will be more fully illustrated by reference to the accompanying drawings wherein

FIG. 1 is a perspective view, partly diagrammatic, of one embodiment of the apparatus of the invention;

FIG. 2 is a perspective view, partly diagrammatic, of another embodiment of the apparatus of the invention; and

FIG. 3 is a cross-sectional view, largely diagrammatic, of still another embodiment of the said apparatus.

Referring now to FIG. 1, the yarn **1** is shown in the state of unwinding from bobbin **2** onto bobbin **3** which is driven by an electric motor **4**. After leaving bobbin **2**, the yarn passes over a guide shoe **5** and thence through a short spiral of a fiberglass wick **6** kept in a moist condition by water in a jar **7**. The wick **6** is adjustable as to height by means of a screw **8** and adjustable as to spacing from the yarn by slight springing of the spiral. From the spiral of the wick **6**, the yarn passes between elements **9** and **10** and thence over a guide shoe **11** before reaching bobbin **3**. Elements **9** and **10** are doubled in order to ensure detection of all yarn faults. Elements **10** are connected to a voltage source **12** and guide shoe **11** is also connected to the voltage source **12** in order to prevent current leakage. Elements **9** are connected to the grid of a preamplifying triode **13** conveniently located in the handle **14** of the apparatus. The triode **13** is in turn connected to an amplifier **15**, the latter activating a counter **16**. Alternatively, the amplifier **15** may be so installed as to control the motor **4**.

In operation, the height of the wick **6** and the size of its spiral are adjusted to such a position as to come into contact with yarn faults of predetermined size in order to moisten them. A suitable voltage is then applied to elements **10** and guide shoe **11** and unwinding of the yarn from bobbin **2** onto bobbin **3** is initiated by the motor **4**. Consequently, faults in the yarn which contact the wick **6** become moistened and thus cause the electric current to pass between elements **9** and **10**. The

current generates a signal at the grid of the preamplifying triode 13, which signal is amplified by the amplifier 15 and activates the counter 16 for recording the number of faults. Alternatively, if the amplifier 15 is related to the motor 4, the electric current may be so used as to stop the said motor and allow for inspection of the faults.

In FIG. 2, the bobbins, motor and fault counter are not shown since they are identical with those shown in FIG. 1 and in the same position relative to the fault detecting part of the apparatus.

This figure shows the yarn 1 passing through a guide 17 and thence through a tiltable inverted V-shaped guide 18 located above a moistened sponge or sintered porous plate 19 resting on a water tank 20. The yarn then passes between elements 21 and 22 and thence through guide 23, element 21 being grounded and element 22 being connected to a voltage source 23 through a transformer 24.

In operation, the guide 18 is tilted to regulate the distance of the yarn from the moistened surface 19 so as to allow yarn faults of predetermined size to come into contact with the surface 19 and become moistened. A voltage is then applied to element 22 and movement of the yarn is initiated. Upon passage of moist faults between elements 21 and 22, the electric current flows between the elements and signals are generated at the output of transformer 24. The signals are conveyed to the amplifier 25 which activates the fault counter or, alternatively, controls the motor regulating the movement of the yarn.

FIG. 3 illustrates the apparatus of the invention in a form suitable for multi-end warp inspection and control of textile machinery. One yarn 26 of a warp is shown passing over a guide bar 27 and thence between moistened surfaces 28 and 29, the latter both being in contact with a water tank (not shown). The yarn then passes between elements 30 and 31, and thence over guide bar 32 to a textile processing machine (not shown). Element 30 consists of a plate connected to a voltage source 33 and element 31 is connected to the grid of a preamplifying tube 34, the output of which may be amplified and controls the textile processing machine.

In operation, the distance between the wicks 28 and 29 is so adjusted as to ensure contact with yarn faults of predetermined size, a voltage is applied to plate 30 and the textile processing machine is set in motion. The yarn faults become moistened when passing between the wicks and thus cause the electric current to flow between the plate 30 and element 31, the said current in turn stopping the textile processing machine and identifying which yarn or group of yarns is at fault.

It will be seen that many modifications can be imparted to the method and apparatus of this invention without departing from the spirit and scope thereof. Accordingly, the invention is not to be limited to the specific embodiments described above but is defined by the following claims.

What we claim is:

1. An apparatus for detecting faults in a multifilamentary textile yarn comprising essentially, in combination, a moistened surface; two spaced elements electrically connected in circuit with a voltage source and a current passage detecting means; and means for passing said yarn at a point adjacent to said surface and thence between said elements, said surface being adjustably spaced from said yarn so as to come into contact only with faults of predetermined size in said yarn, and said elements being so spaced from each other as to allow passage of electric current when the moistened faults in said yarn contact said elements, and said current detecting means thus detecting said faults.

2. An apparatus for recording faults in a multifilamentary textile yarn comprising essentially, in combination, a moistened surface; two spaced elements electrically connected in circuit with a voltage source and a current passage recording means; and means for passing said yarn at a point adjacent to said surface and thence between said elements, said surface being adjustably spaced from said yarn so as to come into contact only with faults of predetermined size in said yarn, and said elements being so spaced from each other as to allow passage of electric current when the moistened faults in said yarn contact said elements, and said current recording means thus recording said faults.

3. An apparatus as claimed in claim 2 wherein said current passage recording means consists of a preamplifying triode, a signal amplifier and a recording counter.

4. An apparatus as claimed in claim 2 wherein said current passage recording means consists of a transformer, a signal amplifier and a recording counter.

5. An apparatus as claimed in claim 1 wherein said moistening surface comprises a spiral wick.

6. An apparatus as claimed in claim 1 wherein said moistening surface comprises a substantially horizontal porous plate and the multifilamentary yarn is spaced therefrom by an adjustable guide.

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