April 21, 1964 E. H. DOERNER 3,129,680

BOBBIN THREAD DEPLETION DETECTOR FOR SEWING MACHINES

Filed May 23, 1962 2 Sheets-Sheet 1

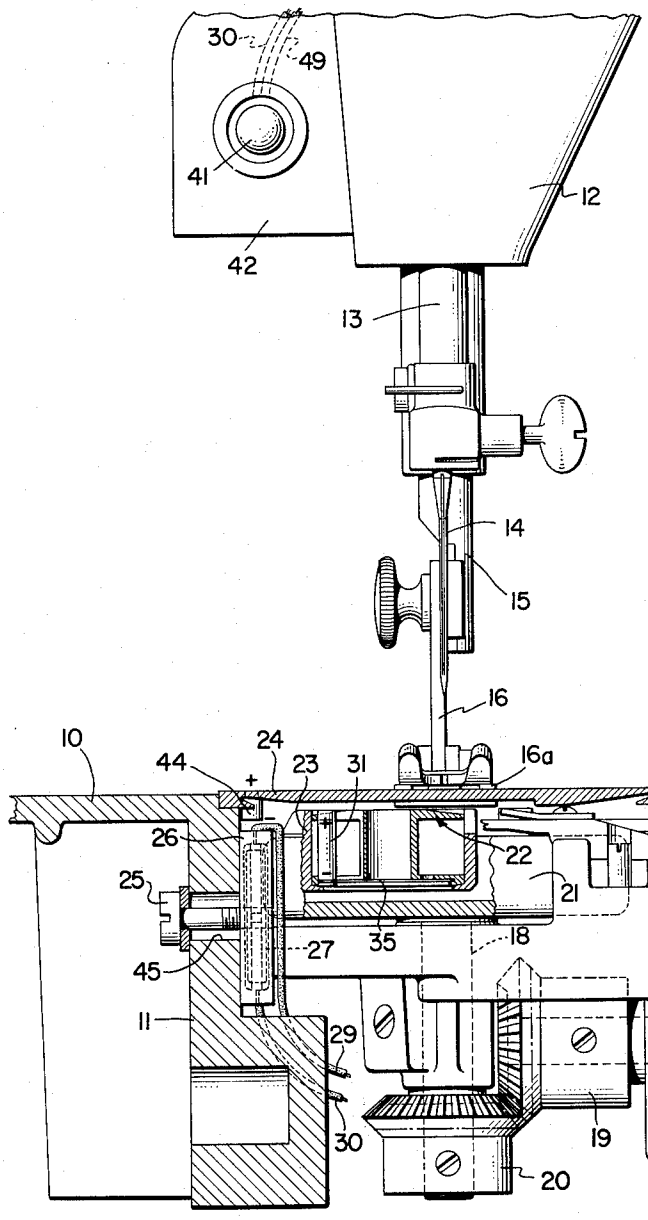


Fig. 1.

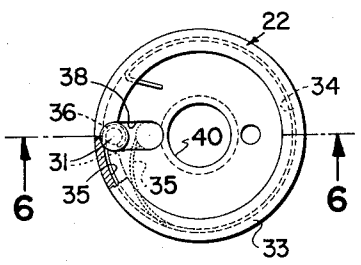


Fig. 5.

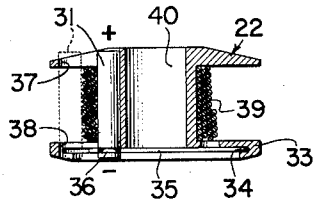


Fig. 6.

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BOBBIN THREAD DEPLETION DETECTOR FOR SEWING MACHINES

Filed May 23, 1962 2 Sheets-Sheet 2

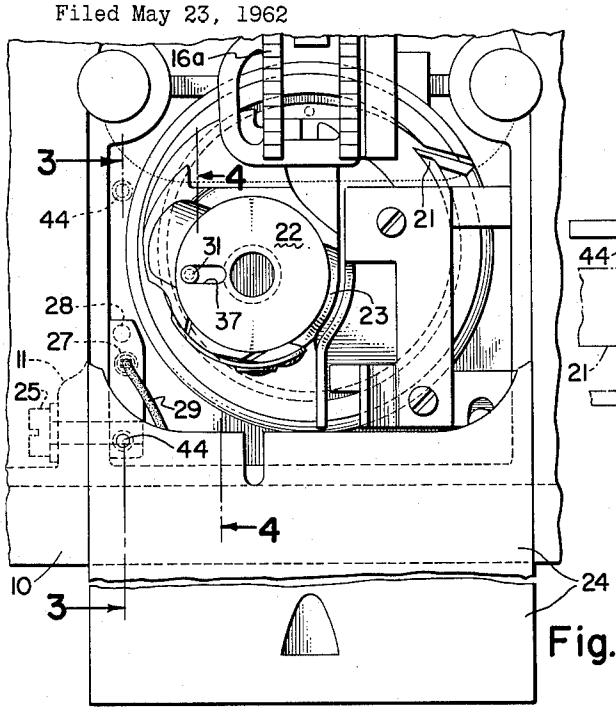


Fig. 2.

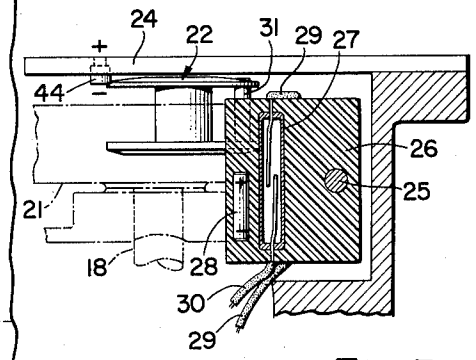


Fig. 3.

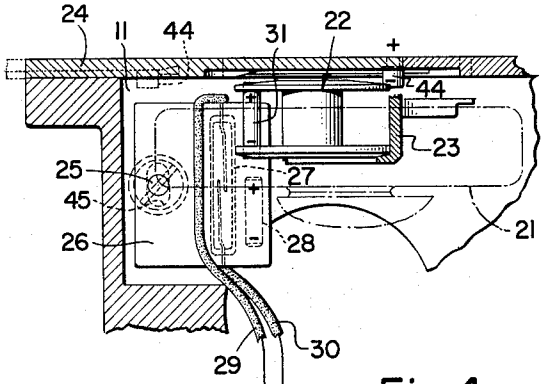


Fig. 4.

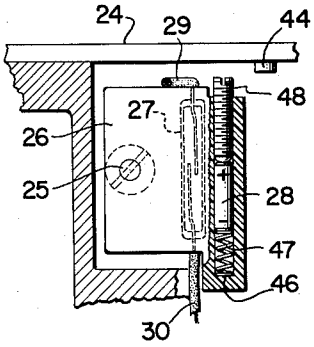
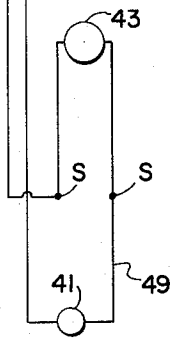


Fig. 7



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United States Patent Office 3,129,680 Patented Apr. 21, 1964

3,129,680

BOBBIN THREAD DEPLETION DETECTOR FOR SEWING MACHINES

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Filed May 23, 1962, Ser. No. 197,151
4 Claims. (Cl. 112—218)

This invention relates to a bobbin depletion detector for sewing machines.

It is desirable in sewing machines, particularly of the lock stitch type, for the operator to know in advance when the bobbin thread is about to run out so she can complete the sewing to the next logical stopping point and rewind the bobbin. In this manner unsuspected run-outs can be avoided and the general quality of the work improved by eliminating the necessity of restitching over paths already perforated by the needle.

It is an object of this invention to provide a sewing machine with means for indicating to the operator that the bobbin thread is nearly depleted.

It is a more specific object of this invention to provide on the bobbin of a sewing machine magnetic means movable in response to near-depletion of the thread wound thereon to a position in which its field influences a magnetic-reed switch to closure to provide a signal to the operator that bobbin thread exhaustion is imminent.

With the above and other objects in view, as will hereinafter appear, the invention comprises the devices, combinations and arrangements of parts hereinafter set forth and illustrated in the accompanying drawings of a preferred embodiment of the invention, from which the several features of the inveniton and the advantages attained thereby will be readily understood by those skilled in the art.

In the drawings, FIG. 1 is a front elevation view partly in section of a portion of a sewing machine embodying the invention.

FIG. 2 is a top plan view of the devices of FIG. 1.

FIG. 3 is a vertical sectional view taken on line 3—3 of FIG. 2.

FIG. 4 is a vertical sectional view taken substantially on line 4—4 of FIG. 2, and includes a schematic wiring diagram.

FIG. 5 is a bottom plan detail view partly in section of a bobbin embodying the invention.

FIG. 6 is a sectional view taken on line 6—6 of FIG. 5.

FIG. 7 is a view similar to FIG. 4 showing a modification of the invention.

As illustrated in the drawings, the present invention is shown embodied in a sewing machine of the type shown and described in United States Patent No. 2,862,468, dated December 2, 1958, to which reference may be had for a complete understanding of the operation thereof.

Referring now to FIG. 1 there is shown a portion of a sewing machine having a base **10** with vertical end wall **11**, and a head **12** carrying a needle bar **13**, needle **14**, presser bar **15**, presser-foot **16** and feed-dog **16***a*.

A bed shaft **17** drives a hook shaft **18** through bevel gears **19** and **20** to impart rotary movement to a hook **21**. A bobbin **22** is shown seated within a bobbin carrier **23** in its relation to the rotary hook **21**. A removable slide plate **24** covers the rotary hook mechanism and may be readily pulled back to gain access for bobbin removal and replacement as is well known.

Secured to the end wall **11** by any suitable means, such as screw **25**, is a molded plastic block **26** in which is embedded a magnetic reed switch **27** of conventional type and a permanent magnet **28** shown best in proper relative position in FIGS. 2 and 3. The reed switch has

conducting leads **29** and **30** for external connections to be described later. The permanent magnet **28** is magnetized along its axis with its terminal ends providing poles of opposite polarity as shown by the plus and minus signs. The magnet **28** is positioned and aligned with respect to the reed switch **27** to provide a constant magnetic flux field tending to close but not actually closing the reed contacts of the switch **27**. That is to say, the magnet **82** provides a biasing magnetic field for the reed switch which requires a slight but definite additional field of the same polarity as the magnet **28** to cause closure of the reed switch **27**. Further, the field created by the magnet **28** is sufficient, by itself, to hold the reed switch closed (when once closed) even when said additional field is removed. This is known as latch action. By the same token, when the reed switch is closed and the additional field is removed, it requires a small but definite subtractive field of opposite polarity to open the reed switch. How these additional and subtractive fields of the respective same and opposite polarity are provided will now be described.

The additional field of the same polarity as the biasing magnet **28** is supplied by the proximity effect of a permanent magnet **31** carried by the bobbin **22** as shown best in FIGS. 5 and 6, the bobbin **22**, formed from non-magnetic material such as aluminum, has its lower flange **33** formed with an internal annular groove **34** within which is seated a circular wire snap-ring **35**. One end of the snap-ring **35** embraces a grooved end **36** of the magnet **31** which is slidable within radial slots **37** and **38** in the flanges of the bobbin **22**. Normally the flexure of the snap-ring **35** biases the magnet **31** to the radially outward position shown in full lines in FIG. 5 and in dotted lines in FIG. 6. However, when sufficient thread **39** is wound on the bobbin **22**, the magnet **31** is forced to a position against the hub portion **40** as shown in full lines in FIG. 6 with the snap-ring **35** flexed as shown in dotted lines in FIG. 5.

From the above it will be perceived that, during the normal course of sewing as thread **39** is pulled from the bobbin **22**, it will rotate and with it will carry the magnet **31** in a small circular path close to the hub axis. In this limited path (see FIG. 2) the magnet **31** never gets close enough to the reed switch **27** to add sufficient field flux to that supplied by the biasing magnet **28** to cause closure of the reed switch **27**. However, when the bobbin thread supply becomes depleted the flexed spring **35** will overcome the snubbing action of the few remaining turns of thread **39** and the magnet **31** will move to its outer radial position and in its first turn past its nearest position to the reed switch **27** will add sufficient magnetic flux to the field of the biasing magnet **28** to cause closure of the reed switch **27** which, according to the latch action described above, will remain closed even when the bobbin magnet **31** moves away from the proximity position as the bobbin rotates.

As shown in the wiring diagram of FIG. 4, closure of the reed switch **27** applies voltage from source S—S to a pilot lamp **41** located in a bracket **42** secured to the head **12** thus lighting the lamp **41** and signalling to the operator that the bobbin thread is about to run out. Lamp **43** connected to the source S—S is the lamp conventionally used to illuminate the sewing area and is included here merely to show that the presently existing voltage supply source S—S can also be used for the pilot lamp **41**.

It is necessary to reset the reed switch **27** to open position and it is desirable that this be done by a normal operating function connected with bobbin replacement, such, for example, as movement of the slide plate. For this purpose a small permanent magnet **44** is secured to the under side of the slide plate **24** and is so located

(FIG. 2) that, as the plate is pulled out and/or pushed in it will traverse a position close to the reed switch **27**. It will be understood that the polarity of the reset magnet **44** is related to that of the biasing magnet **28** such that it exerts a sufficiently subtractive effect on the biasing field flux to open the reed switch. As a result, when a wound bobbin is inserted, the bobbin magnet **31** is out of the field of influence as regards the reed switch **27** so that, when the slide plate **24** is pushed in, the reset magnet takes control and opens the reed switch which is then reset and ready for the next signal actuation.

Due to manufacturing tolerances, particularly related to the relative strength of the various magnets, **28**, **31**, and **44**, some adjustability is desirable so that a final setting can be made to secure the desired latching action. This may be provided by a vertically elongated slot **45** formed in the wall **11** which permits adjustment of the vertical position of the reed switch **27** with respect to magnets **31** and **44**.

It may also be desirable to provide independent adjustment of the biasing magnet **28** and the modification of FIG. 7 may be used for this purpose. In this case the biasing magnet **28** is held in a well **46** formed in the block **26** between a non-magnetic bottoming spring **47** and a non-magnetic adjusting screw **48** threaded into the well **46**. The screw **48** is readily accessible by pushing back the slide plate **24**.

In order best to control the flux path influencing the proper poeration of the reed switch **27**, the slide plate **24**, bobbin **22** and bobbin carrier **23** are all preferably made of non-magnetic material such as aluminum.

Having thus set forth the nature of my invention what I claim herein is:

1. A bobbin thread depletion detector for sewing machines comprising a bobbin, a magnetic reed switch mounted adjacent to said bobbin, a biasing magnet mounted in fixed relation to said switch and providing a flux field for said switch sufficient to hold it closed, if closed, but insufficient to close it, if open, a magnet rotatable with said bobbin and normally restrained in a first path in which it has no operative effect on said swtich but movable responsively to near-exhaustion of said bobbin thread supply to a second path in which it causes closure of said switch, and a reset magnet movable to a position adjacent said reed switch and of such polarity as to oppose the holding field of the biasing magnet and effect opening of said reed switch.

2. Apparatus according to claim 1 in which the biasing magnet is selectively adjustable in its position relatively to the reed switch.

3. Apparatus according to claim 1 in which the reed switch and biasing magnet are adjustable as a unit in its position relatively to said bobbin magnet.

4. A bobbin thread depletion detector for sewing machines comprising a bobbin, a permanent magnet normally held by the thread wound on the bobbin to a first position closely adjacent to the bobbin axis and movable to a second position radially outwardly from said first position responsively to near-exhaustion of the bobbin thread supply, a magnetic reed switch mounted adjacent to said bobbin, a biasing magnet mounted adjacent to said reed switch, said bobbin magnet and said biasing magnet being so polarized that their combined magnetic effect is additive and effects closure of said reed switch in the second position of the bobbin magnet, a slide plate covering said bobbin, and a reset magnet mounted on said slide plate and movable therewith to a position adjacent to said reed switch, said biasing magnet and said reset magnet being so polarized that their combined magnetic effect is subtractive and effects opening of said reed switch when said slide plate is moved to gain access for bobbin replacement.

References Cited in the file of this patent

UNITED STATES PATENTS

2,760,024	Tunstall	Aug. 21, 1956
2,877,361	Chase	Mar. 10, 1959
3,043,931	Gruber	July 10, 1962