

[54] **DETECTOR MECHANISM FOR BROKEN STRANDS OF YARN**

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[56] **References Cited**

UNITED STATES PATENTS

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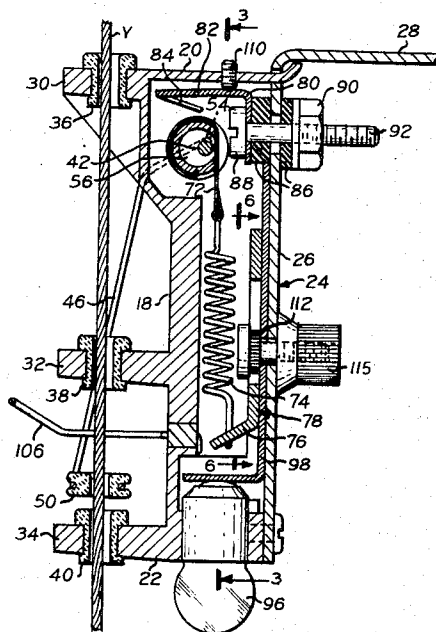
Primary Examiner—James R. Scott

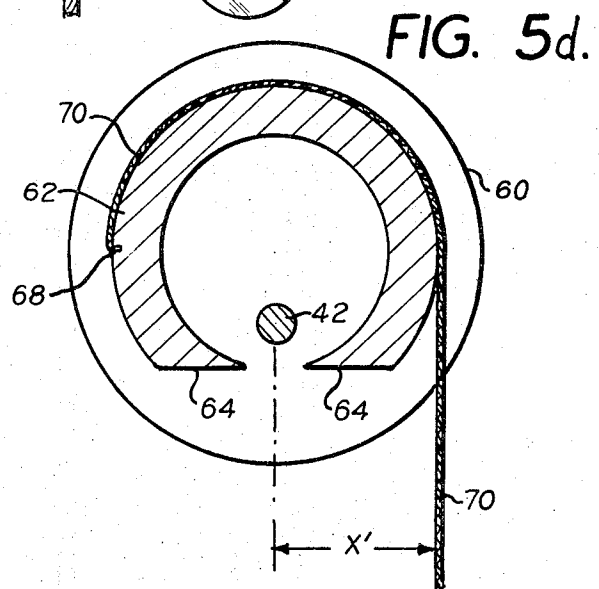
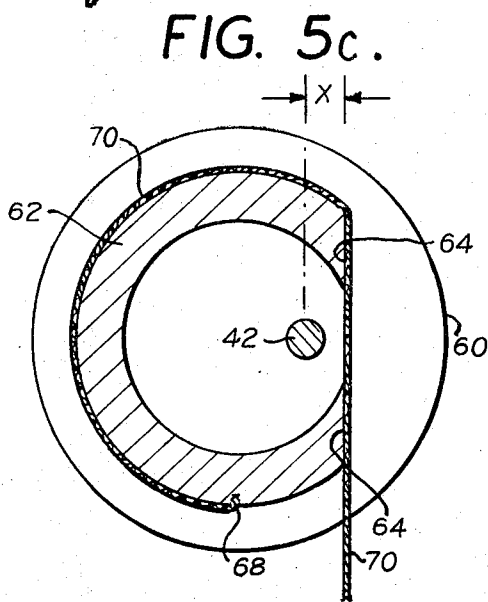
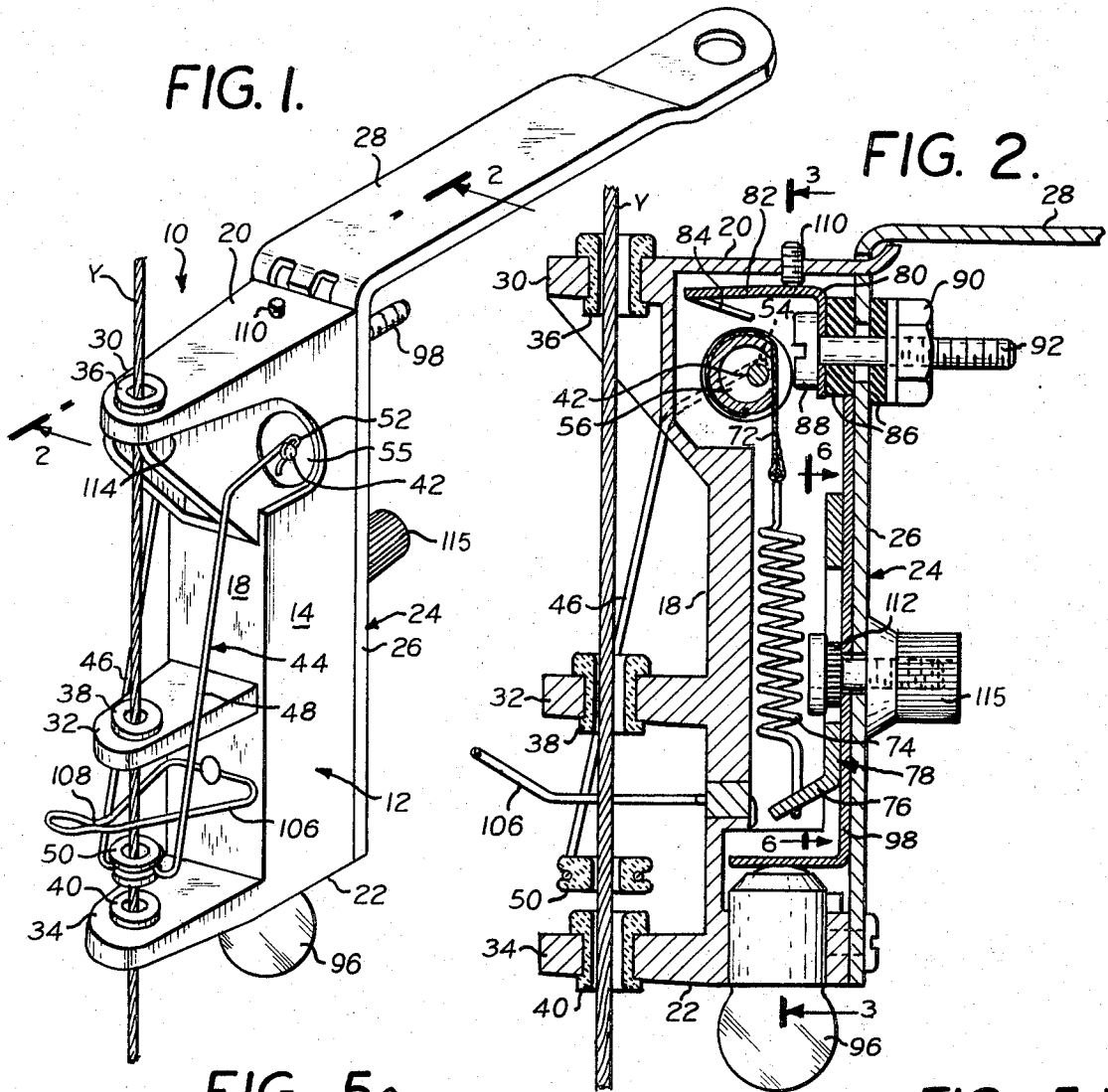
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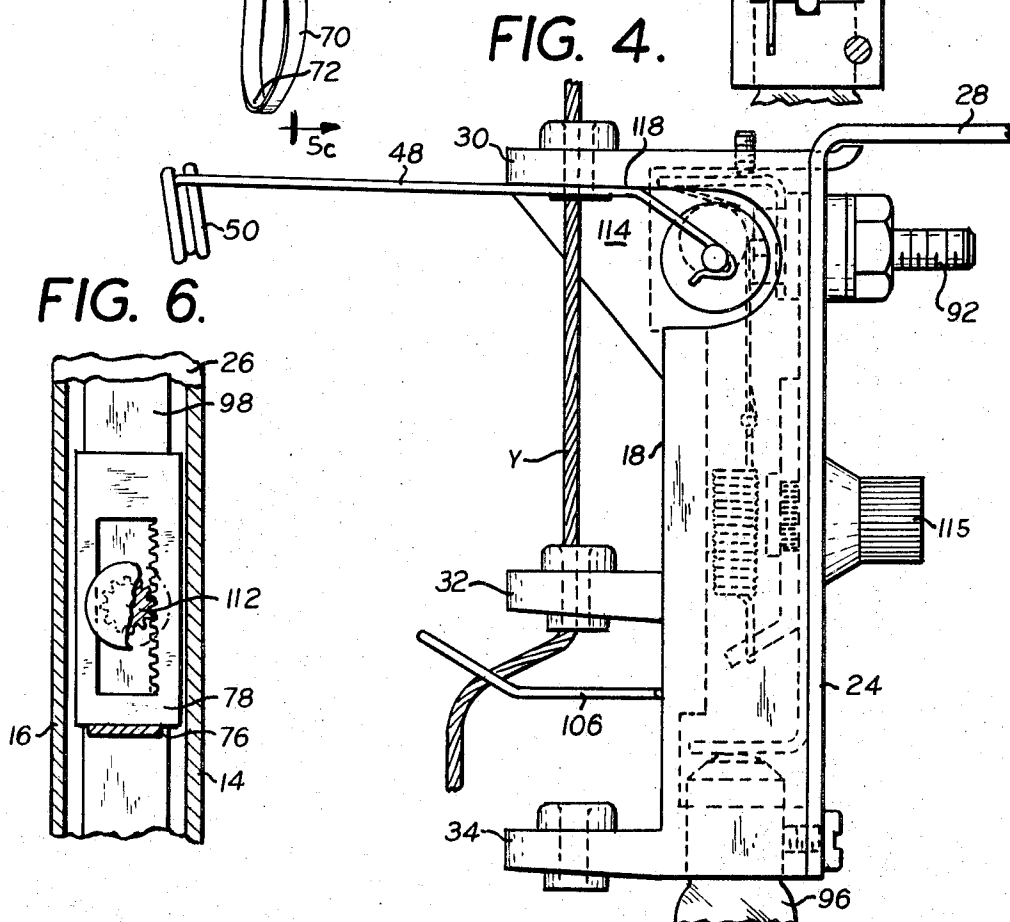
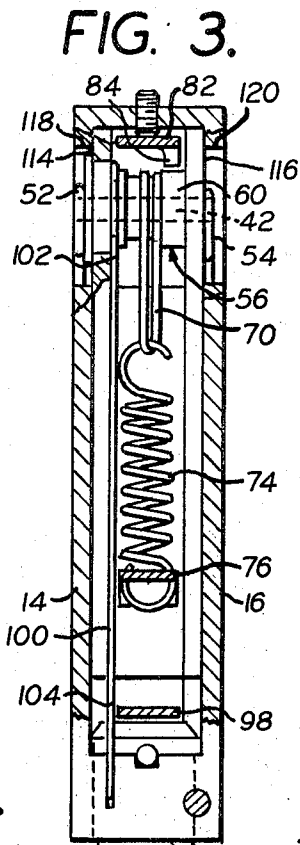
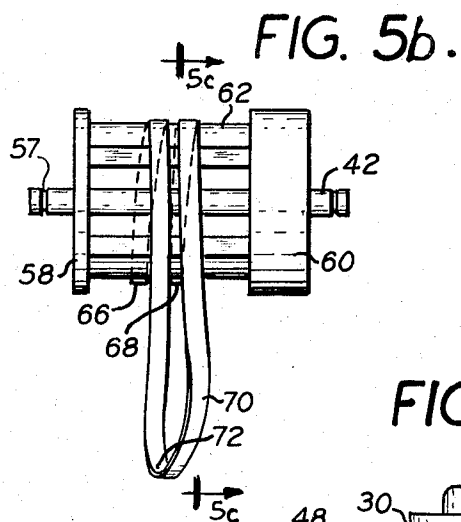
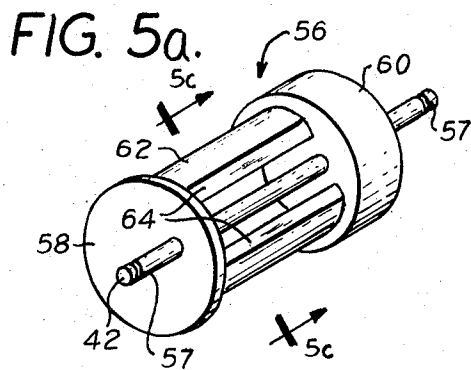
[57] **ABSTRACT**

A stop motion for detecting the interruption of yarn travel therethrough comprising a pivotally mounted fly wire restrained in a first position by the yarn traveling through its guide means, and biased for pivotal movement away from said first position when the yarn travel is interrupted due to its running out or breakage. The means biasing the fly wire apply minimum torque thereto when the fly wire is restrained by the yarn and such torque progressively increases when the fly wire is freed from its restraint whereby it acquires gradually increasing pivotal momentum for providing firm wiping engagement of the stop motion switch, said switch being defined by a contact element movable in unison with the fly wire and another contact element carried by the housing, the latter's position being movable for selectively adjusting the point of engagement of said contact elements.

10 Claims, 9 Drawing Figures







DETECTOR MECHANISM FOR BROKEN STRANDS OF YARN

BACKGROUND OF THE INVENTION

The present invention relates to a stop motion for use in association with a knitting machine and particularly to such stop motion which is adapted to detect yarn breakage or yarn running out.

Conventional stop motions of this type usually comprise a fly wire terminating at its free end in a yarn guide and mounted at its other end for pivotal movement. The fly wire is biased for pivotal movement into a position in which it is operative to close a switch but is restrained from such pivotal movement by the yarn passing through its yarn guide. Accordingly, upon breakage or running out of yarn, the fly wire assumes its biased position causing the closing of a switch which is operative to interrupt the knitting machine drive. An example of such conventional stop motion is shown in U. S. Pat. No. 2,733,308, assigned to the assignee hereof.

In conventional stop motions of the type involved herein, the fly wire biasing means may comprise a tension or torsion spring whereby the torque transmitted to the fly wire is at a maximum when the latter is restrained by the traveling yarn, thus imparting to such yarn more tension than desirable. When the yarn runs out, releasing the fly wire from its restraint, the torque acting on the fly wire gradually decreases as the fly wire pivotally moves into position wherein it is operative to close the switch, resulting in a decreased torque at such closing and an accompanying less reliable switch contact. Further, the switch closing in response to the pivotal movement of the fly wire usually occurs when the fly wire reaches a predetermined position, normally fixed. This limits the flexibility of the stop motion and may render its use less efficient in situations where it is desirable for the stop motion switch to be closed within a shorter period of time than it normally takes for the fly wire to reach its predetermined switch closing position.

The present invention therefore constitutes an improved stop motion which is void of deficiencies pointed out above.

SUMMARY OF THE INVENTION

In accordance with the present invention, the fly wire is secured at one end thereof to a pin mounted for rotation within the housing whereby the fly wire is pivotable with respect to the housing. The pivot pin also mounts a cam to which there is secured one end of a tape loop, the other end of which is secured to one end of a tension spring, with the other end of the tension spring being fixed. Accordingly, the spring force is transmitted by means of the tape loop to the cam and the pin, biasing the latter for pivotal movement. The fly wire, cam, tape and spring are assembled within the stop motion housing so that when the fly wire is in its normal operating position, i.e., the position in which it is restrained by the yarn passing through its guide, the point of engagement of the tape and the cam is at a minimal distance from the pivot pin whereby the torque transmitted by the spring to the pivot pin is at a minimum. Accordingly, during normal operation of the stop motion, the force imparted by the fly wire to the travelling yarn is at a minimum. In the event of yarn breakage, restraint of the fly wire is removed allowing

the cam to rotate under action of the tape whose point of contact with the cam moves gradually more distantly from the pivot pin, whereby to transmit a progressively increasing torque to the cam and the fly wire. Thus, upon yarn breakage, the unrestrained fly wire and cam acquire gradually increasing pivotal momentum in response to such progressively increasing torque applied thereto. Such pivotal movement of the cam results in a firm wiping engagement thereof with a flexible metallic tongue fixed to the housing, such tongue and cam collectively defining the stop motion switch and such firm wiping engagement therebetween assuring superior electrical contact. Further, the metallic tongue which forms one of the elements of the stop motion switch is adjustably movable to enable an earlier or later contact with the cam as may be desired.

Thus, the improved stop motion construction in accordance with the invention imparts minimum tension to the yarn during normal operation, and provides gradually increasing torque to the cam and fly wire, upon breakage of yarn, to provide firm wiping engagement of the cam with the metallic tongue to insure superior switch closing contact.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational perspective view of the stop motion in accordance with the invention;

FIG. 2 is a sectional view taken along line 2—2 of FIG. 1;

FIG. 3 is a section taken along line 3—3 of FIG. 2;

FIG. 4 is a right side view of the stop motion, when activated by yarn breakage;

FIG. 5a is a perspective view, on an enlarged scale, of the stop motion cam;

FIG. 5b is an elevational view of the cam with the tape loop secured thereto;

FIG. 5c is a sectional view taken along line c—c of FIG. 5b, on a further enlarged scale;

FIG. 5d is a view similar to FIG. 5c, but showing the cam position upon activation of the stop motion; and

FIG. 6 is a view taken along line 6—6 of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1, the stop motion device 10 in accordance with the present invention comprises a housing 12 made of a suitable plastic or other insulating material, having spaced side walls 14 and 16, front wall 18, top wall 20 and bottom wall 22. An L-shaped metallic bracket 24 comprises leg 26 which defines a rear wall closure for the housing and leg 28 provided with conventional means for securing stop motion 10 to the knitting machine. Housing 12 includes an upper forwardly projecting portion 30, an intermediate forwardly projecting portion 32 and a lower forwardly projecting portion 34, all three being provided, respectively with aligned apertured yarn guides 36, 38 and 40, respectively. A pivot pin 42 is mounted for rotation within housing 12, being suitably supported for rotation in side walls 14 and 16 from which said pin projects outwardly to a slight extent. A U-shaped fly wire 44 comprising legs 46 and 48 terminates at one end with yarn guide 50 and at the other end in a pair of ears 52, 54 adapted to be removably secured to the opposite ends of pivot pin 42 which project outwardly of side

walls 14 and 16, respectively, a bushing 55 being provided between ear 52 and side wall 14 where it is slightly recessed. The projecting ends of pivot pin 42 are appropriately slotted as at 57 (FIG. 5) for receiving ears 54 and 52 whereby the fly wire and pin move in unison.

In the normal operating position of the stop motion, fly wire 44 is in a position wherein its yarn guide 50 is held in alignment with yarn guides 36, 38 and 40 by the yarn Y passing therethrough.

Pivot pin 42 mounts a cam 56 between end walls 14 and 16. As best shown in FIG. 5, cam 56 comprises opposite flanges 58 and 60, eccentric with respect to pin 42, and reduced diameter portion 62 extending between the flanges which may be hollow as shown. Such reduced diameter portion 62 is truncated as at 64—64 in a plane spaced from the axis of pivot pin 42 a small distance identified as X in FIG. 5c. Opposite ends 66, 68 of an endless tape are fixedly secured to portion 62 whereby to define a tape loop 70 which is wrapped about cam portion 62 from which it then depends. The depending end 72 of tape loop 70 is secured to one end of a spring 74, the other end of which is secured to a detent 76 which forms part of a rack member 78 adjustably secured to bracket 26. Bracket 26 also mounts a metallic strip 80 comprising an inwardly extending part 82 from which is struck out an angularly depending tongue 84. Metallic strip 80 is appropriately insulated from bracket 24 by means of insulating spacers 86 and is secured to bracket 80 by bolt 88 and nut 90. Stud 92 of bolt 88 extends outwardly of the housing and defines a suitable terminal in electrical conductivity with tongue 84. A lamp 96 is mounted in the bottom wall 22 of the housing and is connected at one terminal thereof, to L-shaped contact member 98 secured between rack 78 and metallic bracket 24, which is grounded. A conductor strip 100 is secured within the housing having its upper portion 102 in physical engagement with cam 54 and its lower portion 104 in engagement with the other terminal of lamp 96. From an electrical standpoint, therefore, cam 54 which is made of conductive material is in series with lamp 96 which is grounded.

When the stop motion is assembled by securement of bracket 24 to housing 12, with spring 74 having its opposite ends secured, respectively, to tape loop 72 and detent 76, the spring tension and the cam positioning are preselected so that the various elements occupy the positions shown in FIG. 2 and FIG. 5c when the stop motion is in normal operating condition, namely when fly wire 44 is restrained from movement by the yarn Y travelling through its guide 50 as well as aligned guides 36, 38 and 40 on the stop motion. In such condition, as best illustrated in FIGS. 2 and 5c, the torque transmitted by the spring, via tape 72, to pivot pin 42, cam 56 and fly wire 44, is at a minimum since the moment arm of the spring force, which is defined by the distance between the pivot pin axis and the point of contact of the tape with the cam is of the magnitude X, as best shown in FIG. 5c. Thus, during normal operation of the stop motion, the force transmitted by the fly wire to the yarn passing therethrough is at a minimum. In such normal operating condition, as shown in FIGS. 2, 3 and 5c, tongue 84 is spaced from the cam 56, and particularly flange 60 thereof with which it is aligned as best shown in FIG. 3. Upon breakage or running out of yarn Y, fly wire 44 is released from the restraint imposed thereon

by the yarn, enabling the spring to impart rotational movement to pivot pin 42, cam 56, and fly wire 44 in a clockwise direction viewing FIGS. 2 and 5c, whereby these assume the positions shown in FIGS. 4 and 5d. As such rotation progresses, it will be apparent that due to the cam effect, the moment arm of the spring force gradually increases from the minimal value X to the value X', thus imparting gradually increasing torque to the pivot pin and cam.

It will also be noted that such rotational movement will cause engagement of flange 60 of cam 56 with tongue 84, such engagement occurring at a point of maximum torque, establishing firm wiping engagement between flange 60 and tongue 84. Cam 56 and tongue 84 collectively define the stop motion switch which is thus seen to be firmly closed when fly wire 44 is released from its restraint due to the breakage or running out of yarn Y. The closing of such switch completes a circuit from ground to terminal 92 which is connected in conventional manner to a power pack operative to instantaneously interrupt the knitting machine drive. Simultaneously, the closing of such switch by completing said circuit to the power pack, energizes lamp 96 to provide a visual indication of the stop motion which has been activated.

The housing 12 is provided with opposed recessed facings 114, 116 defining shoulders 118 and 120 which define stops for legs 48 and 46 of the fly wire, respectively, when such fly wire is released from its restraint.

Thus, the utilization of the cam action for the fly wire biasing simultaneously achieves two highly desirable goals not existing in conventional stop motions of this type. First, it reduces to a minimal quantity the tension applied to the yarn by the fly wire during normal operation of the knitting machine. Secondly, upon yarn breakage, the fly wire rotates with increasing momentum to insure a prompter and firmer switch closing for interrupting the knitting machine drive. By contrast, in conventional stop motions of this type the fly wires apply maximum tension on the yarn during normal operation and, when released from restraint, the fly wire moves into switch closing position with reduced momentum. The movement of the fly wire with increased momentum when released from its restraint is particularly desirable where the stop motion is equipped with a yarn catcher 106 best shown in FIG. 1, which comprises a wire conformation terminating in a narrow gap 108 intended to retain the free end of the broken yarn in order to facilitate rethreading of the device. Such yarn catcher is far more likely to retain the yarn where the released fly wire moves with increasing momentum upon yarn breakage, to enable it to carry with it the yarn to be captured by the yarn catcher, as shown in FIG. 4.

In accordance with another aspect of the invention, there is provided a set screw 110 threaded through an aperture in upper wall 26 of the housing for engagement with metallic strip portion 82 as best shown in FIG. 3. By adjustment of set screw 110, strip portion 82 can be moved upwardly or downwardly to adjust the spacing between tongue 84 and cam 56. In this way, the point of contact between flange 60 and tongue 84 can be preselected to occur sooner or later, as may be desired, after yarn breakage. In this connection, it should be noted that metallic strip 80 which includes portion 82 and struck out tongue 84 are naturally resilient to

permit the adjustability thereof under the action of set screw 110.

As previously described, the bottom end of spring 74 is secured to detent 76 which forms part of a toothed rack member 78 best shown in FIGS. 2 and 6. A toothed wheel 112 rotatable externally by means of knob 115 enables vertical adjustment of rack 78 in order to adjust the tension of spring 74 as may be desired.

While there is herein shown and described the preferred embodiment of the invention, it will be understood that the invention may be embodied otherwise than as herein specifically illustrated or described, and that in the illustrated embodiment certain changes in the details of construction and in the form and arrangement of parts may be made without departing from the underlying idea or principles of this invention within the scope of the appended claims.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:

1. A stop motion for detecting the interruption of yarn travel therethrough, comprising,
 - a. a housing having yarn guide means,
 - b. a fly wire, having yarn guide means, mounted on said housing for pivotal movement relative thereto about an axis of rotation and adapted to be restrained in a first position in which the guide means thereof is in aligned relation with said housing guide means by the uninterrupted yarn travel through said aligned guide means,
 - c. means biasing said fly wire for pivotal movement away from said first position thereof whereby said fly wire assumes a second position when freed from its restraint in said first position in response to the interruption of said yarn travel, and
 - d. a cam member eccentrically mounted about said axis of rotation, said cam member being operatively related to said biasing means and to said fly wire whereby said biasing means applies minimal torque to said fly wire when it is in said first position thereof and progressively increasing torque thereto when said fly wire is freed from said restraint.
2. A stop motion in accordance with claim 1, wherein there is further provided a pivot pin co-axial with said axis of rotation to which said fly wire is secured for pivotal movement in unison therewith, and wherein said

cam member is carried by said pin.

3. A stop motion in accordance with claim 2, wherein said biasing means comprise tape means secured at one end thereof to said cam member and at the other end thereof to tension spring means whereby the spring force is transmitted to said cam member through said tape means.

4. A stop motion in accordance with claim 3, wherein the effective torque arm of said spring force upon said pin progressively increases when said fly wire moves from said first position thereof in response to the interruption of said yarn travel.

5. A stop motion in accordance with claim 1, wherein there is provided electrical switch means closed in response to the assumption by said fly wire of said second position thereof.

6. A stop motion in accordance with claim 4, wherein there is provided electrical switch means closed in response to the assumption by said fly wire of said second position thereof.

7. A stop motion in accordance with claim 6, wherein said switch means comprise an electrical contact member mounted on said housing and a surface portion of said cam member which wipingly engages said contact member as said fly wire pivotally moves away from said first position thereof when freed from said restraint.

8. A stop motion in accordance with claim 7, wherein there is provided adjustable means operatively related to said electrical contact member and adapted to vary the position of said electrical contact member for selectively controlling the point of engagement thereof with said cam member surface portion.

9. A stop motion in accordance with claim 5, wherein said switch means comprise a first electrical contact member mounted on said housing and a second electrical contact member movable in unison with said fly wire whereby said second contact member moves into engagement with said first contact member as said fly wire pivotally moves away from said first position thereof when freed from said restraint.

10. A stop motion in accordance with claim 9, wherein there is provided adjustable means operatively related to said first electrical contact member and adapted to vary the position of said first contact member for selectively controlling the point of engagement thereof with said second contact member.

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