Oct. 7, 1958 R. W. WINBERG 2,854,938

BOBBIN MANUFACTURE AND CONTROL

Filed Oct. 14. 1955 2 Sheets-Sheet 1

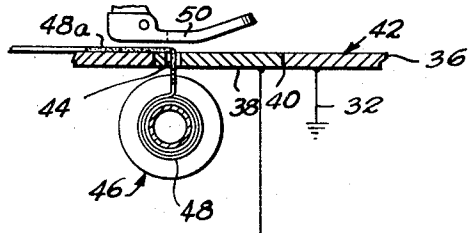


FIG. 1.

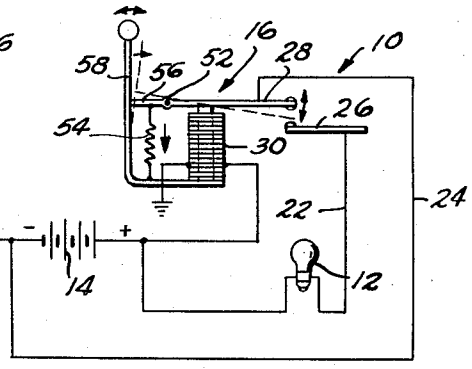
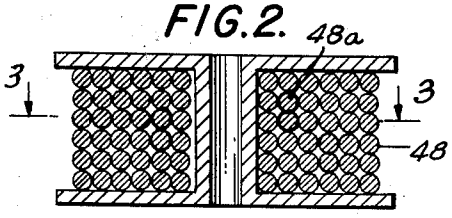


FIG. 2.



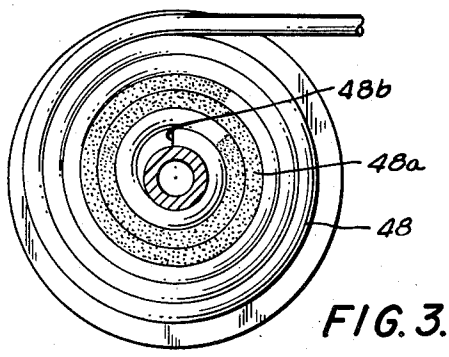


FIG. 3.

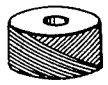


FIG. 4.

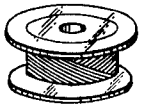


FIG. 5.

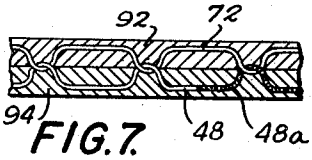


FIG. 7.

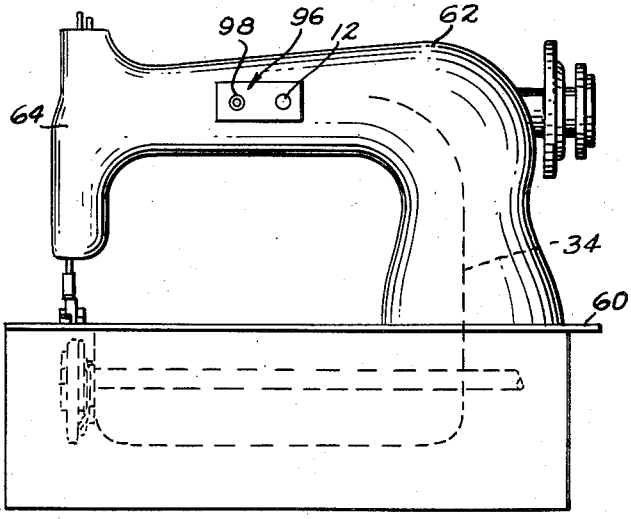


FIG. 6.

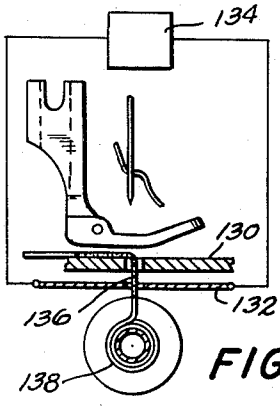


FIG. 13.

INVENTOR.
RAGNAR W. WINBERG
BY
Morton Amster
ATTORNEY

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BOBBIN MANUFACTURE AND CONTROL

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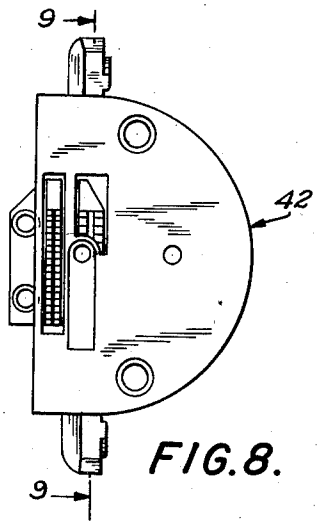

FIG. 8.

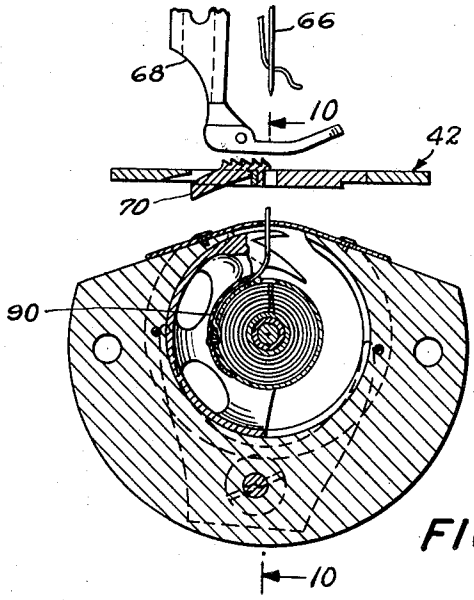

FIG. 9.

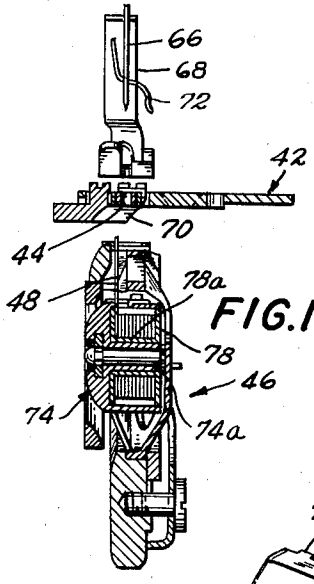

FIG. 10.

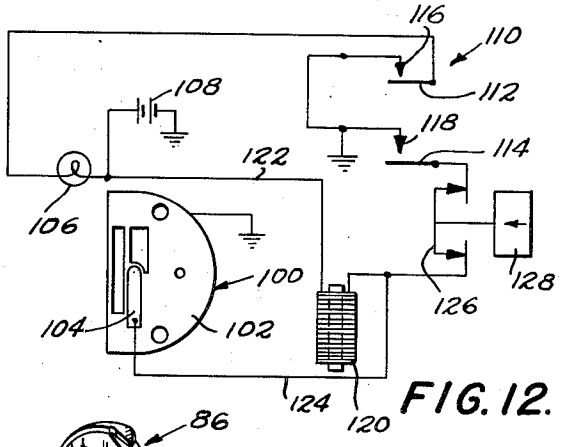

FIG. 12.

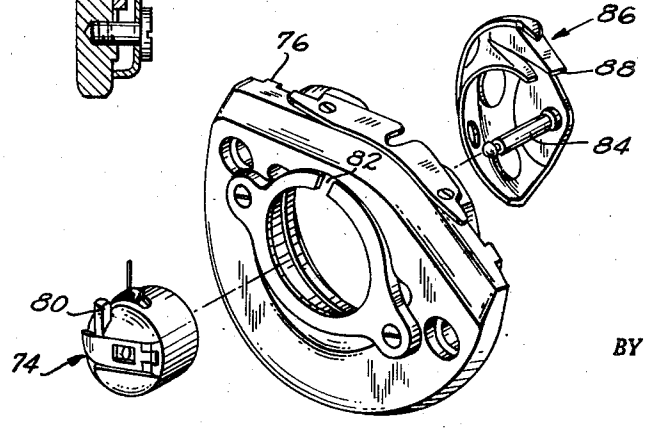

FIG. 11.

INVENTOR.
RAGNAR W. WINBERG

BY Morton Amster

ATTORNEY

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2,854,938

BOBBIN MANUFACTURE AND CONTROL

Ragnar W. Winberg, Floral Park, N. Y., assignor to O & W Sewing Machine Attachments Inc., New York, N. Y., a corporation of New York

Application October 14, 1955, Serial No. 540,457

8 Claims. (Cl. 112—218)

The present invention relates to the manufacture of wound bobbins for sewing machines, and in particular to an improved method and mechanisms for providing a visual or audible warning or signal and/or a control function incident to the impending exhaustion or runout of the bobbin thread being run through the sewing machine.

Numerous devices in the prior art have been suggested to warn the operator of a sewing machine that the supply of bobbin thread is about to become exhausted. Upon receiving such warning, the operator can replace the bobbin. It is important that the indication or warning be given to the operator while some thread remains in the bobbin. As pointed out in my United States Patent No. 2,420,275 of May 6, 1947, a signal at some time in advance of runout may allow the operator to complete a stitching operation to an intermediate finishing point, for example to the end of a seam. Further, with a not too critical interval for stopping the sewing machine, it is unlikely that the operator will run the machine after the supply of bobbin thread is exhausted, which of course would require pulling back of the work and restitching. Apart from the obvious waste of time, pull back and restitching may cause the stitch line to have a patched appearance; further many fabrics cannot tolerate the extra needle holes formed incident to restitching. All in all, substantial cost and time savings as well as improved quality of the stitching may be realized by the provision of a signal at some time prior to exhaustion of the supply of bobbin thread.

It is broadly an object of the present invention to provide improved method and apparatus suitable for the aforesaid purposes.

The well known sewing machine includes a needle which delivers a needle thread through an opening in the throat plate of the machine, while the bobbin thread is delivered from a bobbin holder or case supported within a bobbin race or way. The mechanisms of the sewing machine manipulate the needle thread and the bobbin thread to form lock stitches, as is well understood in the art. The very nature of the sewing machine requires that the bobbin, which is contained within the bobbin holder or case, float during the stitching operation so that the required interlocking of the bobbin thread and the needle thread may be achieved. This necessary structure of the sewing machine has required resort to rather complex expedients for achieving the warning or control function and/or mechanisms which in some way effect the normal operation of the sewing machine. For example, in my aforementioned patent, a special bobbin holder is illustrated in which a contact member is released after the major portion of the bobbin thread has unwound, the release of the contact member completing an electrical circuit which in turn provides a visual warning. Apart from the fact that this type of control is limited in its application to certain type of sewing machines, structural complexity and

reliance upon the bobbin thread itself to hold the contact member in a retracted position, renders the system somewhat critical for use in commercial production wherein it is required that the signal device be reliable and readily adapted to conventional sewing machines.

Other systems have been suggested in which the signal in advance of runout is obtained by causing an oscillation or jerking of the bobbin holder and/or the bobbin thread. The reliability of warning units designed according to this approach is necessarily a function of the displacement of the bobbin holder and/or change in tension on the bobbin thread. Either of these actions, if pronounced enough for reliability in the control or warning function, must necessarily effect the stitching operation. Either the character of the stitches will be changed due to the variation in the tension control, or there is the rick of bringing about a break in the bobbin thread.

It is a further object of the present invention to provide an improved signaling means and method for monitoring the bobbin thread supply of a sewing machine which in no way interferes with the normal operation of the sewing machine. Specifically, it is within the contemplation of the invention to incorporate a positive-acting sensing system into a sewing machine which provides a warning at a time prior to the exhaustion of the bobbin thread, and which system operates with a high degree of reliability and in a manner completely compatible with normal functioning of the sewing machine.

I have found that the conductivity state or condition of the bobbin thread may be changed from its normal state along a section adjacent the innermost end of a wound bobbin; and that upon feed of this section of changed conductivity to or through the sewing mechanisms, the change in conductivity may be sensed and employed to initiate a warning or other control function. In accordance with an illustrative embodiment demonstrating features of the present invention, a bobbin of the comparatively non-conductive thread is wound, either on the conventional bobbin spool or in coreless form, with a section or length of the bobbin thread adjacent its innermost end treated to provide surfaces of low electrical resistivity and high electrical conductivity. During normal operation of the sewing machine, the wound bobbin delivers thread which is of the usual low conductivity until such time as the section or length of high conductivity is pulled from the bobbin and advanced to and through the stitching mechanism. This high conductivity section is employed to physically complete an electrical circuit. Advantageously, the bounding walls of the needle hole which are in continuous contact with the bobbin thread during the entire stitching operation is employed as one contacting or sensing element which, in association with contiguous but electrically insulated contacting portions of the machine, serve to complete the electrical circuit when the conductive thread section bridges the contacting element and said contiguous portions of the machine.

The above description, as well as further objects, features, and advantages of the present invention will be best appreciated by reference to the following detailed description of a presently preferred embodiment, when taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a schematic showing of an illustrative visual warning system demonstrating features of the present invention;

Fig. 2 is a sectional view in elevation of a wound bobbin on a spool prepared in accordance with features of the present invention;

Fig. 3 is a sectional view taken substantially along the line 3—3 of Fig. 2 and looking in the direction of the arrows;

Fig. 4 is a perspective view of a coreless and shelless wound bobbin prepared in accordance with the present invention;

Fig. 5 is a perspective view of a further wound bobbin prepared in accordance with the present invention;

Fig. 6 is an elevational view, with parts shown in phantom, of a conventional lock-stitch sewing machine embodying a warning and/or control mechanism according to the present invention;

Fig. 7 is an enlarged longitudinal vertical section through two pieces of material joined together by lock-stitching with the apparatus shown in Fig. 5;

Fig. 8 is a plan view on an enlarged scale, with parts removed, showing the details of the throat plate of a sewing machine modified in accordance with the present invention;

Fig. 9 is a sectional view taken substantially along the line 9—9 of Fig. 8 and looking in the direction of the arrows;

Fig. 10 is a sectional view taken substantially along the line 10—10 of Fig. 9 and looking in the direction of the arrows;

Fig. 11 is an exploded perspective view showing the assembly of the raceway, the bobbin holder and the bobbin support in its dismantled condition;

Fig. 12 is a schematic showing of a modified control circuit in accordance with the present invention; and

Fig. 13 is a schematic showing of a still further modified control circuit in accordance with the present invention.

Referring now specifically to the drawings, there is shown schematically in Fig. 1 an indicator or control circuit demonstrating several aspects of the present invention. The unit is generally designated by the reference numeral **10** and includes a signaling or indicating means, illustrated specifically as a lamp **12**, and an energization circuit for the lamp **12** including a voltage source **14**, a relay **16** and certain component parts of the sewing machine. The lamp **12** is connected to the voltage source **14** via leads **22, 24** over the normally open contacts **26, 28** of the relay **16** which has its energization coil **30** connected via leads **32, 34** to the voltage source **14**. The lead **32** is connected to a first electrically-conductive contacting element **36**, while the lead **34** is connected to a second electrically-conductive contacting element **38**. The elements **36, 38** are insulated from each other, as indicated by the reference numeral **40**, and together make up the throat plate **42** of the sewing machine, the details of which are shown in Figs. 8 to 11 inclusive. The throat plate **42** is provided with a needle hole or opening **44**, said hole being formed in the contacting or sensing element **38** at a location appropriate for cooperation with the several components of the sewing mechanisms. A supply of bobbin thread, generally designated by the numeral **46**, is arranged to deliver a bobbin thread **48** through the needle hole **44** for interlocking with the needle thread during operation of the sewing mechanisms. The supply of bobbin thread has been illustrated in this diagrammatic showing as being close to exhaustion, that is at a time prior to the total removal of the bobbin thread **48** from the supply **46**.

In accordance with the present invention, a section **48***a* of the bobbin thread **48** is of changed electrical conductivity state or condition whereby the feed of this section or length of the bobbin thread **48** through the sewing mechanisms will be effective to automatically perform a warning and/or control function prior to exhaustion of the supply of bobbin thread. In this diagrammatic showing, the section **48***a* is seen to bridge the contacting or sensing elements **36, 38**, making up the throat plate **42** of the sewing machine, which contacting elements are

respectively connected to the lines **32, 34** and complete the energization circuit for the coil **30** of the relay **16**. Although the bobbin thread **48** is shown alone in its travel beneath the presser foot **50** in Fig. 1, it will of course be appreciated that this showing is simplified to the extent that the needle thread and the several plies of material have been omitted in order to more effectively demonstrate the principles of the present invention. As the section **48***a* is fed into interlocking relation with the needle thread the insulated insert **38** and the main body part **36** of the throat plate **42** will be electrically connected together for a period of time, the duration of which will depend upon the length of the conductive section **48***a*, to complete the energization circuit for the coil **30** of the relay **16**. Energization of the coil **30** will cause the contacts **26, 28** to engage, completing the energization circuit for the lamp **12**. The lamp circuit includes the battery **14**, the lead **22**, the contacts **26, 28** and the lead **24**. Completion of this energization circuit, will light the lamp **12** and provide a warning to the operator of the imminent runout of the supply of bobbin thread.

In order to continue the energization circuit for the lamp **12** after the conductive section **48***a* no longer bridges the contacting elements **36, 38**, there is provided a simple mechanical holding circuit of the type which may be manually reset after the operator has finished the particular seaming operation. This mechanical holding circuit includes a pivotal mount **52** for the contact **28**, a spring **54** which maintains the contact **28** in its open position away from the contact **26**, a latch piece **56** integral with the contact **28** and in bearing engagement with an L-shaped abutment or bracket. The bracket is arranged to hold the latch piece in the dotted line position illustrated in Fig. 1 with the contact **28** against the contact **26**. However the bearing contact between the latch piece **56** and the abutment **58** is readily overcome by manipulating the latch piece to restore the contact **28** to the open position.

The supply of bobbin thread may take any of the forms employed generaly in the trade, such as the wound bobbin thread on the re-usable metallic spool of Figs. 2 and 3, the preformed coreless and shelless wound bobbin illustrated in Fig. 4, or the wound bobbin on the expendable shell illustrated in Fig. 5. In the several types of wound bobbins, one or more turns of the bobbin thread **48** making up section **48***a* are rendered highly electrically-conductive as compared to the remainder of the bobbin thread which is of low conductivity. The requisite conductivity for the section **48***a* may be obtained by applying metal particles in a suitable binder to a length of the bobbin thread. Suitable electrical conductors include india ink or metal-lacquer suspensions. A commercially available coating material which has been found to be particularly suitable is a silver suspension manufactured by Dupont and described in Ceramic Products Bulletin CP2–554. These silver powder suspensions may be applied by spraying, dipping, brushing or stenciling and produce surfaces of low electrical resistance and high conductivity when applied to the compartively non-conductive bobbin thread. Such silver coatings firmly bond themselves to the thread as its base and have comparatively little color. Actual experience indicates that the requisite conductivity may be imparted to the bobbin thread without effecting its properties for the stitching operation, particularly with respect to strength and flexibility, and without introducing a noticeable color change in the stitched line.

The actual spacing of the conductive section **48***a* from the innermost end of the wound bobbin is ultimately determined by the needs of the particular industry. A more or less optimum length is that which would be required for an operator to complete any particular seam on a garment or article so that it would not be necessary to interrupt the stitching operation for the replacement of a bobbin during the completion of any particular

seam. The criteria is that the operator should not be required to stop the machine immediately, but rather should be able to complete a particular section of work and/or to stop the machine in a leisurely fashion. Of course, the above must be consistent with the requirement that there not be excessive waste of thread.

Bobbins of the several types shown in Figs. 2 to 5 inclusive may be prepared by the use of conventional bobbin winding equipment with appropriate modification of such known equipment and/or its operation. The winding operation may be such that a number of turns of the bobbin thread are wound on a temporary or permanent core, the requisite electrically-conductive length formed at the appropriate spaced location from the innermost end of the winding, and the winding completed with the equipment. In the alternative, a section of the bobbin thread may be rendered conductive before the winding is started, and the operation carried forth with the conventional equipment in the usual fashion.

Reference will now be made to Figs. 6 to 11 inclusive wherein a control or warning system according to the present invention is illustrated as incorporated in a known type of Singer sewing machine, for example, the type referred to in the trade as the 241W. This is typical of lock-stitch machines most commonly found in the garment industry and allied fields. However, the invention finds application with numerous other types of machines which employ a thread fed from a bobbin, such as shoe manufacturing machines, and the like. For the sake of simplicity and clarity, many of the parts of the illustrative lock-stitch machine have been omitted; however it will be appreciated that the equipment is well known and widely used, and as detailed herein requires no material modification for the incorporation of a control or signaling system according to the present invention.

As seen in Fig. 6, the conventional machine includes a bed plate **60** which is mounted on a table or bench and has a goose-neck body through which a main drive shaft extends toward the head end **64** of the machine which carries the needle bar and the presser foot bar. The needle bar and presser foot bar have not been shown, but as is well understood and shown specifically in Figs. 9 and 10, these bars carry a needle **66** and a presser foot **68** which cooperate in the usual manner with a feed dog **70** extending through the specially-constructed throat plate **42**, previously described. The needle **66** delivers a needle thread **72** through the needle hole **44** for interlocking with the bobbin thread **48**, the latter coming from the bobbin supply or mechanisms, heretofore generally designated by the numeral **46**.

The bobbin mechanisms cooperate with the needle **66** in the usual fashion and include a bobbin case or holder **74** which is held stationary during operation of the machine in a raceway **76** and rotatably carries the wound bobbin, which in Figs. 8 and 9 is seen to be of the type illustrated in Figs. 2 and 3 having a thread supply on a metallic spool **78**. The bobbin holder **74** is of conventional structure and includes a central sleeve or hollow shaft **74***a* which extends concentrically of and within the hollow core or sleeve **78***a* of the spool **78**. The assembly of the bobbin holder **74** and the wound bobbin thread on the spool **78** are confined in the raceway **76** through provision of a lug or finger **80** which is received within a cut out **82** on the raceway. The spool or core **78** receives a concentric shaft or central spindle **84** on the oscillating or rotating drive member **86** which carries a hook **88** adapted to engage the bobbin thread **48**. The bobbin thread **48** emerges from an appropriate slot formed in the side wall of the holder **74**, the thread having travelled between portions of the casing or holder **74** and an appropriate tensioning spring **90** secured against the outer surface of the casing **74** (see Fig. 9).

Except for the use of the specially-constructed throat plate **42** and a supply of bobbin thread formed with a changed conductivity length or section, the operation of the sewing machine and the several component parts illustrated in detail in Figs. 8 to 11 inclusive is well understood to those skilled in the art. It will suffice to point out that the bobbin supply and associated mechanisms are effective to bring the bobbin thread **48** into interlocking relation with the needle thread **72** to form interlocking stitches. An illustration of a typical lock-stitch assembly is shown in Fig. 7 wherein two layers or plies of material, designated by the numerals **92, 94**, have been stitched together by the interlocking bobbin and needle threads **48, 72**. In this diagrammatic showing, a portion of the conductive section **48***a* is shown in the stitch assembly and the threads **48, 72** have been shown as being somewhat embedded in the material. Under these circumstances, the changed conductivity section **48***a* of the bobbin thread **48** will be virtually nondiscernible. However, even if the threads do not embed themselves within the several plies, when the assembly is viewed from its right side, that is the side facing ply **92**, only the needle thread **72** will be seen, and possibly the interlocking region with the bobbin thread. However, the exposed incremental lengths of the bobbin thread, which might be seen, are so short that they go practically unnoticed. Thus for all practical purposes, the changed conductivity section is effective for the required control function, yet does not detract from the overall appearance of the stitched assembly.

As seen in Fig. 6 the entire signaling, indicating or warning unit may be incorporated into a small housing **96** which is mounted on the frame **62** of the sewing machine at a location in a field of view of the operator. The housing **96** may contain all of the essential components of the system including the warning light **12**, the voltage supply in the form of one or more batteries, and an appropriate reset button **98** which is associated with the mechanical holding arrangement illustrated in Fig. 1. The housing-enclosed unit is connected to the modified throat plate with but a single wire, corresponding to the lead **34** diagrammatically shown in the control circuit of Fig. 1.

In a typical cycle of operation, the operator will employ wounud bobbins prepared in accordance with the present invention on a machine having the modified throat plate and the indicating unit. When the bobbin supply is about to become exhausted, the conductive section **48***a* will be fed into the stitched assembly in the conventional mode of operation of the sewing machine. However the length of changed conductivity will be effective to bridge the parts **36, 38** of the throat plate **42** which will complete the energization circuit for the coil **30** and thereby close relay **16**. Closing of the relay **16** will cause the bulb **12** to light up, indicating to the operator the approach of exhaustion of the bobbin supply. At rates of travel of the order of 5000 stitches per minute, which is of the order of the highest rates of travel obtainable with commercially available sewing machines, a section or length of approximately one-half inch of electrically-conductive bobbin thread is effective to initiate the desired control or warning function. When once energized, the relay armature or contact **28** will assume the dotted line position of Fig. 1 and be held therein by the mechanical holding mechanisms including the latch piece **56** and the abutment **58**. With the light still on and serving as a constant reminder that the bobbin needs to be replenished, the operator can continue working for a short period and until a convenient stopping point is reached. Thereupon, the reset button **98** is manipulated which will allow the spring **54** to restore the contact **28** to its normal position illustrated by the full lines in Fig. 1, turning off the light. The operator then replaces the bobbin supply and resumes the stitching operation.

The conductive coating formed on the comparatively short length of bobbin thread does not in any way in-

terfere with the normal operation of the sewing machine, and particularly does not exert a hold back effect or place a load on the bobbin thread which might cause breakage and/or improper operation of the sewing mechanisms. The modification of the sewing machine is at a minimum, requiring only the replacement of the throat plate, which of course may be accomplished either at the manufacturing level or in the field. In this connection, it is not uncommon for throat plates and feed dogs of sewing machines to be replaced, for example, when a special formation for the feed dog is required. The enclosed warning unit **96** may be mounted on the sewing machine without interfering with the operation of the machine and as previously pointed out requires but a single electrical connection to the throat plate. Thus, installation is but a simple task and requires no substantial modification of the sewing machine.

Referring now specifically to Fig. 12 there is shown a modified circuit in accordance with the present invention incorporating an electrical hold for the indicating means which is to be manually reset by the operator. Specifically, the circuit includes a throat plate of the type previously described having a main body section **102** and an insulated insert **104** formed with the needle hole. As before the signaling means is in the form of a lamp **106** which is connected to a battery **108**. The energization circuit for the lamp **106** includes a double pole single throw relay **110** which includes stationary contacts **112, 114** and movable contacts **116, 118**. The relay **110** is activated by an energization coil **120** which is connected by line **122** to the battery and by line **124** via contacting or sensing elements **104, 102** to ground. Upon completion of the energization circuit for the coil **120** by bridging of the contacting elements **102, 104** with a conductive section of the thread, the relay **110** is closed and connects the lamp **106** between the battery **108** and ground via the contacts **112, 116**. The holding circuit for the relay includes a switch **126** connected in circuit in the line **124** with the contact **114** and controlled by a push button **128** which is normally biased to the closed position. Upon closing of the relay **110** in response to bridging of the contacting elements **102, 104** by the thread, a secondary energization circuit for the relay coil **120** is provided via the line **122**, the normally closed reset switch **126** and the contacts **114, 118**. This holding circuit is effective until the operator depresses the button **128** to interrupt the secondary energization circuit for the coil **120**, thus restoring the relay **110** to the normally open position with the contacts **116, 118** away from the contacts **112, 114**.

In Fig. 13 there is shown a still further modified arrangement for utilizing the change in conductivity state of the bobbin thread for achieving a control or warning function in accordance with the present invention. Rather than employing a system which relies upon direct electrical contact as a result of the feed of the changed conductivity length through the sewing machine, a circuit may be set up to respond to a change in a different electrical parameter. For example, a magnetic circuit may be established along the feed path of the bobbin thread through the machine and the bobbin thread appropriately treated throughout a portion of its length to create a change in the magnetic field. The detection of this type of change may then be utilized to achieve the desired signal or control. In the diagrammatic arrangement of Fig. 13, there is shown apparatus **134** for detecting a change in capacitance between a throat plate **130** and one capacitance element and a further plate **132** as another capacitance element. The sensing circuitry **134** is known in the art and may be employed to continuously measure the capacitance between the plates **130, 132**, which of course will vary as a function of the dielectric between said plates. Introduction of an appropriately treated length **136** of the bobbin thread **138** into the field between the plates **130, 132** will cause a change in the capacitance, which in turn is detected by the circuit **134** and utilized to provide the required warning or signal.

Accordingly the term "changed conductivity state" and equivalent terminology employed in the claims should be construed in a manner consistent with the scope of the disclosure herein; and further the term "indicating and/or signaling means" should be construed to include both the warning and control functions. Still further, the term "fibrous" as employed in some of the appended claims is intended to include materials and threads, whether natural, synthetic or man-made. In some instances; certain features of the invention will be used without a corresponding use of other features.

What I claim is:

1. In combination with a sewing machine in which a bobbin thread is adapted to travel along a predetermined path and including a bobbin holder adapted to receive a wound bobbin of thread having a region of changed conductivity state in advance of its innermost end, means along said path for detecting the conductivity state of said thread during running of said sewing machine, and means responsive to the detecting means for providing a signal in response to detection of said region.

2. In combination with a sewing machine in which a bobbin thread is adapted to travel along a predetermined path and including a bobbin holder adapted to receive a wound bobbin of thread having an electrically conductive region in advance of its innermost end, means along said path for detecting the electrical conductivity of said thread during running of said sewing machine, and means responsive to the detecting means for providing a signal in response to detection of said region.

3. In combination, a sewing machine including a throat plate having a needle hole, a needle operative through said hole, a bobbin race, a hook operative in said race, a bobbin holder adapted to receive a wound bobbin of thread having an electrically conductive section at a location adjacent the innermost end thereof, said hook being arranged to cooperate with said needle and adapted to deliver the bobbin thread to said needle, detecting means external to said bobbin holder and along the path of travel of said bobbin thread and adapted to sense the electrical conductivity of said bobbin thread, and signaling means responsive to said detecting means for warning the machine operator of the impending runout of the supply of bobbin thread.

4. In combination, a sewing machine including a throat plate having a needle hole, a needle operative through said hole, a bobbin race, a hook operative in said race, a bobbin holder adapted to receive an electrically wound bobbin of thread having a conductive section adjacent its inner end, said hook being arranged to cooperate with said needle and adapted to deliver the bobbin thread to said needle, a contact external to said bobbin holder and forming part of said throat plate and adapted to continuously contact said bobbin thread, and signaling means responsive to contact between said conductive section and said contact for warning the machine operator of the impending runout of the supply of bobbin thread.

5. In a sewing machine, a bobbin holder adapted to receive a wound bobbin of thread which is unwound during operation of said sewing machine, said bobbin thread having a section thereof at a predetermined location from the inner end of said wound bobbin providing electrically conductive surfaces, contact means external to said bobbin holder and along the path of travel of said bobbin thread through said sewing machine, said contact means being arranged to continuously sense the electrical conductivity state of said bobbin thread during unwinding of said bobbin, indicating means, and operating means including said contact means for activating said indicating means in response to sensing of said electrically conductive section whereby a warning is provided to the ma-

chine operator of the impending runout of the supply of bobbin thread.

6. In a sewing machine, a bobbin holder adapted to receive a wound bobbin of thread which is unwound during operation of said sewing machine, said bobbin thread having a section thereof at a predetermined location from the inner end of said wound bobbin providing electrically conductive surfaces, contact means external to said bobbin holder and along the path of travel of said bobbin thread through said sewing machine, said contact means being arranged to continuously sense the electrical conductivity state of said bobbin thread during unwinding of said bobbin, indicating means, operating means including said contact means for activating said indicating means in response to sensing of said electrically conductive section whereby a warning is provided to the machine operator of the impending runout of the supply of bobbin thread, and holding means for said operating means arranged to continue activation of said indicating means to sustain said warning after said electrically conductive section moves out of contact with said contact means.

7. In a sewing machine, a bobbin holder adapted to receive a wound bobbin of thread which is unwound during operation of said sewing machine, said bobbin thread having a section thereof at a predetermined location from the inner end of said wound bobbin providing electrically conductive surfaces, contact means external to said bobbin holder and along the path of travel of said bobbin thread through said sewing machine, said contact means being arranged to continuously sense the electrical conductivity state of said bobbin thread during unwinding

of said bobbin, indicating means, operating means including said contact means for activating said indicating means in response to sensing of said electrically conductive section whereby a warning is provided to the machine operator of the impending runout of the supply of bobbin thread, holding means for said operating means arranged to continue activation of said indicating means to sustain said warning after said electrically conductive section moves past said contact means, and reset means for said operating means arranged to enable deactivation of said warning under control of said machine operator.

8. As a new article of manufacture, a wound bobbin of substantially non-conductive thread, said thread having a longitudinal section formed with an electrically conductive coating, said longitudinal section extending for a relatively short portion of the length of said thread and being adjacent to but spaced from the innermost end of said thread a substantial distance to enable the operator to complete a stitching operation with the section of said thread following said longitudinal section serving as the bobbin supply for the completion of said stitching operation, said coating containing metallic material of low electrical resistance and high electrical conductivity.

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