May 29, 1962 E. D. JONES ETAL 3,037,162

FAULT DETECTION IN MULTI-FILAMENT YARNS

Filed Jan. 19, 1960 2 Sheets-Sheet 1

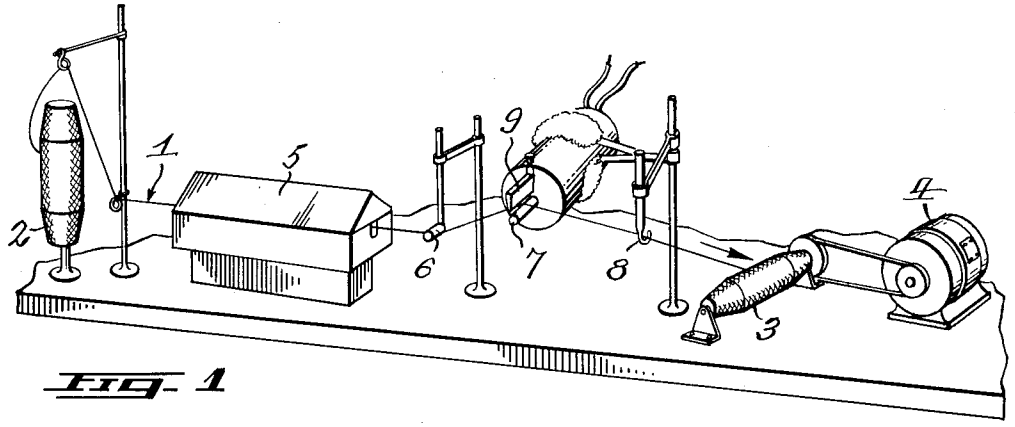


Fig. 1

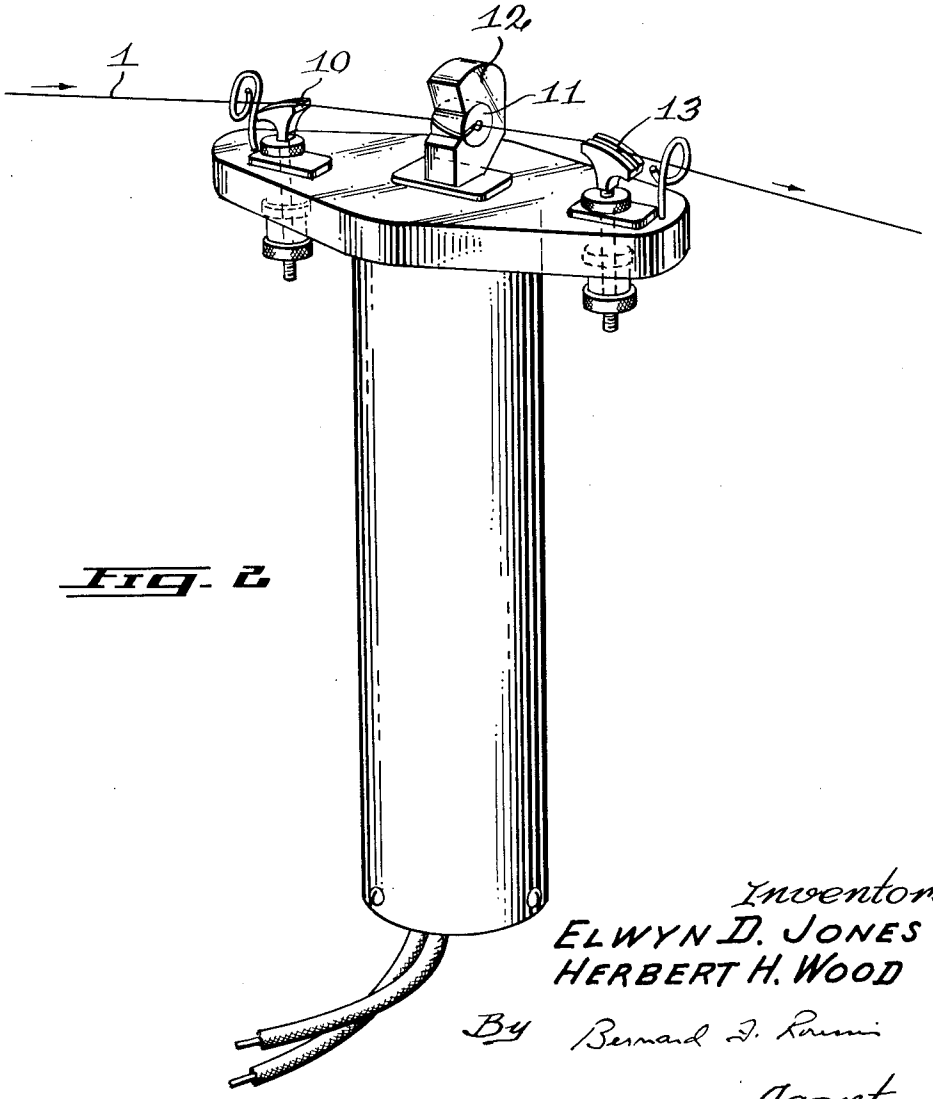


Fig. 2

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FAULT DETECTION IN MULTI-FILAMENT YARNS

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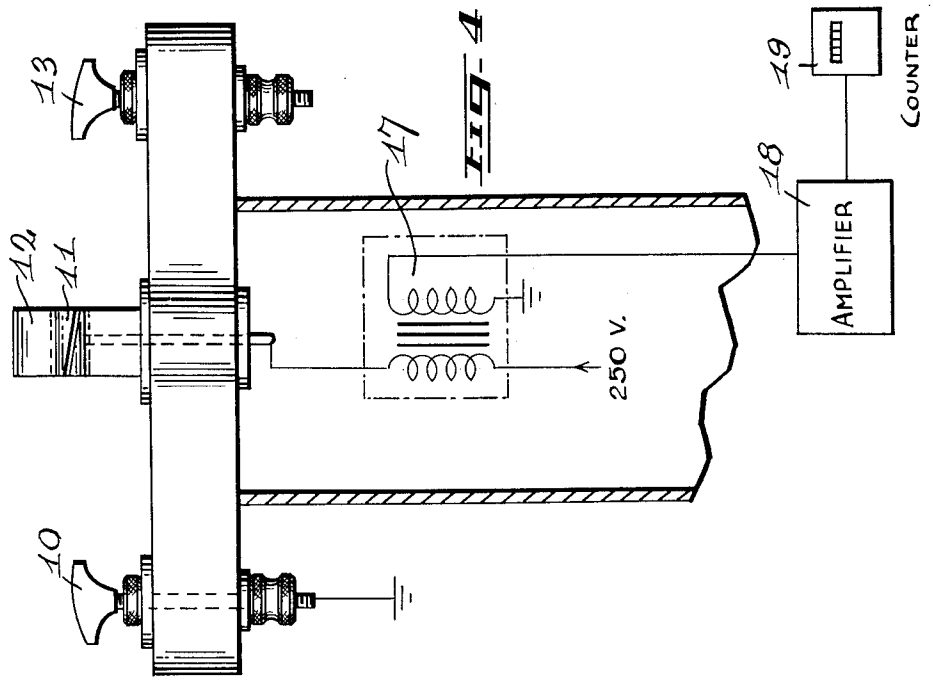


Fig. 4

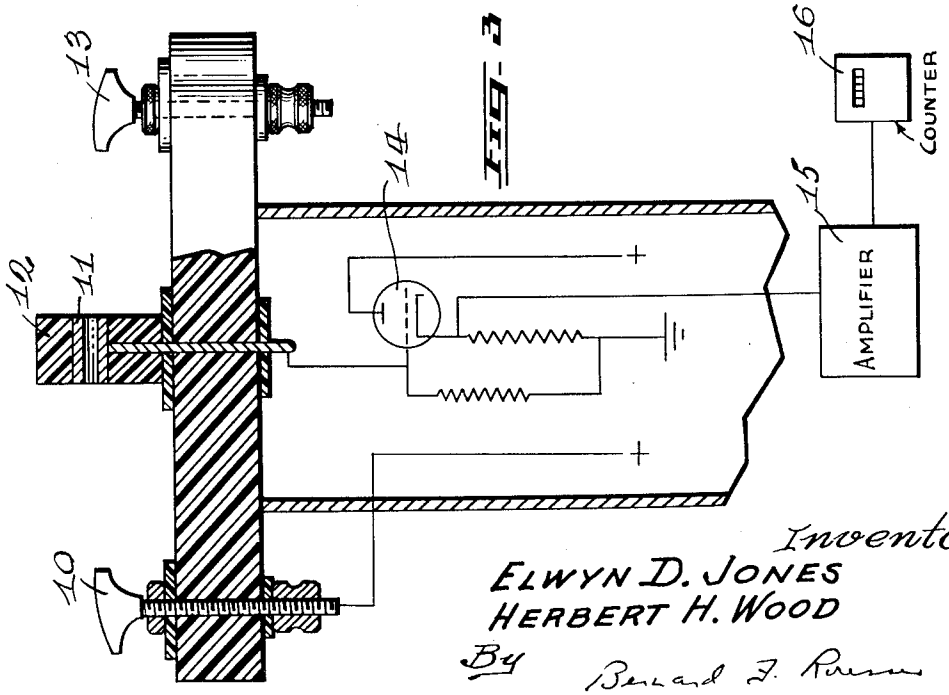


Fig. 3

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FAULT DETECTION IN MULTI-FILAMENT YARNS

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4 Claims. (Cl. 324—54)

This invention relates to the detection of faults in multifilament textile yarns, and more particularly to the detection of faults in continuous filament synthetic textile yarns.

By "continuous filament synthetic textile yarns" are meant those yarns obtained by bringing together a plurality of fine threads usually produced by extrusion of a molten synthetic fibre-forming material through a spinneret plate containing, for example, thirty to forty fine 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 synthetic yarns may be contrasted with natural fibres such as cotton or silk, or with synthetic staple fibres, for these latter 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 because 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 detection methods based upon the interruption of a light path have been equally unsuccessful.

It is an object of this invention to provide a method and a sensitive apparatus for detecting faults in continuous filament textile yarns. Another object is to provide a method of measuring the fault level on spools of such yarns and also to provide an apparatus capable of controlling textile machinery using such yarns. Additional objects will appear hereinafter.

These objects are accomplished, broadly, by passing a multifilament yarn in an electrically conductive state between two elements one of which is connected to a voltage source, one of said elements being in contact with the yarn and the other being adjustably spaced therefrom so as to come into contact only with faults in said yarn and thus allow passage of the electric current between the elements through said yarn, and thus detecting said faults by means of said electric current.

The apparatus for carrying out the aforesaid method comprises essentially, in combination, a voltage source, two spaced elements one of which is connected to said source, means for passing the yarn in an electrically conductive state between said elements and in contact with one of them, means for adjusting the position of the other element relative to the yarn so that it only comes into contact with faults in said yarn and thus allows passage of the electric current between said elements through said yarn, and means governed by said electric current for recording said faults.

The adjustable position of the element spaced from the yarn permits the detection of faults of varying sizes and the method and apparatus of the invention are thus adaptable to the detection of faults in such natural yarns as cotton and silk yarns or in staple fibres where comparatively gross faults are to be detected.

It is, of course, necessary that the yarn be in a state of electrical conductivity in order that the electric current be allowed to pass from the yarn-contacting element to the other element through the yarn. Synthetic textile yarns are usually insulators but, during their spinning, finishes are usually applied to them which impart the necessary conductivity. Non-conductive yarns can be given conductivity by passage through a steam bath before reaching the inter-element space.

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

FIG. 1 is a perspective view of one embodiment of the apparatus of the invention wherein yarn faults are detected in one plane only;

FIG. 2 is a perspective view of another embodiment of the apparatus of the invention wherein the faults are detected through 360°;

FIG. 3 is a cross-sectional, partly diagrammatic, view of the apparatus shown in FIG. 2 showing, in addition, an electronic preamplifier as well as fault-counting means; and

FIG. 4 is another cross-sectional, partly diagrammatic view of the apparatus shown in FIG. 2 showing in addition, a transformer as well as fault-counting means.

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 through a steam bath **5** and a guide **6**, thence comes into contact with fixed grounded element **7** and then passes through a guide **8** before reaching bobbin **3**. The fixed element **7** is spaced from adjustable element **9** which is connected to a voltage source (not shown).

In operation, the element **9** is adjusted to such a position as to come into contact with yarn faults of predetermined size, e.g. 1 mm. from element **7**. A suitable voltage, e.g. 500 volts, is then applied to element **9** and unwinding of the yarn from bobbin **2** onto bobbin **3** is initiated by the motor **4**. The yarn acquires conductivity by passage through the bath **5** and, consequently, any fault in the yarn which contacts element **9** causes the electric current to pass between elements **7** and **9**. This electric current activates a counter (not shown) which thus records the number of faults.

In FIGS. 2, 3 and 4, the bobbins, steam bath and yarn guides 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. These figures show the fixed element **10** contacting the yarn **1** in the form of a shoe and the adjustable element **11** adapted to contact the yarn faults in the form of a tube held in place by an insulating support **12**. One of the two elements **10** and **11** is connected to a voltage source (not shown in FIG. 2), and the other is grounded. A second shoe **13** serves as a support and guide for the yarn **1** past the element **11**. For ease of string-up, the tube **11** may have a slot-cut in its wall.

In operation, the yarn passes over the shoe **10** and thence through the tube **11** and any fault contacting the tube wall causes the electric current to pass between the shoe **10** and tube **11**. Adjustment of the position of the

tube **11** according to the size of the faults to be detected may be accomplished by springing the tube or, more conveniently, by using tubes of different bore.

In FIG. 3, the tube **11** is shown connected to the grid of a preamplifying triode **14** which is in turn connected to the main amplifier **15**. The latter activates a counter **16** for recording the number of faults and, if desired, may be so arranged as to control the motor which activates the winding bobbin so that the winding of the yarn is stopped when a fault or group of faults is detected. A similar arrangement can be installed on a complete knitting machine or like yarn processing equipment.

In FIG. 4 the tube **11** is shown connected to a transformer **17** which is in turn connected to an amplifier **18** activating a counter **19**. Either the preamplifier or transformer can be included in the handle of the instrument, thus rendering it transportable and usable at some distance from the main amplifier.

It is evident that many modifications can be imparted to the method and apparatus of the invention without departing from the spirit and scope thereof. Accordingly, this 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 non-conductive multifilament textile yarn which comprises essentially, in combination, means for moistening the surface of said yarn; two adjustably spaced elements electrically connected in circuit with a voltage source and a current passage recording means; and means for advancing said yarn through said moistening means and subsequently between said elements and in contact with one of them, the other of said elements being adjustably spaced from the yarn so as to come into contact only with faults therein and thus allow the passage of current between said elements and the consequent recording of faults by said recording means.

2. An apparatus as claimed in claim 1 wherein said elements are two substantially parallel rods.

3. An apparatus as claimed in claim 1 wherein the yarn-contacting element is in the form of a shoe and the other element is a metallic tube through which the yarn passes.

4. An apparatus as claimed in claim 1 wherein said means for moistening the surface of the non-conductive multifilament textile yarn is a steam bath.

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