Feb. 25, 1969 W. T. WINDLEY 3,429,491

BREAK DETECTOR AND SHUT DOWN MEANS

Filed May 8, 1967

FIG. 1

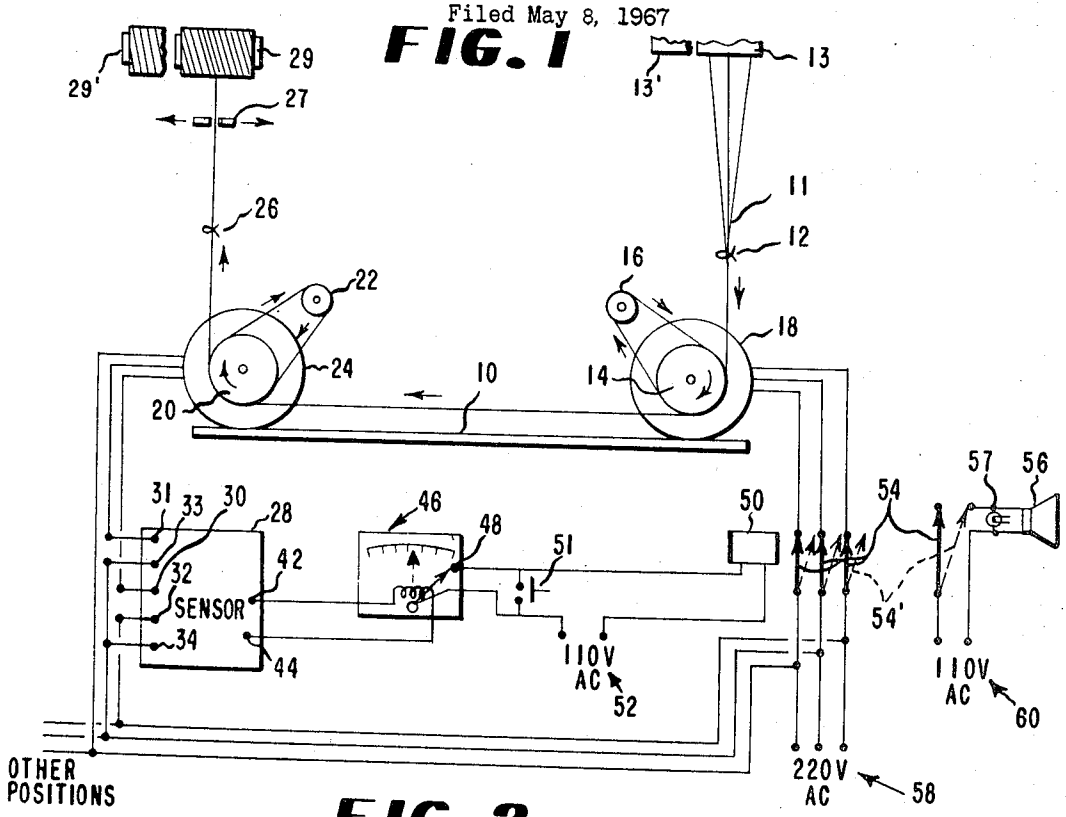
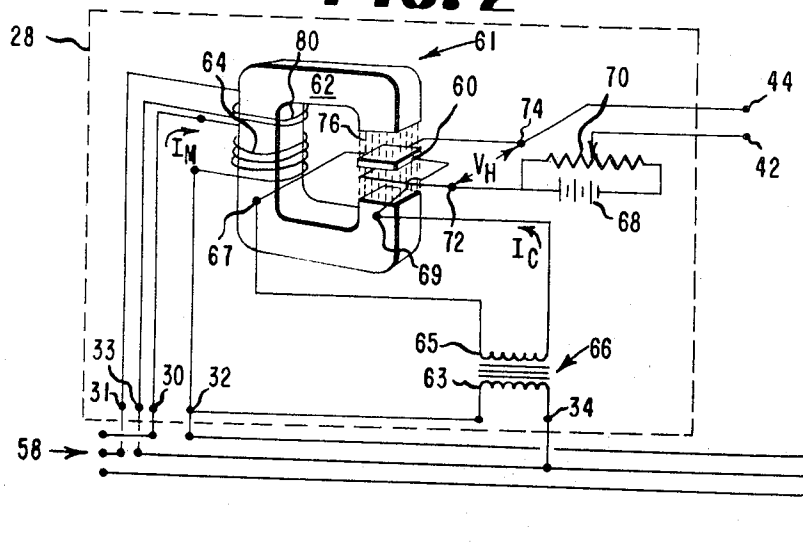


FIG. 2



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BREAK DETECTOR AND SHUT DOWN MEANS

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Int. Cl. B65h 25/22

ABSTRACT OF THE DISCLOSURE

In a multi-position strand handling machine, an apparatus for detecting a break in the advancing strand material, shutting down the strand advancing means and selectively indicating the location of the break. The apparatus employs at each position a power sensor connected to an advancing roll motor and to a switching arrangement for shutting down the strand advancing means and activating an alarm system upon sensing reduced power requirements for the advancing roll motor due to a strand break.

Background of the invention

This invention relates to the handling of strands advancing continuously from an operating source and, more particularly, to an apparatus for stopping the advancing means in a strand handling machine upon the occurrence of a strand break and for giving a selective indication of the break location.

The term "strand" as used herein is intended to include either a single filament, a bundle of such filaments or the threads, yarns, narrow webs and the like produced from filaments or staple fibers.

In a spinning process, wherein a filament forming material is extruded from a spinneret, the extrusion is normally not stopped when a defective condition occurs in the handling steps which follow extrusion. Such defects are usually in the form of complete breakage of a filament bundle or of a low number of filaments in the bundle being handled, resulting in wraps forming on advancing rolls of the downstream handling equipment. Since it is customary to have a single operator patrol a multiplicity of positions, such wrap conditions may go unnoticed for a considerable period of time with resultant damage to the handling equipment. In some instances, it has been the practice to employ yarn contact sensing elements to detect strand breaks and to actuate stop motion equipment or cut-down devices, thereby interrupting downstream delivery from a given source to prevent wrap buildup. While these devices are operable, the yarn contact elements are trouble spots in that they wear rapidly and degrade yarn being sensed. Additionally, these yarn contact elements are insensitive to a low number of filament breaks in a bundle of filaments being handled.

Summary of the invention

It is accordingly the object of this invention to provide an apparatus for sensing and indicating a break in a strand material and stopping the strand advancing means that does not rely on contacting the advancing strand.

This object is accomplished, in a strand handling machine that includes first and second advancing rolls driven by respective electric motors, by an apparatus for detecting a break in a strand advancing between the rolls. The apparatus includes a power sensor having input terminals and output terminals. The input terminals are connected to the second advancing roll motor and the power sensor provides a signal at its output terminals proportional to the power input to the second advancing roll motor. Switching means connected between the output terminals of the power sensor and the first advancing roll motor are provided for de-energizing the first advancing roll motor upon a change in signal from the power sensor due to a change in power input to the second advancing roll motor. Signalling means connected to the switching means and operative upon de-energization of the first advancing roll motor selectively indicates the positional location of the strand break.

Brief description of the drawings

FIGURE 1 is a schematic showing of one position of a multi-position strand drawing machine in conjunction with electrical sensor control means; and

FIG. 2 is an electrical schematic showing of the power sensor in combination with the draw roll motor.

Description of the preferred embodiment

Referring to FIG. 1, one position of the strand handling machine chosen for purposes of illustration is a filamentary threadline drawing machine and includes generally, as components, an equipment frame **10**, a first advancing roll or a feed roll **14** directly coupled to synchronous motor **18**, a separator roller **16** in spaced relationship to feed roll **14**, a second advancing roll or a draw roll **20** directly coupled to synchronous motor **24** on frame **10**, a separator roller **22** in spaced relationship to the draw roll **20**, a pair of yarn guides **12** and **26** and a power sensor **28** electrically connected to the power lines between three-phase power source **58** and motor **24**. The output terminals **42** and **44** of power sensor **28** are connected to a meter relay **46**, that, in turn, is electrically connected to power source **52** and relay coil **50**. Relay **50** carries contactors **54** which are connected in power supply lines connecting power source **71** with audio and visual alarms **56** and **57**, respectively, and in power supply lines connecting power source **58** with motor **18**.

Referring again to FIG. 1, filamentary threadline **11** is advanced continuously from a spinneret **13** through a fixed guide **12** and around positively driven feed roll **14** and its separator roller **16**. The yarn is then passed around positively driven draw roll **20** and its separator roller **22**. Draw roll **20** operates at a greater peripheral speed than feed roll **14**, thus drawing the threadline. In which case, feed roll **14** acts as a tension changing device or as a yarn movement control roll. This control is effected by synchronous motor **18** which sometimes acts as a motor and sometimes as a generator to maintain the speed of feed roll **14** constant regardless of changes in the restraining yarn tensions applied to the feed roll. The yarn is then passed through guide **26** and traverse guide **27** onto bobbin **29**. Bobbin **29'** and spinneret **13'** are shown as representative of another position in a multi-position machine. As is well known in the art of yarn drawing, a portion of the total power consumed by the draw roll motor **24** is related to the restraining yarn tensions between draw roll motor **24** and feed roll motor **18**. Such tension related power can be readily determined by comparing load vs. no load conditions on motor **24** for various draw ratios and is monitored by power sensor **28** which produces an output signal at terminals **42**, **44** which is in turn indicated by meter relay **46**. Meter relay **46** is adjusted so that, under a selected draw ratio load conditions of motor **24**, the set of contacts **48** of the meter relay **46** are normally closed, thus energizing relay coil **50** through power source **52**. When relay **50** is energized, contacts **54** carried by relay **50** are closed in the power feed lines between motor **18** and power source **58** with one contact open in power feed line connecting power source **71** with audio alarm **56** and visual warning light **57**.

In FIG. 2, power sensor **28** is shown connected through input terminals **30, 31, 32, 33, 34** to 3-phase 220 v. power source **58** supplying power to motor **24**. Numeral **61** generally designates a Hall effect device which includes a Hall plate **60** disposed within the air gap of an iron core **62**. Coils **64, 80** are placed around core **62** and each is connected in series with one phase of power supply **58** to provide magnetizing current I_m that are in phase with line current. The primary winding **63** of transformer **66** is connected across one phase of voltage source **58** with the secondary winding **65** connected to terminals **67** and **69** of Hall plate **60** to provide a control current I_c that is proportional to and in phase with line voltage. D.C. supply **68** is a bias voltage paralleled by potentiometer **70** and connected in series with Hall plate terminal **72** and output terminal **42** to provide an incremental adjustment to the output of the Hall plate at output terminals **42, 44**.

It is well known that when a current I_c flows in a Hall effect device and a magnetic field **76** is applied at right angles to the current flow, an electrical potential known as Hall voltage (V_H) is generated which is perpendicular to both the direction of the current flow and the magnetic field. This potential appears at the mid-points of the lateral faces of plate **60** at which points electrodes **72** and **74** have been connected. This potential is measured by meter relay **46** (FIG. 1), e.g., Model 202 manufactured by Assembly Products, Inc. Since the control current I_c is proportional to and in phase with the line voltage **58** and the magnetizing current I_m is in phase with the line current, the Hall voltage output V_H (**72, 74**) is proportional to the power input to motor **24**. The coils **64, 80** connected in series with two phases of the power supply provide a linear output regardless of phasing of lead polarity.

In operation the loss of threadline **11** of the breakage of one or more filaments in the bundle causes a decrease in tension related power to motor **24**. This decrease in power is sensed by Hall device **61** in the form of a reduced output at terminals **42, 44**. This reduced output is indicated by meter relay **46** and contacts **48** are opened, which, in turn, break the circuit between the 110 v. supply **52** and relay coil **50**. Deenergizing coil **50** displaces contacts **54** to the position **54'** shown in phantom. This opens the 220 v. power supply to motor **18**. Additionally, alarm light **57** and audio alarm **56** are energized from 110 v. source **71** to notify the operator that a position is down. A switch **51** (FIG. 1) is employed to bypass open contacts **48** so that motor **18** will be operative during stringup procedure. After threadline **11** is passed around roll **24** and through guide **26**, switch **51** is opened and the power sensor control is again operative.

The Hall device **61** is sufficiently sensitive to detect not only the complete loss of threadline **11** but also the breakage of a low number of filaments in a multifilament threadline. It is recognized that in the illustrated embodiment if a low number of filaments in a multifilament bundle should break the shutting down of the feed roll motor will cause the remainder of the threadline to be pulled apart by the continued operation of the draw roll motor, which could be harmful to the handling equipment. To overcome this, it is contemplated that the solenoid **50** may be connected to and used to actuate a threadline cutdown device of the type disclosed by Edwards in U.S. Patent 3,090,268.

While the invention has been described in conjunction with equipment wherein one or more strands are drawn between two positively driven rolls, it should be understood that in strand handling equipment where more than two driven advancing rolls are used, power sensors could be connected to each roll motor to sense various processing conditions and then in turn function as stop motion devices for individual motors or various combinations of these motors.

It should also be noted that alternative to meter relay **46**, solid state switching equipment is readily adaptable for detecting changes in the output of the power sensor and initiating operation of switching means to shut down advancing roll motors and to positionally indicate fault locations.

It is apparent that many changes and modifications may be made to the disclosed apparatus without departing from the spirit of the present invention which is intended to be limited only by the scope of the appended claims.

What is claimed is:

1. In a strand handling machine that includes first and second advancing rolls driven by respective electric motors, an apparatus for detecting a break in a strand advancing betwen the rolls and shutting down the first advancing roll motor, said apparatus comprising:

(a) a power sensor having input terminals and output terminals, said input terminals being connected to the second advancing roll motor, said sensor providing a signal at said output terminals proportional to the power input to the second advancing roll motor; and

(b) switching means connected between the output terminals of the power sensor and the first advancing roll motor for de-energizing the first advancing roll motor upon a change in signal from the power sensor due to a change in power input to the second advancing roll motor.

2. The apparatus of claim **1** wherein is provided a signalling means connected to said switching means for signalling a strand break, said signalling means being operative upon de-energization of said first advancing roll motor.

3. The apparatus of claim **1**, wherein said sensor is a Hall effect device.

4. In a strand drawing machine having a plurality of positions, each including a feed roll and a draw roll driven by respective three-phase electric motors, an apparatus for detecting the breaking of one or more filaments in a bundle of filaments being drawn between the rolls, shutting down the feed roll motor, and selectively indicating the positional location of the filament break, said apparatus comprising:

(a) a Hall effect device having input terminals and output terminals, said input terminals being connected to the draw roll motor, said Hall effect device providing a signal at said output terminals proportional to the power input to the draw roll motor;

(b) means connected between the output terminals of the Hall effect device and the feed roll motor for de-energizing the feed roll motor upon a decrease in signal from the Hall effect device due to a decrease in power input to the draw roll motor; and

(c) signalling means connected to said means for de-energizing the feed roll motor for signalling a filament break and selectively indicating the positional location of the break, said signalling means being operative upon de-energization of said feed roll motor.

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U.S. Cl. X.R.

226—108; 28—51; 57—81