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[54] **BOBBIN RUNOUT SIGNALLING DEVICE**

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[52] **U.S. Cl.** ..... **112/219 R**

[51] **Int. Cl.** **D05b 69/36**

[58] **Field of Search** ..... 112/219 R, 218 R, 112/219 A, 220; 200/61.18

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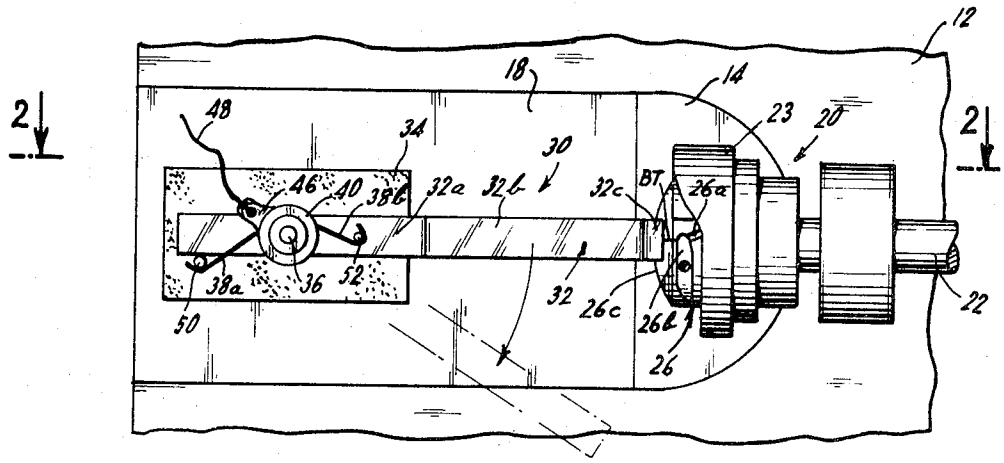
Primary Examiner—H. Hampton Hunter

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[57] **ABSTRACT**

A monitoring device for the bobbin mechanism or assembly of a conventional sewing machine which provides a sensing or control signal in response to the imminent runout of the supply of bobbin thread and disrupts stitching with an adequate tail of bobbin thread to avoid loss of the stitch and operation of the sewing machine without a supply of bobbin thread.

7 Claims, 4 Drawing Figures



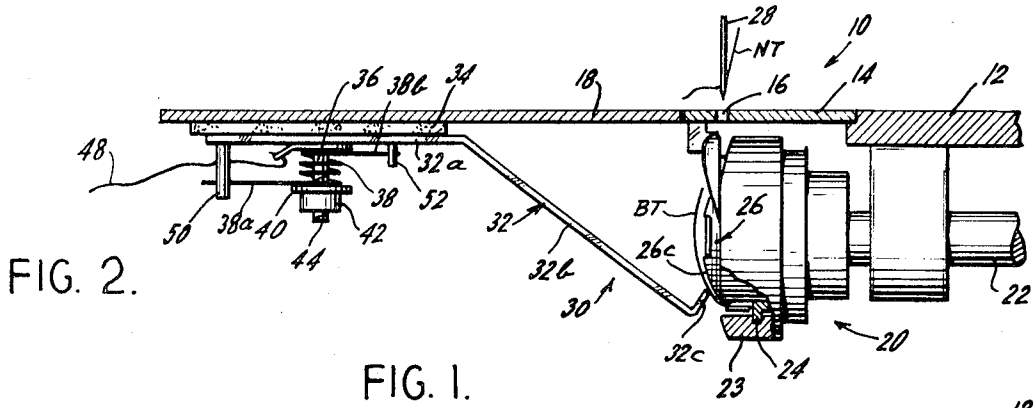


FIG. 2.

FIG. 1.

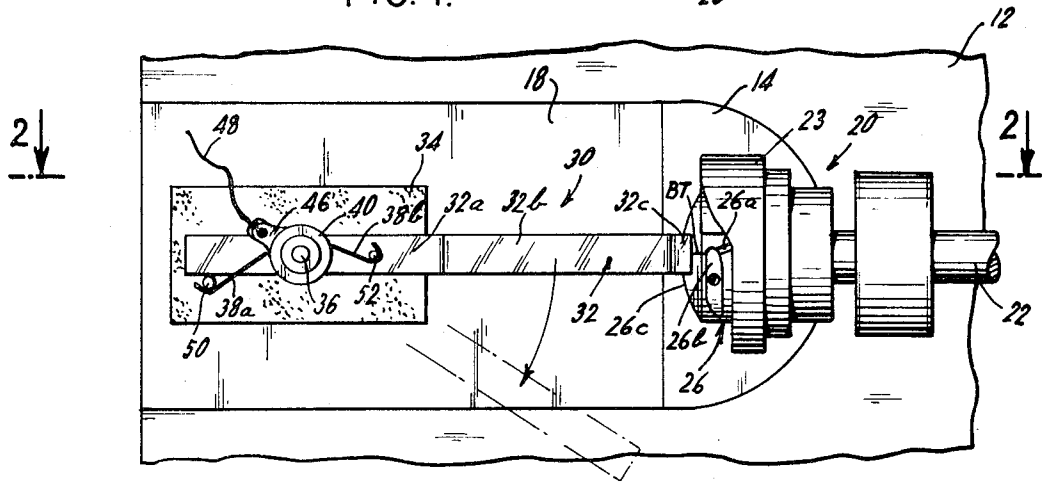


FIG. 3.

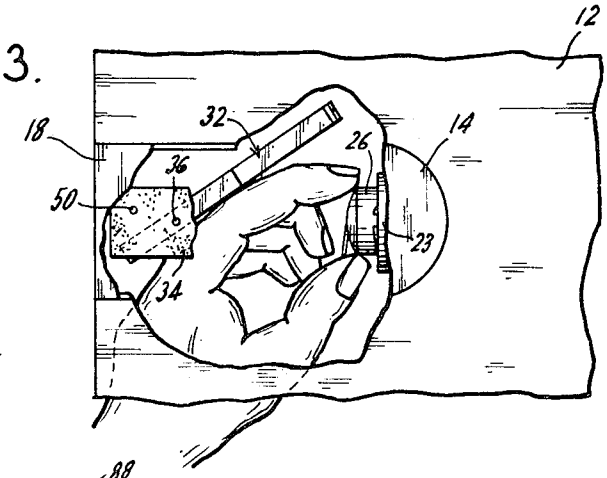
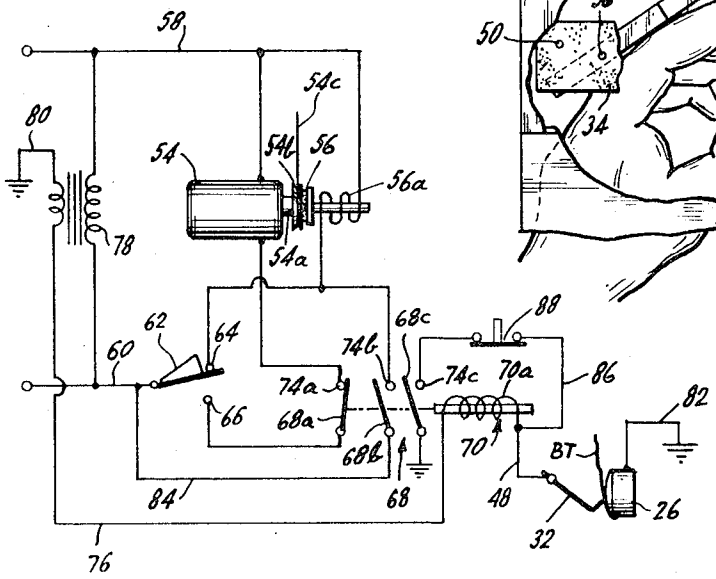


FIG. 4.



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BOBBIN RUNOUT SIGNALLING DEVICE

The present invention relates generally to sewing machines, and in particular to a bobbin thread monitoring and sensing device for such sewing machines.

In a typical lockstitch sewing machine, the stitching mechanisms include a needle which is movable through a stitch-forming stroke and carries a needle thread into position for engagement with a bobbin thread. Typically, the bobbin thread is contained within a bobbin case which is removably mounted in the bobbin assembly of the sewing machine. The bobbin thread emerges from the bobbin case at a location approximately 30° displaced from the line of the needle stroke, passes beneath a tensioning spring and is then engaged by the needle thread as the hook of the bobbin mechanism rotates to form successive stitches.

Various techniques have been described and suggested over the years for sensing the imminent runout of the bobbin thread to thereby signal the machine operator that the bobbin supply must be replenished by removing the bobbin case and replacing the empty spool thereof with a fresh spool of bobbin thread or with a prewound coreless bobbin. For example, it has been suggested in the art to provide the bobbin thread itself with either a mechanical or electrical indicator (i.e. an enlargement or a conductive segment) at a location removed from the inner end of the wound bobbin which, upon being sensed, would signal and operator of the imminent runout of the bobbin thread supply and/or initiate a control function. Obviously, altering the characteristics of the bobbin thread in some manner introduced a complexity and cost factor which is undesirable. Other techniques have been proposed for sensing runout but these do not have the essential attributes of reliability and repeatability such that the monitoring or sensing device will function without any false indications and will signal each and every imminent bobbin thread runout. Further, it is important in a device of this kind to provide a runout signal and to interrupt the stitching operation before a stitch is missed and with at least a short tail of bobbin thread extending from the last completed stitch. If bobbin thread runout is sensed under these conditions, when the supply of bobbin thread is replenished, the operator is capable of picking up the stitch line such that there is little or no tell-tale evidence of the runout of the bobbin thread and the replenishment thereof.

Broadly, it is an object of the present invention to provide a bobbin-monitoring or sensing device realizing one or more of the aforesaid objectives. Specifically, it is within the contemplation of the present invention to provide a bobbin runout sensor which is constructed and arranged to provide a signal of the imminent runout of the bobbin thread and to initiate a control function, with the signal occurring with an adequate supply of bobbin thread left in relation to the stitching mechanisms to assure that there will be a tail of bobbin thread extending from the needle.

It is a further object of the present invention to provide a bobbin thread runout sensing device which, although simple in construction and operation, is highly reliable such that it may be used with a high degree of confidence on the vast number of industrial sewing machines which require periodic bobbin thread replenishment.

It is a further object of the present invention to provide a bobbin monitoring and sensing device which is constructed and arranged such that it may be displaced from its operative position as part of the same manipulative sequence which the operator employs to replenish the exhausted bobbin case such that the presence of the device in no way interferes with or slows down the manual replenishment of the bobbin thread.

In accordance with an illustrative embodiment demonstrating objects and features of the present invention, there is provided a conventional sewing machine which includes a support, stitching mechanisms having a needle adapted to receive a needle thread, a bobbin mechanism adapted to receive successive electrically conductive bobbin cases each containing a supply of bobbin thread and a machine control including a drive motor for activating the stitching mechanisms to form successive stitches from the needle and bobbin threads. In this environment, a bobbin thread monitor is provided which includes a flexible and electrically conductive sensor blade normally disposed in an operative position relative to the bobbin mechanisms wherein a contact portion of the sensor blade is adapted to resiliently bear against the bobbin thread emerging from the particular bobbin case in the bobbin mechanism. During normal running, the contact portion of the sensor blade is electrically isolated from the bobbin case by the intervening bobbin thread. Means are provided in the machine control which are responsive to the sensor blade making electrical contact with the bobbin case when the bobbin thread therein runs out for deactivating the stitching mechanisms. In a preferred form of the invention, both the thread guiding and tensioning means associated with the bobbin case and the contact portion of the sensor blade are substantially diametrically opposed to the needle of the sewing machine whereby runout sensing is accomplished with a tail of bobbin thread extending from the needle and throat plate. Further, in such preferred form, the bobbin thread monitor is constructed and arranged such that the simple act of reaching in to remove the empty bobbin case, displaces the monitor from its operative position thereby enabling the machine operator to remove the empty bobbin case and the further act of reaching in to place the full bobbin case into the bobbin mechanism once again is effective to displace the monitor, with the monitor being automatically restored to its operative position such that it is automatically arranged for its sensing function when a freshly loaded bobbin case is placed into the sewing machine.

The above brief description, as well as further objects, features and advantages of the present invention will be more fully appreciated by reference to the following detailed description of a presently preferred, but nonetheless illustrative embodiment in accordance with the present invention, when taken in conjunction with the accompanying drawing, wherein:

FIG. 1 is a bottom plan view of a typical sewing machine, in the region of the throat and slide plates thereof, having a bobbin thread monitor embodying features of the present invention installed thereon, with the sensor blade being shown by the full lines in its operative position and in the dot-dash lines in its inoperative position;

FIG. 2 is a sectional view taken substantially along the line 2—2 of FIG. 1 and looking in the direction of

the arrows showing details of the bobbin thread monitor;

FIG. 3 is a top plan view, with the sewing machine support broken away, showing a typical bobbin case-changing sequence wherein the operator's hand, in reaching in for the empty bobbin case (or to place a full bobbin case in the bobbin assembly), has automatically displaced the sensor blade to its inoperative or clearance position; and,

FIG. 4 is a schematic diagram of a typical, but simplified, sewing machine control which may be activated by the bobbin thread monitor of the present invention.

Referring now specifically to the drawings and in particular to FIGS. 1 to 3, there is shown a typical sewing machine 10 which includes a bed plate 12 serving as a support having the usual throat plate 14, needle opening 16 and slide plate 18 which permits access to the bobbin mechanism 20 which is mounted beneath the bed plate 12. The bobbin mechanism 20 includes the usual rocker or actuating shaft 22, hook mechanism 23 operated from the shaft 22 and stationary bobbin holder 24 which receives bobbin case 26 from which the bobbin thread BT emerges for interengagement with the needle thread NT which is delivered into co-acting relation with the bobbin thread BT by needle 28 as the latter moves through its stitch-forming stroke. The mechanisms of the sewing machine 10 thus far described are conventional and subject to a latitude of modification, change and substitution as is well understood by those skilled in the art. The only modification required in accordance with the present invention is the construction of the bobbin case 26 with the bobbin thread guiding and tensioning means being disposed diametrically to the needle 28. Typically, and when looking at the bobbin case 26 from the left in FIGS. 1 to 3 inclusive, the needle 28 may be considered to be operative at the 12 o'clock location and the thread guiding and tensioning means which includes guiding slot 26*a* and tensioning spring 26*b* are at the 6 o'clock location such that the bobbin thread BT passes over the curved outer face 26*c* of the bobbin case 26 at the maximum distance from the location at which the needle 28 enters the bobbin case through the usual needle hole, as illustrated and described in co-pending Application Ser. No. 118,148, filed on Feb. 23, 1971 and entitled "Bobbin Changing Mechanism Method and Product".

The bobbin thread monitor or sensor assembly of the present invention, which is generally designated by the reference numeral 30, is preferably mounted on the slide plate 18 of the sewing machine and includes a sensor blade 32 which is electrically conductive and resilient and may be fabricated of beryllium copper. Blade 32 includes a horizontally extending mounting section 32*a*, an intermediate section 32*b* and a terminal or contact section 32*c*. In this illustrative embodiment, the blade 32 is pivotally mounted to swing between the operative position shown in the full lines in FIGS. 1 and 2 and the inoperative position shown by the dotted lines in FIG. 1 and by the full lines in FIG. 3. The mounting arrangement includes an insulating spacer or board 34 which mounts a depending, vertical pivot 36 on plate 18 in electrical isolation therefrom. The mounting section 32a of sensor blade 32 is journaled on the pivot 36 and is biased against insulating spacer 34 by coil spring 38 which also serves to normally bias the sensor blade 32 into its operative position relative to the bobbin case 26. The dual-function spring 38 is placed in compression by washer 40 and adjustment nut 42, with the nut 42 being mounted on a threaded terminal section 44 of pivot 36 thereby enabling the finite adjustment of the amount of tension with which the spring 38 urges the mounting section 32*a* of the sensor spring 32 against the back-up afforded by the insulating spacer or board 34. Interposed between the inner end of the spring 38 and the mounting section 32*a* is a contact ring 46 to which there is connected a lead 48 over which a runout signal is provided to the control, as will be described in conjunction with FIG. 4. The dual-purpose spring 38 includes leg 38*a* which bears against stop pin 50 depending from the stationary support afforded by insulating spacer 34 and leg 38*b* which bears against anchoring pin 52 on the mounting section 32*a* of the sensor blade 32. Spring 38 is constructed such that blade 32 is biased into the operative position illustrated in FIGS. 1 and 2, that is in the counterclockwise direction when viewed looking upwardly beneath the sewing machine. Stop pin 50 is positioned not only to anchor spring 38 via arm 38*a* but also to engage the side of the mounting section of sensor blade 32 to establish the operative position for the sensor blade relative to the bobbin case 26 wherein the terminal section 32*c* bears against the bobbin thread BT as it emerges at the 6 o'clock location from the bobbin case 26 after passing beneath the tensioning spring 26*b*. Of course, stop pin 50 does not preclude the sensor blade 32 from swinging in the clockwise direction about pivot 36 (when viewed from above and as seen in FIG. 3) such that sensor blade may assume the inoperative or clearance position illustrated in FIG. 3.

In view of the foregoing it will be appreciated that the flexible and electrically conductive sensor blade 32 is normally disposed in the operative position illustrated in FIGS. 1 and 2 relative to the bobbin mechanism 20 wherein contact section or portion 32*c* of the sensor blade 32 bears resiliently against the bobbin thread BT emerging from the bobbin case 26 of the bobbin mechanism. For so long as there is a supply of bobbin thread, sensor blade 32 is electrically isolated from the bobbin case 26 by the intervening bobbin thread. When the bobbin thread runs out from beneath the contact section or portion 32*c* of the sensor blade 32, the sensor blade will make electrical contact with bobbin case 26; and this electrical contact is employed in the machine control to deactivate the stitching mechanisms. Due to the location at which the bobbin thread emerges from bobbin case 26 and the corresponding location of sensing, it will be appreciated that as the terminal end of the bobbin thread emerges from beneath the contact section 32*c* and permits an electrical contact to be completed and the signal initiated, there still remains an adequate length or tail of bobbin thread BT between the throat plate and the end of the bobbin thread to preclude interruption of the stitch configuration. Of course, the control which utilizes the signal so derived must be capable of responding rapidly to such signal to quickly interrupt the operation of the stitching mechanisms.

In FIG. 4 there is illustrated a typical, but nonetheless illustrative machine control for activating the stitching mechanisms of the sewing machine 10 to form successive stitches from the needle thread NT and the bobbin thread BT which control responds to the sensor blade 32 making electrical contact with the bobbin case 26 when the bobbin thread therein runs out for deactivat-

ing the stitching mechanisms. In the illustrative control, there is provided a sewing machine motor **54** which via output pulley **54***b* on motor shaft **54***a* and belt **54***c* drives the sewing mechanisms. On the motor shaft **54***a* there is also provided a solenoid controlled brake **56**, the coil **56***a* of which is connected to power input lines **58, 60** over foot switch **62**. Foot switch **62** may be of the type which is activated in response to pressing down on the treadel of the sewing machine. Thus, when the sewing machine is not running, a circuit is completed over lines **58, 60** to energize the coil **56***a* of the brake **56**. Upon depressing foot switch **62**, the circuit over contact **64** is interrupted and a new circuit is completed over contact **66** and triple pole, single throw switch **68** which is controlled by solenoid **70**. In the illustrated position, pole or contact blade **68***a*, over contact **74** completes an energization circuit for motor **54**. This circuit includes line **58** connected directly to one side of motor **54** and line **60** connected to the other side of motor **54** over actuated foot switch **62**, contact **66**, contact blade **68***a* and contact **74**a. As is apparent, when foot switch or treadle **62** is depressed, the brake energization circuit is interrupted. As is apparent to those skilled in the art, a sewing machine motor control of this type is of conventional construction and is subject to a latitude of modification and change. In accordance with the present invention, the illustrative control further includes sensor blade **32** which is connected over lead **48** to the coil **70***a* of solenoid **70** and completes an energization circuit for solenoid **70** over line **76** which is connected through the secondary of step-down transformer **78** to ground at **80**, with a ground connection being provided for the bobbin case **26** at **82**. As the bobbin thread BT is exhausted, sensor blade **32** is grounded over bobbin case **26** and lead **82** and the solenoid **70** is activated to transfer the triple contact or pole switch **68**. As contact blade **68***a* moves away from contact **74***a*, the energization circuit for motor **54** is interrupted. As contact blade **68***b* engages contact **74***b*, an energization circuit for the solenoid controlled brake **56** is completed over auxiliary line **84**; and as contact blade **68***c* engages contact **74***c*, an auxiliary energization circuit is provided for switch-control solenoid **70** over line **86** and a normally closed reset button **88**. Thereafter, notwithstanding the removal of bobbin case **26** from the bobbin assembly, switch **68** remains in the transferred position corresponding to disruption of the motor energization circuit and activation of the solenoid-controlled brake **56** until such time as the machine operator pushes the normally closed reset button **88**, at which time switch **68** transfers to the illustrated position such that the next sequence of operations may be initiated by depressing the foot switch or treadle **62**.

A typical sequence of operations will now be described to facilitate a more thorough understanding of the present invention:

Before starting a stitching sequence, the operator reaches beneath the slide plate **18** of the sewing machine **10**, as illustrated in FIG. **3**, and places a loaded bobbin case into the bobbin assembly **20**. As the operator does this, his or her index finger engages the sensor blade **32** to swing the same rearwardly relative to the bobbin mechanism, as seen in FIG. **3**. Once the bobbin case is loaded, the operator usually turns the machine over by hand to cause the needle and hook to engage the needle and bobbin threads. Stitching is initiated by depressing the usual foot treadle which actuates switch **62** to disrupt the energization circuit for brake **56** and to establish the energization circuit for motor **54** over contact blade **68***a* of switch **68**. The stitching operation continues until such time as a runout signal is derived from sensor blade **32** which runout signal occurs as the bobbin thread BT passes beneath the sensor blade **32** and establishes a ground connection between blade **32** and line **82** to thereby activate solenoid control **70** which transfers all three contact blades of switch **68**. Such transfer disrupts the energization circuit to the motor, completes an energization circuit for the brake over line **84** and completes the holding circuit for solenoid control **70** until such time as the operator pushes the reset button **88** to restore the illustrative control circuit to its standby condition for the next operator-initiated stitching sequence.

What we claim is:

1. The combination with a bobbin case containing a supply of bobbin thread and a control for sensing runout of said bobbin thread and an empty bobbin case in a sewing machine of a sensor assembly providing a signal to said control in response to runout of said bobbin thread, said control including a sewing machine motor, said sensor assembly including a support, a resilient sensor blade, means including electrical insulation mounting said sensor blade on said support for pivotal movement between an operative and sensing position wherein said sensor blade is arranged to resiliently bear against said bobbin thread as it emerges from said bobbin case and an inoperative and clearance position wherein said sensor blade is removed from said bobbin case such that an empty bobbin case may be replaced by a loaded bobbin case, and means responsive to said signal from said sensor assembly for deenergizing said motor.

2. The combination according to claim **1** wherein said support is in the form of a sewing machine slide plate.

3. The combination according to claim **1** wherein the mounting means includes a pivot and a spring mounting said sensor blade for pivotal movement, said spring normally biasing said sensor blade into said operative and sensing position.

4. The combination according to claim **1** wherein the mounting means includes a sewing machine slide plate serving as said support and said insulation includes]n znsulating board mounted on the underside of said slide plate, a pivot on said board mounting said sensor blade for pivotal movement and a spring operatively connected to and biasing said sensor blade into said operative and sensing position.

5. In a sewing machine including a support, stitching mechanisms having a needle adapted to receive a needle thread, a bobbin mechanism adapted to receive successive electrically conductive bobbin cases each containing a supply of bobbin thread and a machine control including a drive motor for activating said stitching mechanisms to form successive stitches from said needle and bobbin threads, the improvement comprising a bobbin thread monitor including a flexible and electrically conductive sensor blade, means for mounting said sensor blade in an operative position relative to said bobbin mechanism wherein a contact portion of said sensor blade is adapted to resiliently bear against the bobbin thread emerging from a bobbin case in said bobbin mechanism and is electrically isolated from said

bobbin case by the intervening bobbin thread, said bobbin case including thread guiding and tensioning means for said bobbin thread as it emerges from said bobbin case, both said thread guiding and tensioning means and said contact portion of sensor blade being substantially diametrically opposed to said needle whereby runout sensing is accomplished with a tail of bobbin thread extending from said needle, and means in said machine control responsive to said sensor blade making electrical contact with said bobbin case when the bobbin therein runs out for deactivating said stitching mechanisms.

6. In a sewing machine according to claim **5**, means mounting said sensor blade for movement to an inoperative and clearance position relative to said bobbin mechanism whereby an empty bobbin case may be removed therefrom and replaced by a full bobbin case, said sensor blade being movably mounted such that a machine operator, upon reaching for said empty bobbin case with one hand, displaces said sensor blade into said clearance position whereupon said empty bobbin case may be removed from said bobbin mechanism with that one hand.

7. In a sewing machine according to claim **6**, said mounting means including a pivot for said sensor blade and a spring normally biasing said sensor blade into said operative position.

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