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AUTOMATIC STOP DEVICE FOR MULTI-NEEDLE SEWING MACHINES

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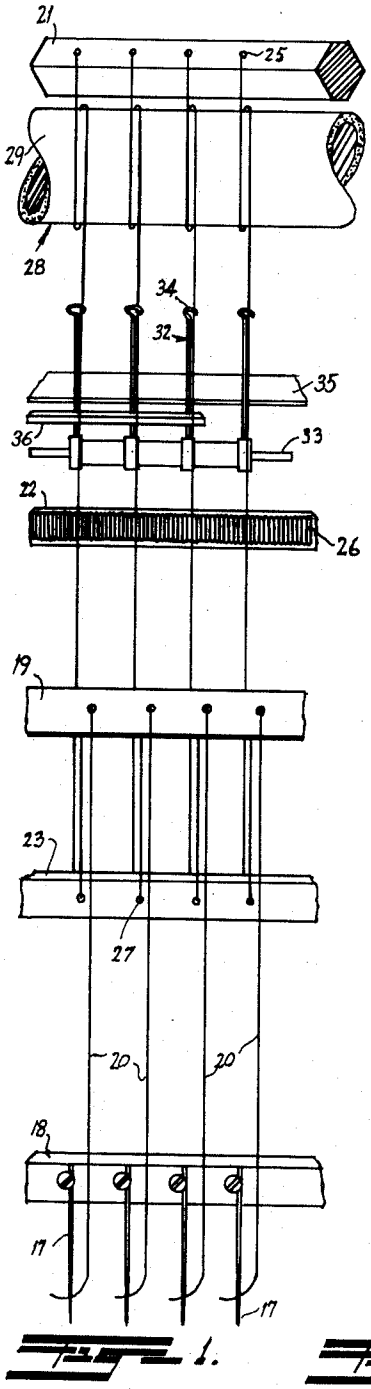

Fig. 1.

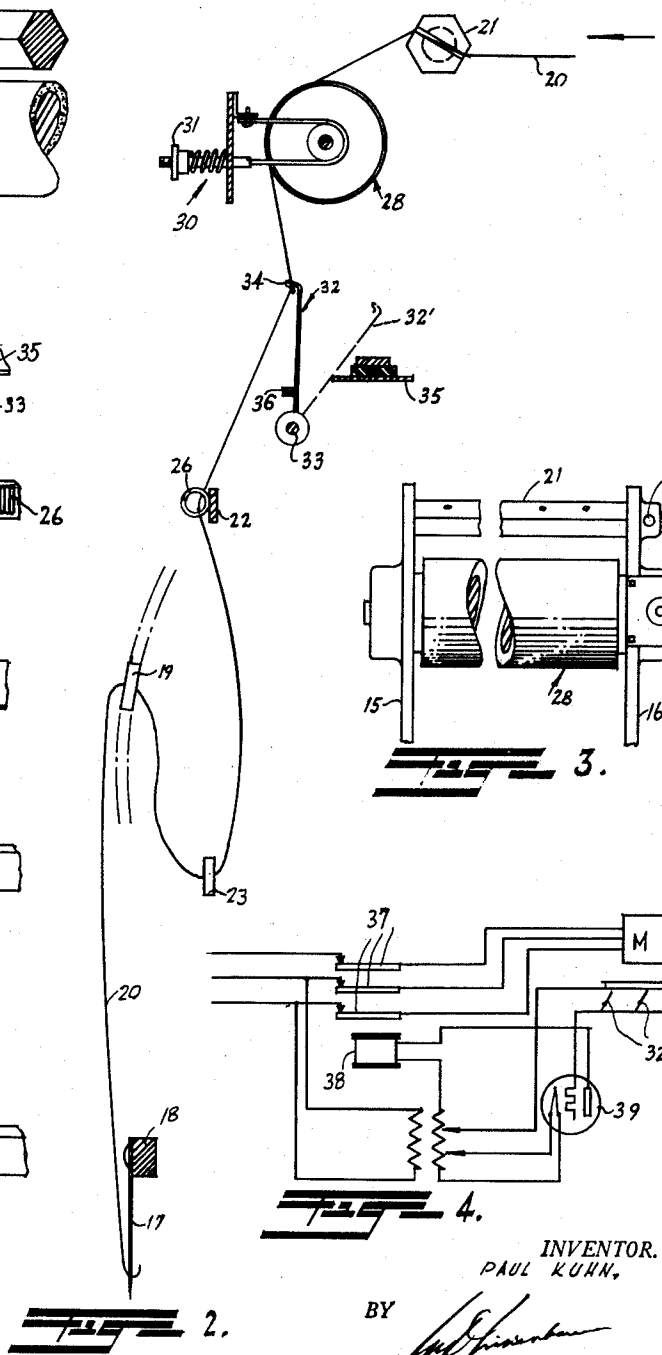

Fig. 2.

Fig. 3.

Fig. 4.

INVENTOR.
PAUL KUHN,
BY
ATTORNEY

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AUTOMATIC STOP DEVICE FOR MULTI-NEEDLE SEWING MACHINES

Paul Kuhn, Waldwick, N.J., assignor to Pathe Equipment Company, Inc., East Paterson, N.J., a corporation of New York

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The present invention relates to improved means for automatically stopping the operation of power-driven multi-needle sewing machines upon the breaking of a thread, and more particularly to the type where all needle threads are maintained in tension along a section of their run where each thread cooperates with a sensing element which moves upon the breaking of its associated single thread, to a position where such element causes the actuation of an electrical circuit accomplishing cut-off of the power supply.

In apparatus of this kind as heretofore employed, an intact thread which has merely become loose, would cause the machine to be stopped though the machine could continue to function properly if allowed to run.

It is therefore the principal object of this invention to provide a novel and improved automatic stopping apparatus of the character mentioned in which any threads which have begun to loosen, will be automatically caused to quickly assume their required tension for proper working of said apparatus, meaning, the machine will stop only when a thread breaks and not otherwise.

In apparatus of this kind as heretofore employed, many of the threads in the tensed portion of their run would loosen some, while the others would remain "tight." You would then have a condition where tension as to all the threads would not be uniform. This condition would prevail especially when the threads were of different size or material and would occur even if all the threads were of the same material and size. Provision for individual adjustment of the tension in all the threads is of course impractical because of the multiplicity of threads and their close spacing apart. A multiplicity of different tensions causes the sensing elements to have sways of different scope and frequency. Since some degree of sway is unavoidable, it is at least desirable that the sway of all the sensing elements should be nearly equal so that the operator could know that the tension in the threads is about uniform. He could then judge how and when to adjust a usual single device for simultaneously adjusting the tension in all the threads.

It is therefore another object of this invention to provide a novel and improved automatic stopping apparatus of the character described, which will automatically equalize the tensions in all the threads to the tension existing in the tight threads while the machine is operating. When this is accomplished, it is evident that the sway of all the sensing elements will be about uniform and the operator can then make a single adjustment to simultaneously adjust the tension in all the threads to be looser or tighter as need be; the extent of sensing element sway, being his guide as to the tension existing in the threads at any time.

A further object of this invention is to provide a novel and improved automatic stopping apparatus of the type described, which can be easily incorporated into existing multi-needle sewing machines, and which apparatus is simple in construction, reasonable in cost and efficient in carrying out the purposes for which it is designed.

Other objects and advantages will become apparent as this disclosure proceeds.

For the practice of this invention, one form it may assume, is to have spaced first and second members positioned on the machine, in a direction across the threads and perpendicular to their line of movement. These first and second members are arranged between the thread supply spools and the thread take-up bar; the first of these members being the one nearest the supply spools. This first member may consist of a bar journalled on the frame with provision to fix it against rotary movement. This bar has a series of parallel holes through it transversely, spaced from each other as the threads should be. The threads are passed through these holes respectively and then wound once similarly around a freely rotatable roller between said first and second members; said roller having an outer sleeve of hard-rough or of resilient material. Each thread then engages a gravity-swingable sensing element, then is frictionally engaged by for instance the turns of a coil spring along the second member, thence through a fixed eye, then through the take-up bar and finally threaded through a needle in its line. All the sensing elements are of metal, identical in construction, and arranged on a common swing axis, and extend upwardly, so that upon the breaking of a thread, its associated sensing element will fall and make contact with a metal bar across the machine, to act as an electrical switch for the power control circuit. A hand brake is provided to control the rubber-covered freely turnable roller aforesaid.

In the accompanying drawing forming part of this specification, similar characters of reference indicate corresponding parts in all the views.

FIG. 1 is a fragmentary diagrammatic front view of a multi-needle sewing machine equipped with an automatic stopping device in accordance with the teachings of this invention.

FIG. 2 is a side view of FIG. 1 and shows the brake.

FIG. 3 shows but a part of FIG. 1, and includes portions of the machine frame showing the brake positioned thereon.

FIG. 4 is a diagram of the electrical circuit which is controlled by each of the sensing elements.

In the drawing showing a preferred form of this invention, the numerals **15**, **16** denote the side frames of a multi-needle sewing machine whose needles **17** extend downwardly from a vertically reciprocatable horizontally positioned needle bar **18**. The numeral **19** designates the machine's take-up bar which serves all the needles, is positioned horizontally and moves up and down in proper timed relation to the movement of the needle bar as is well known. Each thread is indicated by the numeral **20**.

The threads come off supply spools not shown, and are frictionally engaged on the spaced horizontal bars **21** and **22** which are across the frames **15**, **16** of the machine, between the supply spools and the thread guide bar **23**; the latter being a usual appertenance of the machine. The bar **21** is journalled on the frame and may be fixed against turning by means of the knobbed set screw **24**. This bar **21** has a series of holes **25** transversely therethrough in spaced relation as the threads should be. Of course, not all of these holes may be utilized in any given use the machine is set for. Certain work, for instance, may require threads only through alternate holes **25**. Other work, may call for a different arrangement as is well known in this art. The bar **22** has a closely wound coil spring **26** therealong. The bar **23** has a series of transverse holes **27** therethrough which are spaced as the threads should be and in line with the holes **25** respectively. Near and along the bar **21**, there is a freely turning roller **28** having a hard-rough or resilient sleeve covering **29** thereon. This roller is provided with an adjustable brake device indicated generally by the numeral **30** and manipulated by means of the turn knob **31**.

Intermediate the roller **28** and the bar **22**, for each

thread 20, there is a sensing element 32 which may be a substantially uprightly positioned wire, swingably mounted on a rod 33 and formed at its upper end with a thread engaging eye 34. When the machine is in operation and each sensing element engages a thread, such sensing element is sloped so that in the event a thread breaks, its associated sensing element will "fall" by swinging down part of a turn to contact a copper bar 35 which is fixed across the machine and insulated therefrom. The sensing elements are of metal and so is their common axis rod 33. It is evident that the bar 35 is one contact of an electrical switch and any sensing element is the other, so that upon their contact, the electrical system shown in FIG. 4 becomes actuated as will be explained.

Each thread 20 coming off the supply spools, is threaded through a hole 25, then wound at least once around the roller 28, then through the sensing element's eye 34, thence set between adjacent turns of the coil spring 26 where it is frictionally engaged, thence through a guide hole 27 in the bar 23, then threaded through a hole in the take-up bar 19 and finally threaded through a needle 17. Said threads are mounted as mentioned so that they are parallel.

The turns 20' of the threads 20 around the roller 28, are all wound in the same direction thereabout and grip said roller. Adjustment of the bar 21 will alter the tension of all the threads simultaneously, in the portions thereof which are between said tension-adjustment bar and the coil spring 26. Any looseness in the threads between the needles 17 and said coil spring, will not effect the tension in any of the threads in the region where tension reigns, because such coil spring 26, due to its frictional hold, acts as a stop which prevents the threads from "going back." Of course, the extent of such hold does not resist the necessary pulling of the threads to the needles by action of the take-up bar 19.

When all the threads are mounted as mentioned, engaged as shown in FIG. 2, they are then pulled by hand downwardly immediately below the coil spring 26, so that all the sensing elements 32 just touch the fixed stop bar 36. The operator then runs the machine and adjusts the bar 21 and the brake 30 until the sensing elements have a slight sway in order to avoid an excessive tension in the threads as might occur if said elements stand motion-less against the bar 36. The brake 30 causes retardation of the roller 28 to avoid any undue fly-wheel effect; it being intended that the turning of said roller shall be caused by its engagement with the running threads on it.

It is evident that if during operation of the machine any thread 20 should break, that its associated sensing element 32 will be released and will fall to the position indicated by the numeral 32' where it contacts the bar 35. As shown in FIG. 4, the power circuit of the electric motor 36 driving the sewing machine, comprises the normally closed switches 37 which when opened by actuation of the solenoid 38, shuts off the motor. Said solenoid forms part of an open electric circuit suitably connected to the motor power circuit which also includes a vacuum tube relay 39 for energizing said solenoid 38 when such open circuit is closed by the switch formed by said contact bar 35 and any of the sensing elements 32. It is evident that upon the breaking or failure of any of the needle threads 20, such switch will close, whereupon the motor power circuit will open and the machine would be stopped.

It is also to be noted that upon any failure occurring in a shuttle thread, not shown, its associated needle thread 20 will loosen between the roller 28 and the coil spring friction means 26, because the length of the needle thread laid atop the running work when the shuttle thread breaks, is less than the needle thread consumed to effect a lock stitch seam along a similar length of run of the work. The occurrence of such looseness in the needle thread will of course cause the associated sensing element 32 to fall and thereby close the solenoid circuit, whereupon the machine will stop.

Of importance to note is the action of the threads 20 on the roller 28 and vice versa. Said roller being freely rotatably mounted, will be driven by the turns of the threads 20 which grip it, but should there occur any looseness in any of such threads in their portions which are between the tension adjusting bar 21 and the frictional engaging spring coil 26, the turns thereof about said roller will also loosen. If the extent of such looseness in any of the threads which have become loose, should be permitted to increase, then their associated sensing elements 32 may become sufficiently released to move into contact with the bar 35, whereupon the machine would stop though such loosened threads remain whole. This is avoided by the roller 28 which immediately acts on any loosened threads about it, by causing a drag thereon causing them to tighten themselves thereabout again. The action of the take-up bar 19 on such specially acted on threads, pulls them to become taut again in their portions which are between the roller 28 and the spring coil 26, and thus the tensions in all the threads 20 become automatically equalized.

This invention is capable of numerous forms and various applications without departing from the essential features herein disclosed. It is therefor intended and desired that the embodiment shown herein shall be deemed illustrative and not restrictive and that the patent shall cover all patentable novelty herein set forth; reference being had to the following claims rather than to the specific description herein to indicate the scope of this invention.

I claim:

1. In combination with a motor-driven multi-needle sewing machine having threads threaded through a plurality of its needles and including a take-up means to pull the threads towards the needles in a predetermined phase of each stitching cycle, a thread-engaging means constantly frictionally engaging all the threads at a region thereof before the threads reach the take-up means, means to adjust the tension in all the threads, constantly frictionally engaging all the threads at a region thereof before the threads reach the first-mentioned thread-engaging means, a freely rotatable roller positioned in a direction across all the threads between said thread-engaging means and the thread-tensioning means; each of said threads being wound a predetermined extent on said roller whereby movement of tensioned threads thereon will cause said roller to rotate; said roller having no external supply of power and being rotated only by the force applied by the threads; the peripheral surface material of said roller being of the character that it will frictionally drag along with it the portions of loosened threads in contact therewith, an electrically conductive member positioned in the direction across and spaced from the threads, sensing elements mounted for automatic movement to come in contact with said electrically conductive member; at least those parts of said sensing elements which come into contact with said electrically conductive member, being electrically conductive and electrically connected to each other; each thread being normally in sliding engagement with one of the sensing elements respectively in a region of the thread which is between the first-mentioned thread-engaging means and said roller and each sensing element when so engaged, being away from said electrically conductive member; the conductive parts of said sensing elements and the said electrically conductive member constituting an electrical switch, a normally open electrical circuit controlled by said switch and means effective upon the closing of such circuit to stop the motor.

2. An apparatus as defined in claim 1, including a brake means controlling the roller; said brake means being adjustable to alter its retarding action on said roller.

3. An apparatus as defined in claim 1, wherein the first-mentioned thread-engaging means is a coil spring; each of the threads being engaged between successive turns of said coil spring.

4. An apparatus as defined in claim 1, wherein the thread tensioning means constitutes a single bar which is journalled for rotation about its longitudinal axis; said bar being transversely perforated; the threads being threaded through such bar and means to fix said bar against turning from any desired set position.

5. An apparatus as defined in claim 1, wherein all the threads are wound on the roller at least to the extent of the major portion of one turn thereabout.

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