Jan. 8, 1957 E. VOSSEN 2,777,026

BREAKAGE DETECTOR FOR YARN OR THE LIKE

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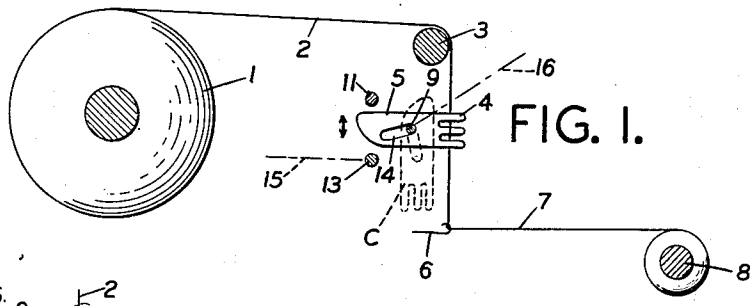

FIG. 1.

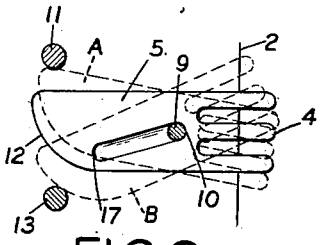

FIG. 2.

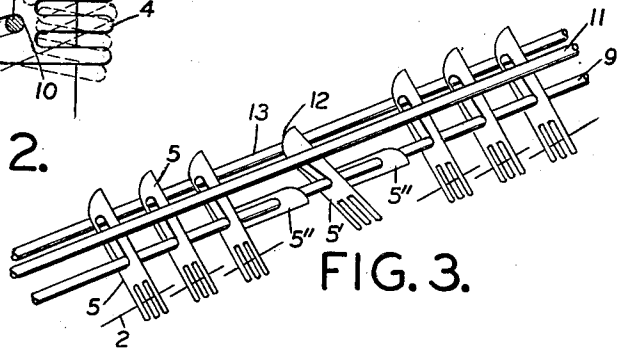

FIG. 3.

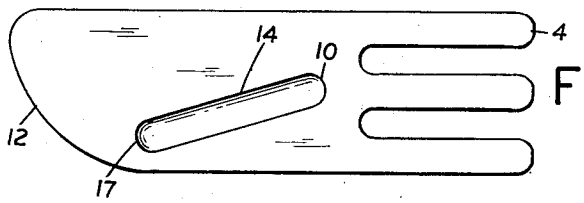

FIG. 4.

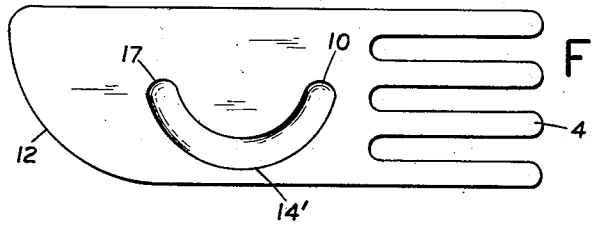

FIG. 5.

INVENTOR
EDWARD VOSSEN

BY Samuel Street

ATTORNEY

United States Patent Office

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BREAKAGE DETECTOR FOR YARN OR THE LIKE

Edward Vossen, Lynbrook, N. Y., assignor to Stop-Motion Devices Corp., Brooklyn, N. Y.

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9 Claims. (Cl. 200—61.18)

The present invention relates to the art of textile machinery and particularly concerns a novel device for detecting broken strands of yarn thread and the like.

In a textile manufacturing machine and the like particular difficulty is encountered in monitoring the individual strands of yarn or thread to detect instantly when breakage of the yarn occurs so as to stop the machine at once. The difficulty is intensified by the fact that from one thousand to four thousand strands of yarn are often aligned side by side in such a machine with only a few thousandths of an inch clearance between adjacent strands. The installation of a separate stop-motion mechanism for each strand of yarn in this limited space is so difficult as to be almost impossible. It has been known to employ certain types of U-shaped hooks in some stop-motion mechanisms. These hooks engage the individual strands. When a strand breaks, a hook drops to make an electrical contact which closes a stop-motion electrical circuit for the machine. The operation of the U-hook mechanism depends on the weight of the hook alone to cause it to drop. If the U-hook is too heavy and the yarn is very fine as is often the case, the weight of the hook breaks the yarn. If the U-hook is too light it often does not make positive electrical contact when it falls after the yarn breaks.

The present invention is intended to overcome all of the above disadvantages and difficulties. The present invention employs a relatively simple structure in the form of a suitably shaped and disposed breakage detector blade of the order of five thousandths (.005) of an inch in thickness. Blades of even less thickness may be used according to the invention. The blades are so thin that they may be readily disposed in the spaces between adjacent strands of yarn. The blade is adaptable to use on all types of cloth and textile manufacturing machines, among which may be mentioned those for knitting, weaving, and warping such as warp, tricot, Raschel, loom etc. The invention may also be used in machines employed to wind yarn in beams, rools, spools and the like. The invention is also usable in many other applications wherever it is necessary to determine breakage of a monitored filament of thread, yarn, wire, and the like.

The detector blade above mentioned operates on a counter-balancing principle. The blade is pivoted so as to make positive electrical contact with an element in a stop-motion circuit when a thread breaks. The blade is provided with a plurality of flexible projecting fingers through which one strand of yarn is threaded. The yarn may be threaded through one, two or more fingers depending on the frictional force required to counterbalance the weight of the blade. Since the blade is small and thin it may be positioned close to the working point. In a knitting machine it may be placed close to the needle receiving the yarn and fabricating the cloth so that maximum effective protection is obtained close to the cloth fabrication point. In winding spools of thread or coils of fine wire, the detector blade may be disposed close to the spools or coils. Provision is made in the

detector blade by means of a suitable slot to hold the blade in an inactive or offset position when necessary. This feature is very important since it is often required to deactivate one or more detector blades at certain times. In a cloth manufacturing machine when a cloth pattern is changed, such as when changing from a plain one thread by one thread (1 x 1) fabric to a complex, special, or fancy patterned fabric, very often not all the yarns in the machine will be used. If the unused detector blades which are free of yarn are not held in de-activated or offset position, the blades will operate the stop-motion mechanism and keep the machine inoperative. With the blade slotted as herein disclosed, the operator uses only as many blades as he uses strands of yarn, one blade for each strand, while the unused blades are held in a retracted position, dormant and out of the way until needed again. A stop bar is provided disposed parallel to a series of counterbalanced blades. The stop bar prevents the blades from overturning on their axes if too much friction is encountered by the blades from the strands of yarn. Each detector blade is mounted to pivot backwards when a thread or strand of yarn breaks. The detector blade then touches a metal element which is part of an electrical relay circuit. When the blade touches the element, the relay circuit closes which then operates a stop-motion mechanism to stop the machine.

It is therefore a principal object of the invention to provide a device for monitoring the movement of a filament to detect when breakage occurs.

It is a further object of the invention to provide a device including a detector blade counterbalanced to operate a stop-motion mechanism when a monitored filament of thread, yarn, or wire breaks.

It is another object of the invention to provide a filament breakage detector which may be de-activated or placed in an offset position when not in use.

Another object is to provide a device for detecting breakage of filaments which is so small in size that it occupies a space of the order of five thousandths of an inch in width.

Another object is to provide a yarn breakage detector blade having a plurality of projecting fingers through which the yarn may be threaded in such manner that the degree of friction between the blade and the yarn may be regulated.

Other and further objects of the invention will become readily apparent from the following detailed description taken together with the drawing wherein:

Fig. 1 is an elevational view of the invention showing the basic construction and manner of operation thereof.

Fig. 2 is a diagram showing further the manner of operation of the detector blade forming part of the invention.

Fig. 3 is a perspective view showing a plurality of detector blades as assembled for use, with spacing between the blades exaggerated to show clearly details of assembly.

Fig. 4 is an elevational view of one form of detector blade.

Fig. 5 is an elevational view of another form of detector blade.

In Fig. 1 is shown a roll or beam 1 of yarn or thread. The yarn 2 is drawn from the beam over an idler roller 3 down through the fingers 4 of the detector blade 5 to a needle 6. From the needle the yarn in the form of cloth 7 is wound up on the roller 8. The detector blade 5 is carried on a rod 9 as shown best in Fig. 3. The blade 5 is substantially rectangular in form with the greater mass of the material thereof on one side beyond the pivoting point 10.

In Fig. 2 is shown the manner in which the blade 5 pivots on the rod 9. As the yarn 2 moves downwardly

between the fingers the top edge of blade 5 contacts the stop rod 11 which prevents further rotation of the blade. This stop position shown by the dotted line A in Fig. 2. The blade 5 has a curved outer edge 12 which makes contact with an electrical circuit element in the form of an elongated rod 13 when the yarn 2 breaks, as shown by the dotted line B in Fig. 2. Thus as clearly shown in Fig. 2 the detector blade pivots on the rod 9 either upwardly or downwardly depending on the presence or absence of yarn 2 and also depending on the amount of friction encountered between yarn 2 and the fingers 4.

In Figs. 4 and 5 are shown two possible forms of detector blade with three and four fingers 4 respectively. In threading the yarn through the fingers the amount of friction between the yarn and the fingers will depend on the manner in which the yarn is threaded therethrough. In Figs. 1, 2 and 3 the yarn is shown threaded under and over alternate fingers. This is only one suggested form of threading. The particular threading required will depend on the nature of the thread, speed of movement, and other factors all of which will affect the degree of friction between the fingers and yarn and consequently the position of the blade with respect to stop rod 9 and contact rod 13. It is intended that the operator of the machine will adjust the threading to suit the particular frictional conditions encountered.

The arrangement for de-activating the detector blade is shown in Fig. 1. Slot 14 is rather elongated in form and extended from the pivot point 10 which is offset from the center of gravity of the blade outwardly toward the curved edge 12 to a point 17 also offset from the center of gravity of the blade. When the blade 5 is to be placed in an offset position, the fingers 4 are disengaged from the yarn so that the blade hangs freely downward from the pivot rod 9 as shown by the dotted line C in Fig. 1. When the blade 5 hangs downwardly in this position it is out of the way of yarn 2 and cannot contact the rod 13 to operate the stop mechanism. In Fig. 5 the slot 14' is in the form of an arc. This is an alternative form of slot made advisable by the greater width of the blade which here carries four fingers as compared with three fingers in Fig. 4. Of course more or less fingers may be provided as required and the spacing thereof will depend on the nature of the filaments to be threaded therethrough. The particular shape of the slot 14, 14' and its disposition in the blade will depend on the particular position in which the blade 5 is to hang when in the offset position. In all cases opposite ends of the slot will be offset from the center of gravity of the blade.

In Fig. 3 the spacing of the several blades is shown somewhat exaggerated to show assembly details. Blades 5 are all parallel with each other, monitoring the yarn 2 passing through the fingers thereof. The upper edges of the blades are close to or in contact with the stop rod 9. Blade 5' has detected a broken filament shown by the absence of yarn in the fingers thereof. Its curved end 12 is in contact with the rod 13 closing a stop-motion circuit (not shown). Blades 5'' are in an offset position and hang free of rods 11 and 13 from the pivot rod 9.

It will be noted that rods 9, 11 and 13 are all disposed parallel with each other. The blades 5 are all substantially flat and thin so that thousands of detector blades can be disposed in almost side-by-side relationship in a minimum of space. By the arrangement of the slots 14, the several blades can be disposed in a de-activated position as required. As an example, if a machine has a total capacity of 4400 strands of yarn and a piece of fancy fabric is being knitted requiring only 3800 strands of yarn, the operator retracts 600 detector blades to the dotted line C position of Fig. 1. Wherever a yarn strand is omitted the operator will place its corresponding detector blade in the offset position. The remaining blades alone will then be in position to operate the stop-motion mechanism. By this means the present invention is adaptable to use in tricot, warp, and Raschel knitting machines fabricating any desired pattern of textile.

The contact made by the curved ends 12 of the blades on the rod 13 closes an electrical relay circuit of which a portion is represented by dotted lines 15—16 in Fig. 1. In this relay circuit only a minute electrical current flows. There is no sparking or arcing because of the low current involved. The electrical current is relayed through a conventional vacuum tube amplifier which steps it up to operate a conventional stop-motion controller which opens a switch in the power supply circuit of a motor driving the machine, to stop the machine. The vacuum tube amplifier can be omitted and the relay can be arranged to operate the stop-motion controller directly. Instead of a conventional stop-motion controller, an electromagnet may be employed on or in the motor control switch box associated with the drive motor of the machine. The electromagnet is operated by the relay in the detector blade circuit and serves to open the switch in the power supply circuit of the motor to stop the machine. As a further alternative a controller or electromagnet may be installed on the machine which will exert a pull on the operating bar of the machine causing it to stop.

It should be understood the particular machine stopping arrangement used is not considered part of the present invention apart from the detector blade-contact element circuit included between the electrical connections 15, 16 indicated in Fig. 1. Many alternative stop-motion arrangements are possible other than those mentioned above, each of which is to be associated in one way or another with the dectetor blade circuit and is to operate directly or indirectly thereby. Many stop-motion mechanisms and suitable control circuits are known to those skilled in the art so that suitable stop-motion arrangements to operate with the detector blade circuit herein disclosed may be readily devised.

A limited number of modifications of the invention have been herein disclosed but it is not desired that the invention be restricted thereto since many changes and modifications are possible. The invention is deemed to be co-extensive with such changes and modifications and with equivalents thereof provided that they are encompassed within the scope of the following claims for which it is desired to obtain United States Letters Patent.

I claim:

1. A device for detecting broken yarn and the like, comprising a thin, flat blade, at least three spaced fingers extending longitudinally from said blade at one end thereof, said fingers being in a common plane with each other and with said blade and being adapted to be inter-threaded with yarn and to frictionally engage the inter-threaded yarn when said yarn is pulled relatively taut, said blade having a slot formed therein to enable the blade to be mounted on a rod for pivotal movement about the axis of said rod and for slidable movement along the axis of said slot.

2. A device in accordance with claim 1, wherein the opposite sides of the slot are curved in parallel relation to each other.

3. A device in accordance with claim 1, wherein the blade and its said fingers are integral with each other, being stamped out of a single metal sheet which is approximately five-thousandths of an inch in thickness.

4. In a textile making machine or the like, a device for detecting a broken filament, comprising a flat, thin blade having at least three spaced fingers formed at one end thereof and occupying a substantially common plane, said fingers being adapted to be inter-threaded with a filament and to frictionally engage said inter-threaded filament when it is pulled relatively taut, means pivotally supporting the blade and an electrical contact element situated adjacent said blade, said blade being pivotally movable in one direction out of engagement with said electrical contact element when its inter-threaded filament is pulled in taut condition in the same direction,

said blade being pivotally movable in the opposite direction into engagement with said electrical contact element when said inter-threaded filament breaks and is no longer pulled in said first mentioned direction.

5. In a textile making machine or the like, a device for detecting broken filaments, comprising a horizontally extending rod, a plurality of thin blades rotatably supported on said rod in parallel relation to each other, each said blade having a slot formed therein through which the rod extends, said slot extending between two points which are offset from the center of gravity of the blade, one on one side thereof and the other on the opposite side thereof, a second horizontal rod situated adjacent the first rod in parallel relation thereto and a third horizontal rod situated adjacent the first two horizontal rods in parallel relation thereto, the second and third rods being spaced from each other, one end of each blade projecting between said second and third rods and being pivotally movable on the first rod into and out of engagement with said second and third rods, said second rod constituting an electrical contact member and said third rod constituting a stop member to limit the pivotal movement of each said blade in the opposite direction from the second rod, each said blade being provided with at least three spaced fingers for frictionally engaging a filament when it is threaded between them and pulled relatively taut, whereby the blade is pivotally swung in one direction toward the third rod, the blade being pivotally movable in the opposite direction into engagement with the second rod when the filament breaks and is no longer pulled taut against said fingers.

6. In a knitting machine, a device for detecting a broken thread, said device comprising a flat, thin blade, a plurality of spaced fingers formed at one end of said blade in a common plane therewith, a hole formed in said blade, said blade being heavier on one side of said hole than on the other side, a rod extending through said hole and pivotally supporting said blade, the heavier end of the blade tending to drop and the lighter end of the blade tending to rise about the pivotal axis of said blade, said blade fingers being adapted to receive a thread threaded therebetween, said thread being pulled through said knitting machine in the normal operation of said machine and being thereby drawn through said fingers and exerting a frictional pull on said fingers, the direction of movement of said thread being such that the pull upon the fingers opposes the pivotal movement of the blade by reason of its two ends being of unequal weight, a stop member situated adjacent one end of said blade to limit the extent of pivotal movement of the blade under the influence of the thread being pulled through its said fingers, and a second stop member situated adjacent said blade and serving to limit the pivotal movement of the blade in the opposite direction resulting from the unequal weight of its two ends, said rod about which the blade pivots, said second stop member and said blade being all made of electrically conductive material and being all included within a stop motion circuit, said circuit being open when the blade is out of engagement with the second stop member and being closed when the blade is in engagement with said second stop member.

7. A device in accordance with claim 1, wherein the slot is formed between two points in the body of said blade, one being offset from the center of gravity of said blade on one side thereof and the other being offset from said center of gravity on the opposite side thereof.

8. In a textile making machine in accordance with claim 4, wherein the blade is pivotally supported by said means at a point offset from the center of gravity of said blade, said blade being adapted to fall in said opposite direction into engagement with said electrical contact element in response to the attraction of gravity thereon when the inter-threaded element breaks.

9. A device for detecting slack or broken yarn, comprising a support, a blade movably mounted on said support, said blade being movable on said support between two positions, electrical contacting means engageable with said blade in one of said positions, and at least three fingers projecting from said blade in spaced relation to each other, said fingers being adapted to be inter-threaded with yarn in such manner that when the yarn is pulled relatively taut, said fingers are frictionally engaged by the yarn and said blade is caused to move into said second position and out of engagement with said electrical contacting means.

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