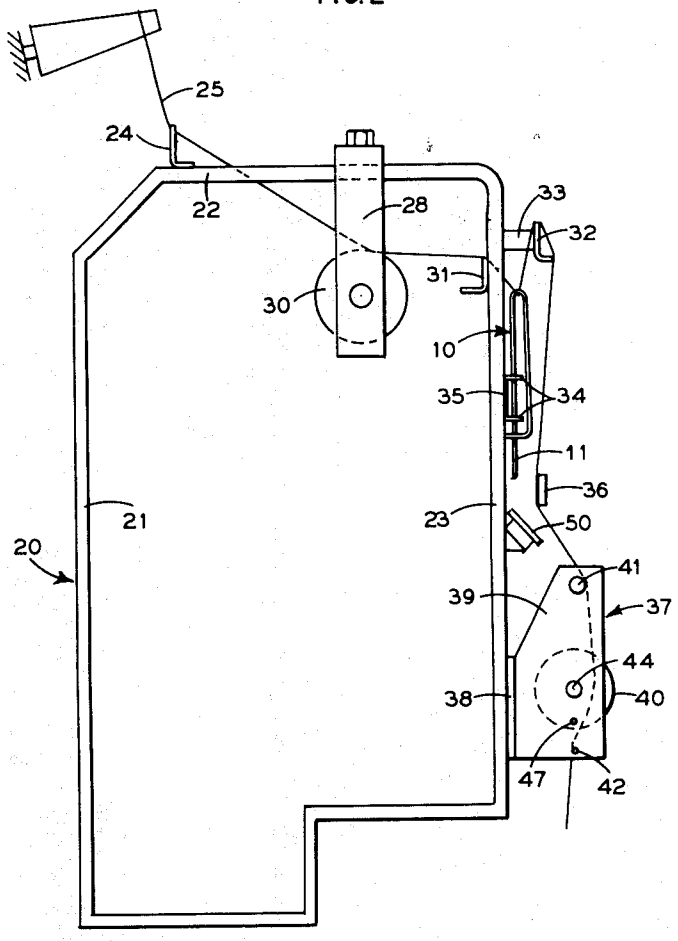
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THREAD OR YARN BREAKAGE DETECTOR

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FIG. 2



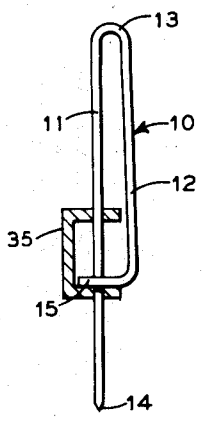


FIG. 1

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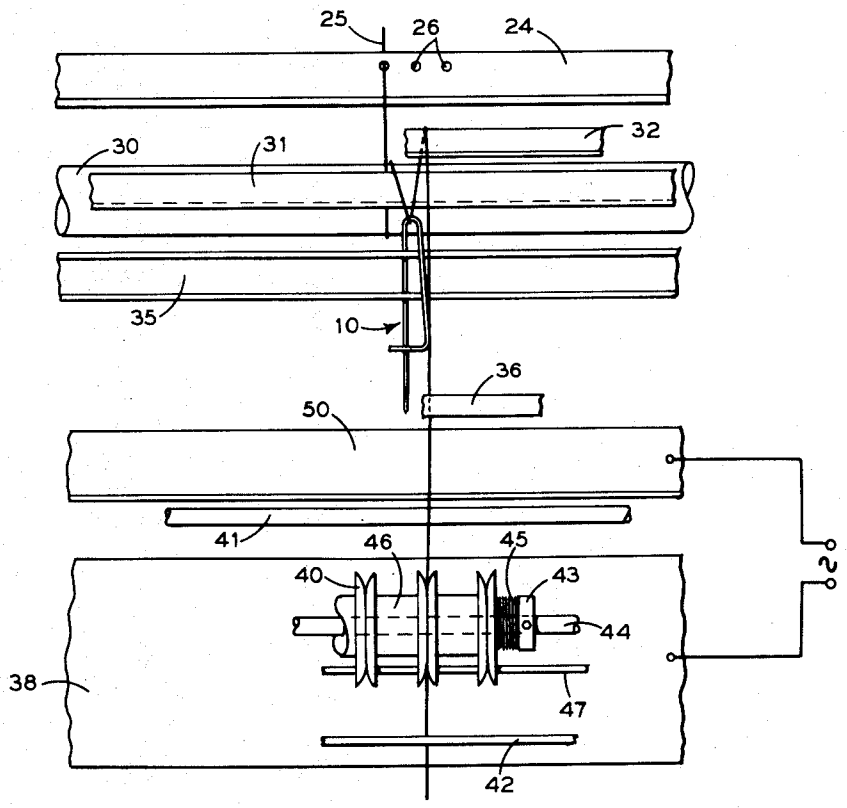
ATTORNEY

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THREAD OR YARN BREAKAGE DETECTOR

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FIG. 3



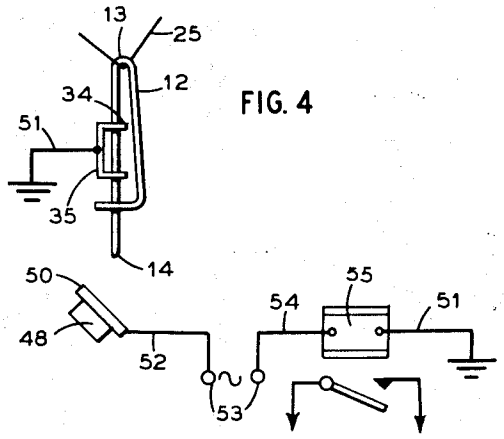


FIG. 4

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THREAD OR YARN BREAKAGE DETECTOR

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4 Claims. (Cl. 200—61.18)

This invention relates to thread or yarn breakage detectors effective to stop operation of fabric manufacturing or processing apparatus responsive to breakage of a thread. More particularly, it relates to an improved detector having a positive control action, not requiring manual attention, and simple and inexpensive to manufacture, install, and replace.

In the manufacture of fabric, as by knitting and weaving, and in the processing of fabric, such as in the sewing of patterned quilting, breakage of a thread, if undetected immediately, can result in spoilage of many yards of the finished product. This is particularly true in the case of high speed fabric manufacturing and processing machinery.

For this reason, many automatic devices have been proposed, and some used, to stop the operation of knitting, weaving, or sewing apparatus immediately upon breakage of a thread. However, known and used devices have been so unreliable in operation as to require constant manual supervision and attention. Most of these devices include oscillatable fingers or the like in engagement with the thread or yarn, and arranged to swing upon breakage of the thread or yarn. This swinging, if of a sufficient predetermined amplitude, operates a switch, in a control circuit for the machinery, to interrupt the power supply to the driving means, such as an electric motor.

One of the factors resulting in malfunctioning of these devices has been the accumulation of dust and lint on the apparatus, this accumulation blocking or hindering proper operation of detectors of the oscillating type. In addition to their susceptibility to malfunctioning in the normal atmosphere of a machine using thread or yarn, known detectors have neither been easily replaceable nor easily "cut out" when their controlled threads or yarn are not in use, or when no yarn or thread is fed at their particular location.

To avoid the foregoing difficulties and to provide a positive and reliable detecting action, the breakage detector of the present invention includes a circuit closer mounted for vertical reciprocation under the force of gravity. This circuit closer is constructed to have the thread or yarn pass freely therethrough with a very large clearance and, in effect, rides on a depending loop of thread which, when the unbroken thread is under feeding tension, restrains the circuit closer against downward movement by gravity.

The circuit closer is slidably mounted, for vertical reciprocation, in an electrically conductive metal component included in series in a control circuit for the driving motor of the machine. At a distance below the lower end of the circuit closer, but well within the range of vertical movement thereof, there is a second electrically conductive metal component, the two components being electrically isolated from each other. This second component is also in series in the control circuit, and the latter is open when the circuit closer is in its upper position. Should the thread or yarn break, the circuit closer drops to engage the second conductive component to bridge the gap in, and close, the control circuit.

In a preferred embodiment, the circuit closer is a relatively elongated piece of relatively heavy copper or brass well bent to provide a relatively long leg and a relatively short leg extending downwardly from a bight to form a wide loop through which the thread is passed. The lower end of the shorter leg is bent crosswise to extend across

the longer leg at a distance above the lower, preferably pointed end of the latter.

A generally channel shape electrically conductive metal bracket is secured in direct contact with a vertical surface of the machine, and the flanges of the bracket are formed with vertically aligned apertures each pair of which is vertically aligned with a thread feed. The longer leg of the circuit closer is inserted through a pair of vertically aligned apertures after passing a thread between the two legs into the bight. The width of the channel is such as to provide for a fairly wide range of vertical movement of the bent wire, with the cross bar below the lower flange of the channel.

Below the channel, an elongated strip of dielectric is supported on the vertical surface of the machine and its upper surface slopes downwardly and outwardly. This surface supports an elongated brass or copper bar aligned with the pointed ends of the row of bent wire detectors. One terminal of a control relay is connected to ground and the other terminal is connected to one side of a source of potential. The other terminal of the source is connected to the upper bar. Thus, when any thread breaks, its wire loop detector drops to contact the copper or brass bar with its pointed end, thus closing the relay circuit which latter, in turn, deenergizes the driving motor.

It will be noted that the wire loops may be simply and easily replaced. To take a detector out of action, its legs are spread and the detector is moved upwardly until its cross bar is above the lower flange of the outwardly facing channel. The cross bar, resting on this flange, holds the detector out of contact with the copper or brass bar even when the detector is not biased upwardly by a tensioned thread or yarn extending therethrough.

For an understanding of the invention principles, reference is made to the following description of a typical embodiment thereof as illustrated in the accompanying drawing. In the drawing:

FIG. 1 is a side elevation view of the breakage detector or circuit closer;

FIG. 2 is a side elevation view of quilting apparatus utilizing the thread breakage detector of FIG. 1;

FIG. 3 is a front elevation view of the apparatus; and

FIG. 4 is a schematic wiring diagram of the control circuit.

In the drawings, the invention is illustrated as used to detect thread breakage on sewing apparatus for forming quilting with pre-determined stitching patterns. It should be understood that this illustration is merely exemplary, as the invention may be applied to detect thread or yarn breakage in any type of machinery utilizing thread or yarn, such as knitting machines, looms, sewing machines, and the like.

Referring to FIG. 1, the detector or circuit closer **10** comprises an elongated piece of relatively heavy gauge copper or brass wire bent to form an elongated relatively wide loop. A longer leg **11** and a shorter leg **12** extend from a bight **13**, and leg **11** is preferably pointed as at **14**. The end of leg **12** is bent at substantially right angles thereto to form a cross bar **15** extending across and projecting beyond leg **11** at a distance above its lower pointed end **14**.

Referring to FIGS. 2 and 3, the frame **20** of a quilting machine comprises rear uprights **21**, top cross members **22**, and front uprights **23**. An angle **24** extends across members **22** and is formed with apertures **26**, at each thread feed, through which are passed threads **25** from supplies thereof on rotatably supported cones **27**. A roller **30**, having a rubberized surface, is rotatably mounted in brackets **28** secured to members **22**. The threads **25** extend for one complete turn around roller **30**, and are then drawn substantially horizontally over the upper edge of an angle **31** on uprights **23**. Above angle **31**, a

second angle 32 is supported on uprights 23 by brackets or spacers 33.

Below angle 31, a channel 35 of electrically conductive metal is secured in direct contact with the uprights 23 with its flanges 34 extending outwardly. These flanges are formed with vertically aligned apertures, each pair of apertures slidably receiving the leg 11 of a detector loop 10, leg 12 being disposed outside the flanges. Each thread 25, after passing over angle 31, is slipped into a detector 10 and extended over angle 32.

The threads are then led downwardly inside of a bar 36 and through a thread tensioning device 37. Device 37 comprises a mounting plate 38 secured to uprights 23 and a pair of end plates 39. A rod 41 extends between the upper ends of plates 39, and a rod 42 extends beneath the lower ends of these plates. A shaft 44 extends between the central areas of plates 39 and supports paired tension disks 40 separated by bushings 46.

The disks 40 of each pair are biased toward each other by a coil spring 45 embracing shaft 44 and engaged between a pair of disks 40 and a collar 43 secured to shaft 44. A thin rod 47 extends through disks 40 to prevent the latter from rotating.

Threads 25 are brought outside rod 41, through the associated pair of disks 40, and inside rod 42. From here the threads go to the stitching needles.

Somewhat below bar 36, a dielectric bar 48 is supported on uprights 23, with its upper face sloping downwardly and outwardly. A copper or brass bar 50 extends along and is anchored to dielectric bar 48 and is aligned beneath the pointed ends of detectors 10.

Referring to FIG. 4, frame 20 may be grounded or else have a conductor 51 secured thereto. A second conductor 52 is secured to bar 50. Conductor 52 is connected to one terminal of a potential source 53, and the other terminal of the latter is connected to one terminal of a control relay 55 by a conductor 54. The other relay terminal either is grounded or connected to frame 20 by conductor 51.

In operation, when a thread 25 is under proper feeding tension, it constrains its associated detector 10 upwardly so that end 14 of the latter is spaced from the surface of sloping bar 50. Should the thread break, loop 10 drops and engages bar 50 to close the energizing circuit of control relay 55. In a manner not shown, relay 50 stops the motive power of the machine. As point 14 engages bar 50, loop 10 is canted due to the sloping surface of the bar, thus wedging leg 11 into firm engagement with the metal of flanges 34 around the apertures therein. This assures a firm closure of the relay circuit.

To take a detector 10 out of action, it is merely necessary to spread legs 11 and 12 sufficiently for cross bar 15 to clear lower flange 34. The end of cross bar 15 will then rest on lower flange 34 to hold loop 10 out of contact with bar 50. Loops 10 are easily removed and replaced in a similar manner and, due to their relatively free movement in their guiding apertures, are not susceptible to malfunctioning due to dust and lint accumulations. All operable parts of the arrangement are easily cleaned or replaced.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the invention principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. For use in apparatus including a metal frame supporting thread or yarn guiding and tensioning means, a thread or yarn breakage detector comprising, in combination, a first conductive metal member mounted on said frame and formed with vertically extending aperture means; a relatively elongated conductive metal circuit closer slidably mounted for free vertical movement in said aperture means, said circuit closer having a relatively large opening in its upper portion to receive a depending loop of thread; the thread, when under tension, restraining said circuit closer against downward movement through said aperture means under the influence of gravity; and a second conductive metal member mounted on said frame below said first member and having a surface positioned for engagement by the lower end of said circuit closer, while the latter is still engaged in said aperture means, only when said thread breaks; said members being electrically isolated from each other, and said members and said circuit closer being connected in series with each other and with a source of potential in a normally open control circuit; said surface of said second member sloping downwardly and outwardly.

2. For use in apparatus including a metal frame supporting thread or yarn guiding and tensioning means, a thread or yarn breakage detector comprising, in combination, a first conductive metal member mounted on said frame and formed with vertically extending aperture means; a relatively elongated conductive metal circuit closer slidably mounted for a free vertical movement in said aperture means, said circuit closer having a relatively large opening in its upper portion to receive a depending loop of thread; the thread, when under tension, restraining said circuit closer against downward movement through said aperture means under the influence of gravity; and a second conductive metal member mounted on said frame below said first member and having a surface positioned for engagement by the lower end of said circuit closer, while the latter is still engaged in said aperture means, only when said thread breaks; said members being electrically isolated from each other, and said member and said circuit closer being connected in series with each other and with a source of potential in a normally open control circuit; said first member being an outwardly facing substantially horizontal channel having a pair of aligned apertures in its flanges constituting said aperture means.

3. A detector as claimed in claim 2 in which said circuit closer comprises a loop of conductive metal wire including a relatively long leg and a relatively short leg extending downwardly in laterally spaced relation from a bight at the upper end of the loop forming such opening, the relatively long leg extending through said aperture means; and a cross bar extending from the lower end of the relatively shorter leg across the relatively longer leg, below said first member in the operative position of said closer; said first member being an outwardly facing substantially horizontal channel having a pair of aligned apertures in its flanges constituting said aperture means; and said surface of said second member sloping downwardly and outwardly; said closer being rendered inoperative by spreading said legs to move said cross bar to engage the upper surface of the lower flange of the channel.

4. A detector as claimed in claim 3 in which said channel is in metal-to-metal contact with the apparatus frame; and a dielectric mounting member supporting said second member on said frame.

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