

[54] **BOBBIN MONITOR FOR SEWING MACHINES**

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[22] Filed: **Sept. 24, 1973**

[21] Appl. No.: **399,818**

[52] U.S. Cl. **235/92 PD; 235/92 PE; 235/92 R; 112/218 R**

[51] Int. Cl. **G06m 3/02**

[58] Field of Search..... 235/92 PD:92 DN, 92 CT, 235/92 PE, 132 E; 112/218 R, 219 R; 340/259

[56] **References Cited**
UNITED STATES PATENTS

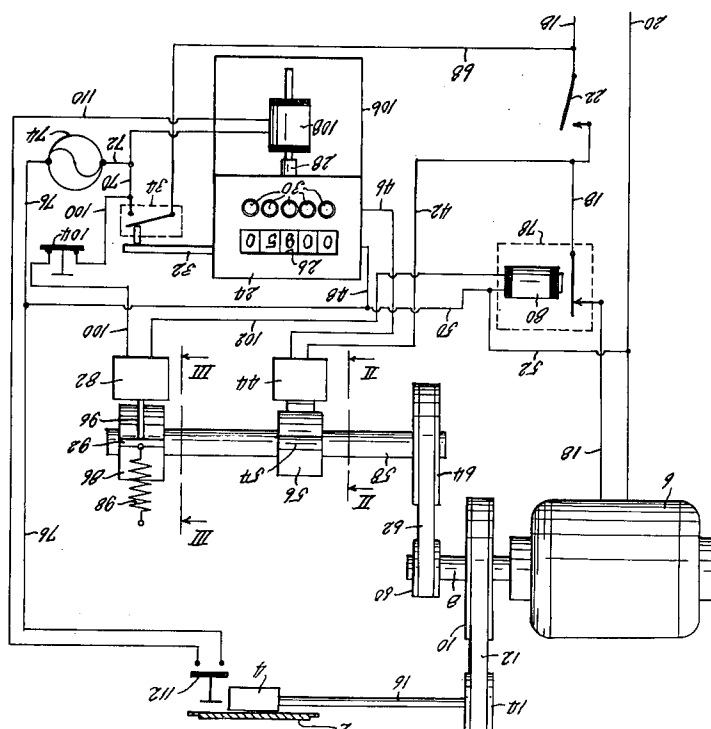
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[57] **ABSTRACT**

A bobbin monitor for indicating near-depletion of the bobbin thread consisting of a counter device operable from any driven element of the machine and operable to actuate a signal when its count arrives at a predetermined figure, which may be preset to occur when any desired proportion of the bobbin thread remains. The monitor can also disable the machine in addition to actuating the signal, to prevent the operator from ignoring the signal, but will, in a manner involving some inconvenience to the operator, permit completion of a line of stitching before rewinding the bobbin.

6 Claims, 3 Drawing Figures



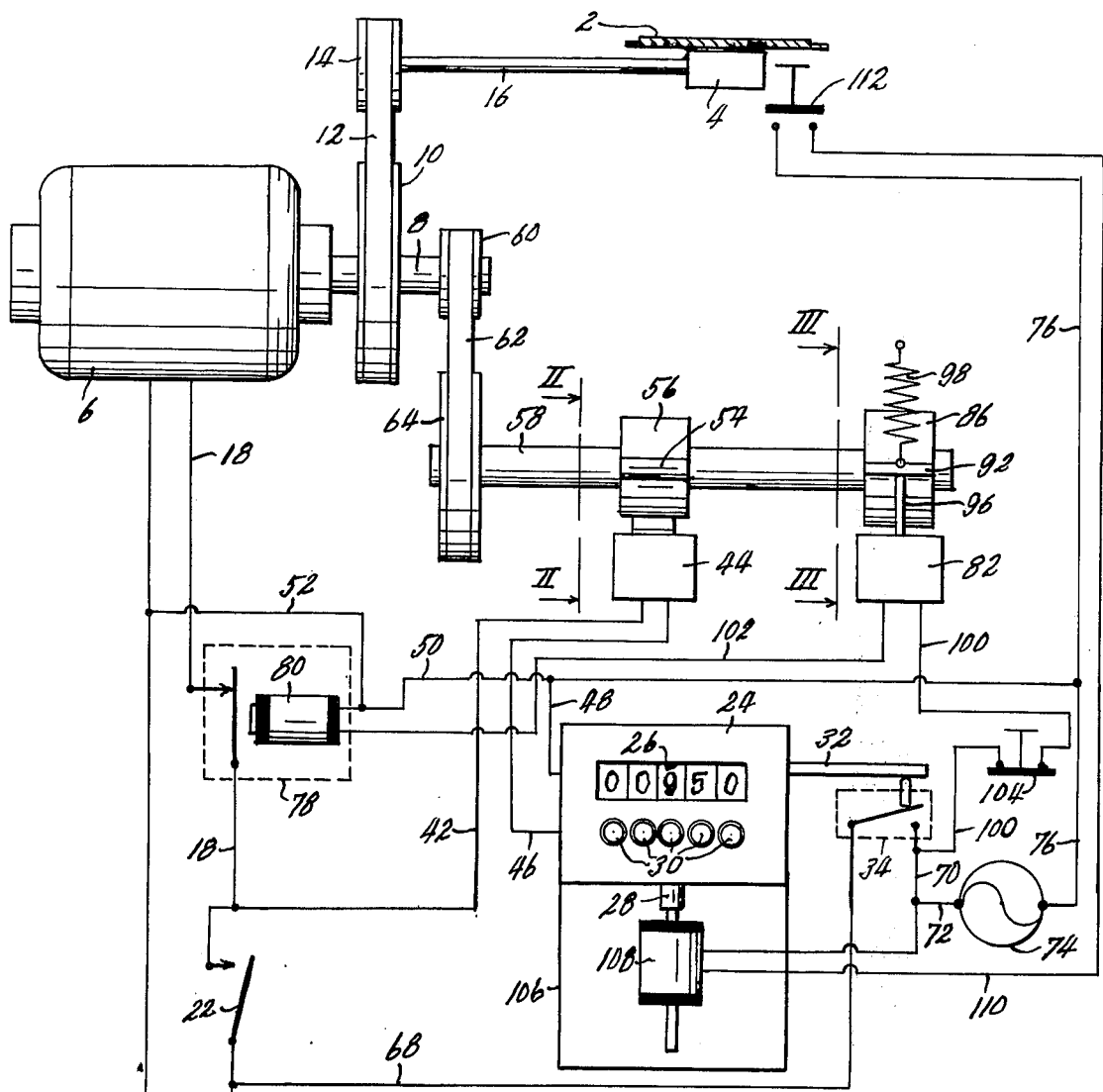


Fig. 1

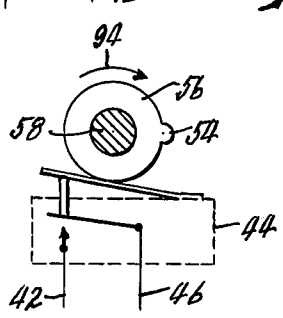


Fig. 2

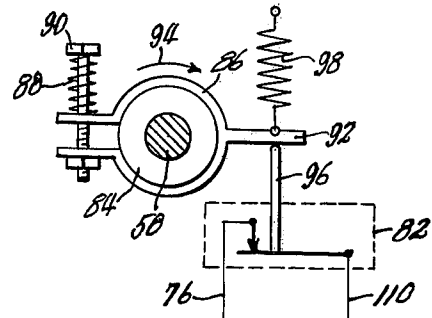


Fig. 3

BOBBIN MONITOR FOR SEWING MACHINES

This invention relates to new and useful improvements in sewing machines, and has particular reference to a device operable to indicate to the machine operator when the bobbin thread is nearly depleted.

The importance of a bobbin depletion indicator of some sort is well recognized, particularly in the case of the usual lock-stitch machine, wherein stitches are formed by the interlooping of a needle thread, carried by a vertically reciprocable needle above the foot plate and extendable downwardly through a hole in the foot plate, with a bobbin thread fed from a bobbin spool carried beneath the foot plate. The bobbin and bobbin thread cannot be observed by the operator, to see if the bobbin is depleted or nearly depleted of thread. If the bobbin thread runs out intermediate the ends of a line of stitching, the operator may begin again after replacing or rewinding the bobbin, overlapping or retracing a portion of the stitch line, but this leaves loose thread ends to be trimmed and creates an unsightly "patched" appearance which ordinarily cannot be tolerated in commercial production, or would downgrade the article being sewed to the status of a "second". In most commercial production, therefore, any stitch line in which the bobbin thread runs out must be ripped out, and completely redone after replacement of the bobbin. In either case, valuable time and production is lost. Also, not uncommonly, the stitch line will appear normal from the top even after the bobbin thread has run out, so that the operator may proceed for some time before discovering the depletion, also with resulting loss of time and production. To prevent these occurrences most operators remove the foot plate periodically to observe the bobbin and check the supply of thread thereon, but this also costs valuable production time.

Many bobbin thread depletion indicators have been heretofore conceived. For example, sensitive electric switches on the bobbin case, operable by a knot in the bobbin thread at an appropriate distance from its end to actuate a warning signal, bobbin devices operable to jerk the thread periodically as it nears depletion to actuate a warning signal, special bobbins carrying movable switch operators movable in response to the absence of thread to actuate a warning signal, special pre-wound bobbins the final portion of the thread of which is treated to render it conductive, so that it completes a warning circuit as it emerges from the bobbin, proximity switches mounted adjacent the bobbin and operable by magnets carried by the bobbin to actuate a warning as the thread is depleted, feeler gauges which periodically contact the thread wound on the bobbin to gauge its depletion and operable to actuate a warning at a certain stage of depletion, and light beams directed past the bobbin and normally interrupted by the thread bulk of a full bobbin, but operable when the thread is depleted to be completed to actuate a signal. However, all such prior devices within my knowledge are subject to certain substantial disadvantages. All are extremely expensive and complicated, require specially built machines or extensive modifications of pre-existing machines, and in some cases, such as those in which the warning signal is actuated by artificially induced jerking or tension changes of the bobbin thread, can adversely affect the quality of stitching produced by the machine.

Accordingly, the principal object of the present invention is the provision of a bobbin monitor for indicating near-depletion of the bobbin thread which overcomes all of the above enumerated defects of prior devices, in that it is simple and inexpensive, has no effect on the stitch quality, requires no special bobbin or bobbin mechanism, nor require any direct connection nor even proximity to said bobbin mechanism, and can be readily added to nearly any pre-existing sewing machine with a minimum of modification thereof. To this end, the monitor includes a simple counter which is driven from any powered element of the machine, such as the power shaft of the machine motor, so that its counting is proportional to the amount of bobbin thread used, and which is operable at a pre-determined count thereof to actuate a warning signal. The counter may be reset to its starting figure after an exhausted bobbin is replaced, and the span of the counter representing a full bobbin may be set variably relative to the alarm count, in order that the alarm may be given when any desired proportion of the bobbin thread remains.

Another object is the provision of a bobbin monitor of the character described which will additionally disable the machine, in order to guard against the possibility that the operator will ignore the warning and continue operation of the machine to full thread depletion.

A further object is the provision of a bobbin monitor of the character described wherein the machine disabling feature referred to does not become effective when the warning signal is actuated, but only after the stitch line then being sewed is completed and the operator stops the machine. This prevents the disabling feature from having the same effect as full depletion of the thread.

A still further object is the provision of a bobbin monitor of the character described with the addition of override means operable to permit continued operation of the machine even after the delayed-action disabling means has been actuated. This is to permit completion of the stitch line being sewed in the event the stitch line traverses corners or the like, at which points operation of the machine is normally stopped by the operator to permit turning of the work. Such continuation, however, can be made only with some inconvenience to the operator, so as to render it extremely unlikely that said override means would be utilized to start a new stitch line without replacing the bobbin.

Other objects are simplicity and economy of construction, and efficiency and dependability of operation.

With these objects in view, as well as other objects which will appear in the course of the specification, reference will be had to the accompanying drawing, wherein:

FIG. 1 is a partially schematic layout of a bobbin monitor device embodying the present invention,

FIG. 2 is a sectional view taken on line II—II of FIG. 1, and

FIG. 3 is a sectional view taken on line III—III of FIG. 1.

Like reference numerals apply to similar parts throughout the several views, and the numeral 2 applies to the foot plate of an ordinary lock-stitch sewing machine, beneath which is the bobbin mechanism indicated generally at 4, which carries a bobbin, not shown but comprising essentially a specially formed spool on which the bobbin thread is wound. The cooperation of the bobbin thread with a needle thread to form lock

stitches in fabric as it passes over the foot plate is well known, and need not be detailed here. The foot plate is removable from the sole plate of the machine, and must be so removed to gain access to the bobbin for rewinding or replacement thereof. The bobbin mechanism is driven by a variable-speed electric motor 6, through the motor drive shaft 8, pulley 10, belt 12, pulley 14, and shaft 16. It will be understood also that motor 6 drives all other operating parts of the sewing machine, not shown. Electric current for motor 6 is supplied by line wires 18 and 20, wire 18 for convenience being indicated the "hot" wire, and wire 20 as the return wire. Inserted in hot wire 18 is a normally open treadle switch 22, which when closed normally completes the motor operating circuit, and which the operator normally uses to start and stop operation of the machine.

The heart of the bobbin monitor device as here contemplated is an electrically operated mechanical counter 24, which reduces its reading by one count each time its operating circuit is momentarily completed, its reading being visually indicated in a digital read-out window 26 thereof. The counter is resettable to any desired reading by momentary depression of a reset button 28 thereof. The reset count thereof may be preset as desired by first depressing button 28, and while holding it depressed, pressing the set buttons 30 thereof, each of which advances the associated number wheel of the counter one digit each time it is depressed, until the desired number appears, then releasing button 28. Thereafter, each time button 28 is pressed, the counter returns to the same reset figure. Also, the counter operates a switch operating arm 32 each time the counter reading is reduced to some specific count to close a normally open switch 34, said switch remaining closed at all lower readings of the counter, until reset button 28 is pressed, whereupon the counter returns to its reset reading and switch 34 opens. Adjustably resettable counters of this type, with switch operating means, are well known and commercially available, so that any specific disclosure of its structure and operation is not considered to be necessary here, and such details are not shown. Switch 34 may be built into the counter itself.

The operating circuit of counter 24 extends from wire 18, between switch 22 and the motor, through wire 42, a normally open pulsing switch 44, wire 46, counter 24, and wires 48, 50 and 52 to return wire 20. Each time this circuit is completed momentarily, counter 24 is reduced one count. Pulsing switch 44 is closed repetitively by the cam lobe 54 of a rotor 56 fixed on a shaft 58 driven by motor 6 through drive shaft 8, pulley 60, belt 62 and pulley 64, so that the switch is closed once for each rotation of shaft 58.

The count span of the counter which it traverses during the use of a complete bobbin-load of thread may be determined by computation, or, more practically, by a trial run in which the bobbin thread is run completely out. This span of the counter is then set into the counter, by use of the described function of buttons 30, in a relationship to the counter reading at which it closes switch 34, so that switch 34 is closed when any desired proportion of the thread remains on the bobbin. For example, if switch 34 is closed at a reading of 100, and if it has been determined that a counter travel of 1000 counts represents a full bobbin, and if it is desired that a warning be given when only 10% of the bobbin thread remains unused, then the reset reading of the counter is set at 1000, and switch 34 will close

when the counter reading is reduced to 100, indicating that 90% of the bobbin thread has been used and only 10% remains. If a 95% depletion warning is desired, then the reset reading of the counter is set at 1050 when the bobbin is full, so that only 5% of the thread remains when switch 34 closes, or at 950 if an 85% depletion warning is desired, and so on. The specific ratio of motor shaft speed to the speed of shaft 58 is immaterial, since they will always maintain a fixed ratio, and changes of ratio will affect only the counter span representing a full load of thread on the bobbin. This fact also permits the motor drive shaft speed to be reduced by pulleys 64 and 60, and belt 62, to a lower speed for driving shaft 58. Many mechanical counters are not physically capable of responding at the rate of 60 counts per second, which would be required if the two shafts turned at the same rate, and if the motor turned at the usual rate of 3600 r.p.m. The inclusion of treadle switch 22 in the counter operating circuit provides for interruption of this circuit whenever the treadle is released. This prevents possible damage to the counter which might occur if the machine were halted with switch 44 closed by cam lobe 54, thus energizing the counter continuously. Many counters of the type shown would be damaged if continuously energized.

Whenever switch 34 is closed by the counter, it completes a warning circuit from wire 18, but not including treadle switch 22, through wire 68, switch 34 wires 70 and 72, an electrically actuated warning device 74, and wires 76, 50, and 52 to return wire 20, thus actuating the warning device. The warning device may be of any suitable type, such as the lamp illustrated, mounted in a position readily visible to the operator, or a bell or buzzer, or any other type of audible or visible signalling device. The operator thus warned that the bobbin thread is nearing complete depletion, will then with the device as thus far described, continue sewing until reaching the end of the stitch line being sewed, then replace or rewind the bobbin, press reset button 28 to reset the counter, which also opens switch 34 to deactivate warning signal 74, and continues normally. The counter span is of course so set relative to the counter reading at which the signal will be activated that ample thread will be left on the bobbin when the signal is activated to complete the stitch line being sewed. In commercial operations, each operator often performs only a single phase of the sewing on each garment, and the amount of bobbin thread required for that phase of the sewing of a single garment can be accurately determined. If not engaged in repetitive work of this type, the operator can set the device to give warning when some average safely ample quantity of thread remains on the bobbin. The exclusion of treadle switch 22 from the warning circuit provides that the warning device 74 will continue to be activated even after the operator releases the treadle, so that the operator will not absentmindedly start a new stitch line in the absence of the signal.

With the device as thus far described, the operator can of course continue sewing after warning is given by signal 74, simply by ignoring the signal, or by pressing reset button 28 to deactivate the signal, either in the possibly mistaken hope that sufficient bobbin thread remains to complete the immediate job. Therefore, it is desirable that means be provided for actually disabling and preventing operation of the sewing machine at some time before the bobbin thread is actually exhausted. However, to disable the machine at the same

time as signal 74 is actuated would have substantially the same undesirable results as occur when the bobbin thread actually runs out, and is therefore highly undesirable.

Accordingly, the present monitor includes means operable to disable the machine, but only after the stitch line being sewed when the signal is activated is completed. This disabling means includes a normally closed relay 78 inserted in line wire 18 between motor 6 and the treadle switch, said relay being opened to interrupt the motor circuit whenever its coil 80 is energized, and a normally closed switch 82. As best shown in FIG. 3, switch 82 is controlled by the shaft 58 from which switch 44 is controlled. A hub member 84 fixed on said shaft has a C-shaped ring 86 engaged frictionally thereon, the split ends of said ring being urged toward each other to increase its grip on said hub by a spring 88 the tension of which is adjusted by turning bolt 90. Extending from the friction ring is an arm 92 which, when ring 86 is frictionally urged in the direction of arrow 94 by rotation of shaft 58, biases a switch operating member 96 to open switch 82. Movement of arm 92 in this direction is resisted by a spring 98. The relative tensions of springs 88 and 98 are so adjusted that switch 82 closes and remains closed whenever shaft 58 is not turning, but is opened at a speed of rotation of said shaft representing a minimum operating rate of the sewing machine, or any greater rate. The operating circuit of the disabling means extends from wire 18 (outside of treadle switch 22) through wire 68, switch 34, wires 70 and 100, switch 82, wire 102, relay coil 80 and wires 50 and 52 to return wire 20. Thus when switch 34 closes to actuate signal 74, the disabling circuit is still open since switch 82 is then open due to operation of the sewing machine, and the machine may continue to operate. However, when the machine is next stopped at the end of the stitch line, switch 82 closes, completing the circuit of relay coil 80 and opening relay 78, so that motor 6 cannot be restarted until switch 84 is again opened by resetting of the counter, which presumably will not be done until the nearly exhausted bobbin is replaced.

Nevertheless, in some cases the stitch line being sewed when switch 34 closes, and the completion of which is to be permitted by the delayed action of switch 82 in disabling the machine, may traverse corners in the garment being sewed, at which points the operator must stop the machine at least momentarily to permit turning of the garment, and the machine would, as thus far described, disable the machine at any such stop. It is still desirable that the operator be enabled to complete any such cornered stitch line. For this purpose there is provided means for overriding the disabling means, constituting a normally closed pushbutton switch 104 inserted in the circuit of relay coil 80, for example in wire 100. The operator, when the machine is disabled before completion of the stitch line, may thus press switch 104 to open it, which de-energizes relay coil 80 to close relay 78, hold it open while closing treadle switch 22 to restart the motor, which opens switch 82, and then release pushbutton 104. The machine may then operate normally until it is again stopped by release of treadle switch 22, whereupon it is again disabled by closure of switch 82.

The above described means for overriding the disabling means of course involves some inconvenience to the operator, since it is not always easy to press pushbutton 104 while at the same time closing the treadle

switch and guiding the work. When faced with this problem, therefore, many operators might elect to press reset button 28 instead of override button 104 to permit restarting of the machine. This is not desirable, since so doing would also deactivate signal 74, since the operator might forget that the signal had been given, and hence forget to replace the bobbin. To prevent this, the present monitor provides that reset button 28 is not directly accessible to the operator, but is enclosed in the counter housing 106 and operable to be depressed by energization of a solenoid 108. The operating circuit of solenoid 108 extends from wire 18, outside of treadle switch 22, through wire 68, switch 34, wire 70, solenoid 108, wire 110, a normally open pushbutton switch 112, and wires 76, 50 and 52 to return wire 20. Thus the operator can reset the counter and deactivate the signal only by depressing pushbutton 112. This pushbutton is disposed beneath the foot plate 2 of the machine, and access thereto can be had only by removing said foot plate, which in turn can be removed only when the garment being sewed is removed from the machine. Therefore, to continue sewing after the signal is actuated and the machine is disabled by closure of switch 82, the operator must make use of pushbutton 104 as described. This added inconvenience will effectively discourage the operator from making excessive use of this pushbutton, and constantly remind him that the bobbin requires replacement.

The operation of the monitor contemplated by the present invention has been thoroughly described in connection with the foregoing description of its construction. It will be seen to possess numerous advantages of operation. It will give a signal warning the operator of impending depletion of the bobbin thread whenever any desired proportion of said thread remains. It will, if desired, also disable the sewing machine at the same time, to guard against the possibility that the operator might ignore the signal, but only after the stitch line being sewed at the time the signal is actuated is completed. Even then, operation of the machine may be continued if the situation warrants it, but only by means involving inconvenience to the operator which reminds him repeatedly that the bobbin must be replaced or rewound as soon as it is practical to do so. It is very economical and practical, utilizing only commercially available components. It does not require a special bobbin or bobbin mechanism, and is therefore well adapted for application to pre-existing sewing machines with a minimum of adaptation. It can be connected to and driven by nearly any powered element of the machine, the speed of operation of such element relative to the bobbin speed being immaterial, as long as it bears some fixed proportion to the length of the stitch line being sewed. The counter forming the heart of the monitor may be of many different types, so long as it is resettable to a predetermined figure, and so long as it is operable to actuate a signal at and after a predetermined count thereof. Another type of counter which could be used, for example, though somewhat more expensive than that shown and described, additionally permits adjustment of the count thereof at which switch 34 will be closed. With this type of counter, the reset count thereof may be so set that a zero count thereof will indicate complete exhaustion of the bobbin thread, and the proportion of said thread remaining when the signal is given can be adjusted by changing the signal count. This type of counter would

be somewhat more simple and convenient, but in no way alters the basic principles of the monitor as shown and described.

While I have shown and described a specific embodiment of my invention, it will be readily apparent that many minor changes of structure and operation could be made without departing from the spirit of the invention.

What I claim as new and desire to protect by Letters Patent is:

1. A monitor for indicating depletion of the bobbin thread of a sewing machine driven by an electric motor having an operating circuit including a treadle switch controlled by the machine operator and a source of electric power, said monitor comprising:

- a. an electrically actuated signal device having an operating circuit including said signal device, said power source, and a normally open signal switch, but not said treadle switch,
- b. a counter operable at and after a pre-determined reading thereof to actuate said signal device by closing said signal switch,
- c. manually actuated reset means operable to reset said counter to a reading representing a full bobbin, whereby once actuated, said signal device remains actuated even when said treadle switch is opened, and until said counter is reset, and
- d. driving means interconnecting said counter to a powered element of said sewing machine and operable to advance said counter at a rate proportional to the length of the stitch line being sewed, the reset and signal readings of said counter being so related that said signal device will be actuated when a pre-determined proportion of the bobbin thread has been exhausted.

2. A monitor for indicating depletion of the bobbin thread of a sewing machine comprising:

- a. a signal device,
- b. a counter operable at and after a pre-determined reading thereof to actuate said signal device,
- c. manually actuated reset means operable to reset said counter to a reading representing a full bobbin,
- d. driving means interconnecting said counter to a powered element of the sewing machine and operable to advance said counter at a rate proportional to the length of the stitch line being sewed, the reset and signal readings of said counter being so related that said signal device will be actuated when a pre-determined proportion of the bobbin thread has been exhausted,
- e. disabling means operable by actuation of said signal device to disable the sewing machine to prevent further operation thereof until said counter is reset, and

f. override means operable to render said disabling means effective only when the sewing machine is stopped, whereby a stitch line being sewed at the time the signal is actuated may be completed before the machine is disabled.

3. A monitor as recited in claim 2 with the addition of manually operable means operable to render said disabling means inoperable even when said machine is stopped, whereby the machine may be restarted, said manually operable means requiring manual positioning by the operator at the time the machine is restarted.

4. A monitor as recited in claim 2 wherein said sewing machine is driven by an electric motor having an operating motor circuit including an operator-controlled treadle switch and a source of electric power, wherein said signal device is electrically actuated and has an operating signal circuit including said source of electric power, said signal device, and a normally open signal switch operable to be closed by said counter at and after a predetermined reading thereof, but not said treadle switch, wherein said disabling means constitutes a normally closed relay included in said motor circuit but operable to be opened by energization of the coil thereof, and a disabling circuit including said power source, said signal switch and said relay coil, but not said treadle switch, and wherein said override means comprises:

- a. a normally closed override switch disposed in said disabling circuit,
- b. operating means for said override switch, and
- c. means connecting said switch operating means to a powered element of said sewing machine and operable to maintain said override switch open as long as said machine is operating, but to close said switch when the machine is stopped.

5. A monitor as recited in claim 4 with the addition of a normally closed, manually operable pushbutton switch interposed in said disabling circuit, whereby by pressing said pushbutton, the machine may be restarted even though said signal switch and said override switch are closed.

6. A monitor as recited in claim 5 with the addition of:

- a. means rendering the manually operable reset element of said counter inaccessible to the machine operator,
- b. electrically actuated reset means operable when energized to actuate said reset element to reset said counter,
- c. a normally open reset switch inaccessible to the operator except when the work being sewed is removed from the machine, and
- d. an operating electric circuit including a source of electric power, said reset means, and said reset switch.

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