United States Patent

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[72] Inventor **William Leslie Simpson**
Birmingham, England

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[73] Assignee **Newey Goodman Limited**
Birmingham, England
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[33] **Great Britain**
[31] **29,879**

[54] **SEWING MACHINES**
5 Claims, 4 Drawing Figs.

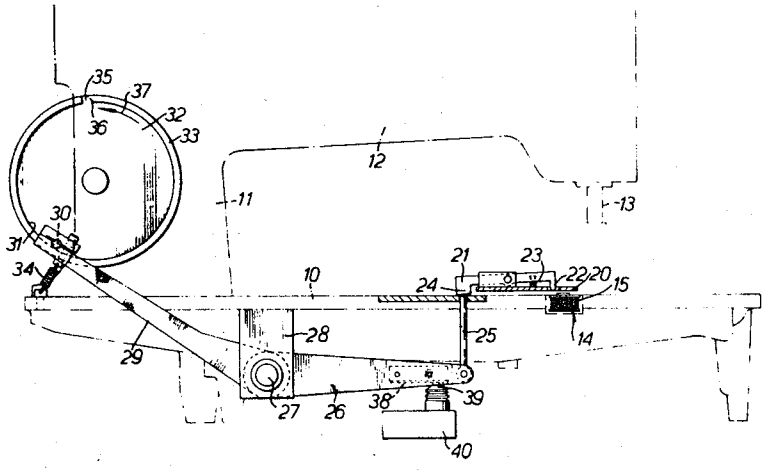
[52] **U.S. Cl.** **112/218,**
242/36, 242/118.4, 200/61.18
[51] **Int. Cl.** **B65h 63/02**
[50] **Field of Search** 112/219,
218, 220, 180, 185; 242/36, 37, 118.4, 118.5,
118.6, 129; 200/61.18, 61.13, 61.15, 61.16, 61.17,
61.42

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Attorney—Scrivener, Parker, Scrivener and Clarke

ABSTRACT: A lockstitch sewing machine including a bobbin holder capable of receiving a bobbin with a part movable to a signalling position when there is little or no thread on the bobbin but held in a normal position by the thread when there is more than a little thread on the bobbin, the machine being characterized in that it is provided with sensing means capable of sensing the position of the movable part of such a bobbin and operative to produce a characteristic signal when the part is in its signalling position.



3 Sheets-Sheet 1

Fig. 1

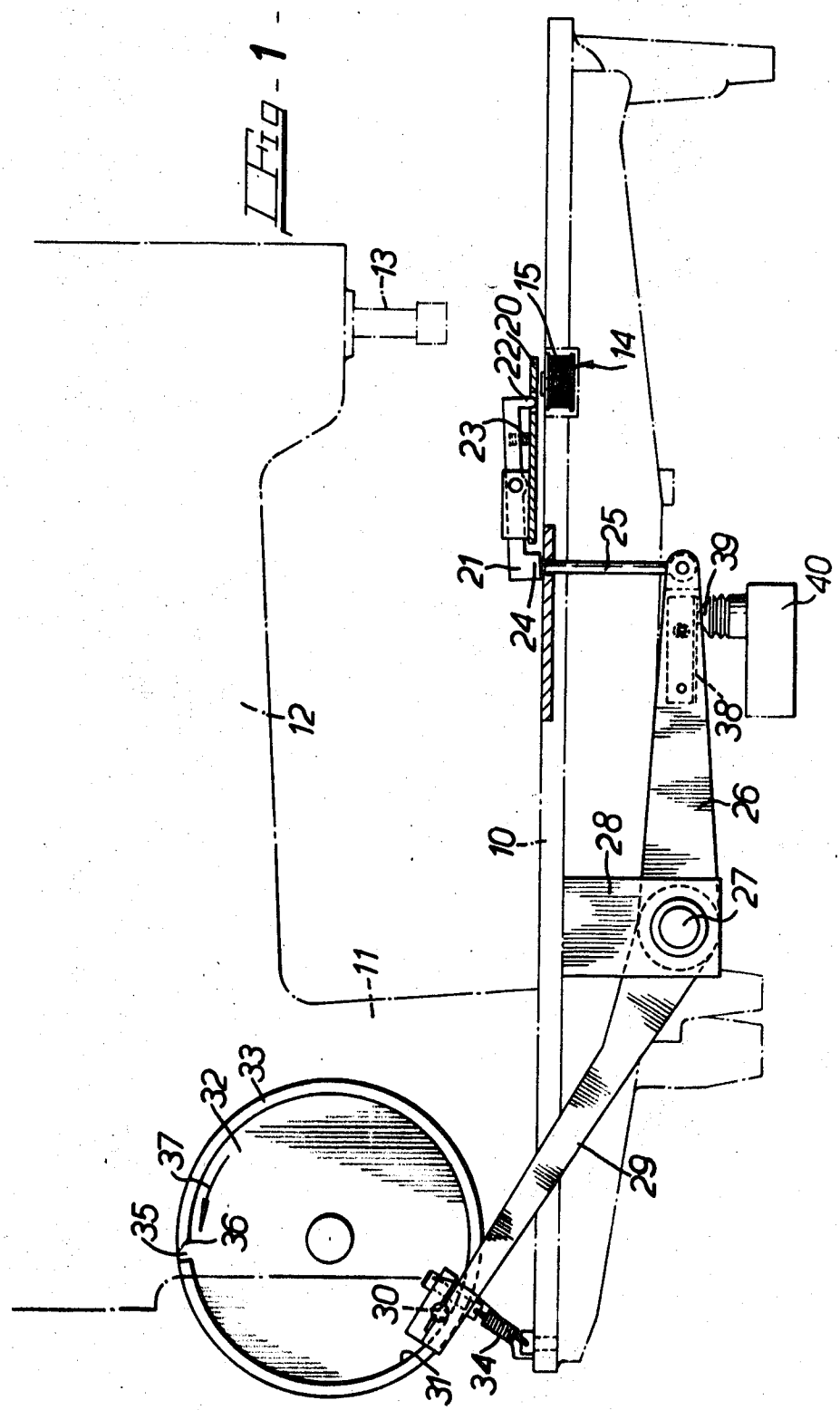
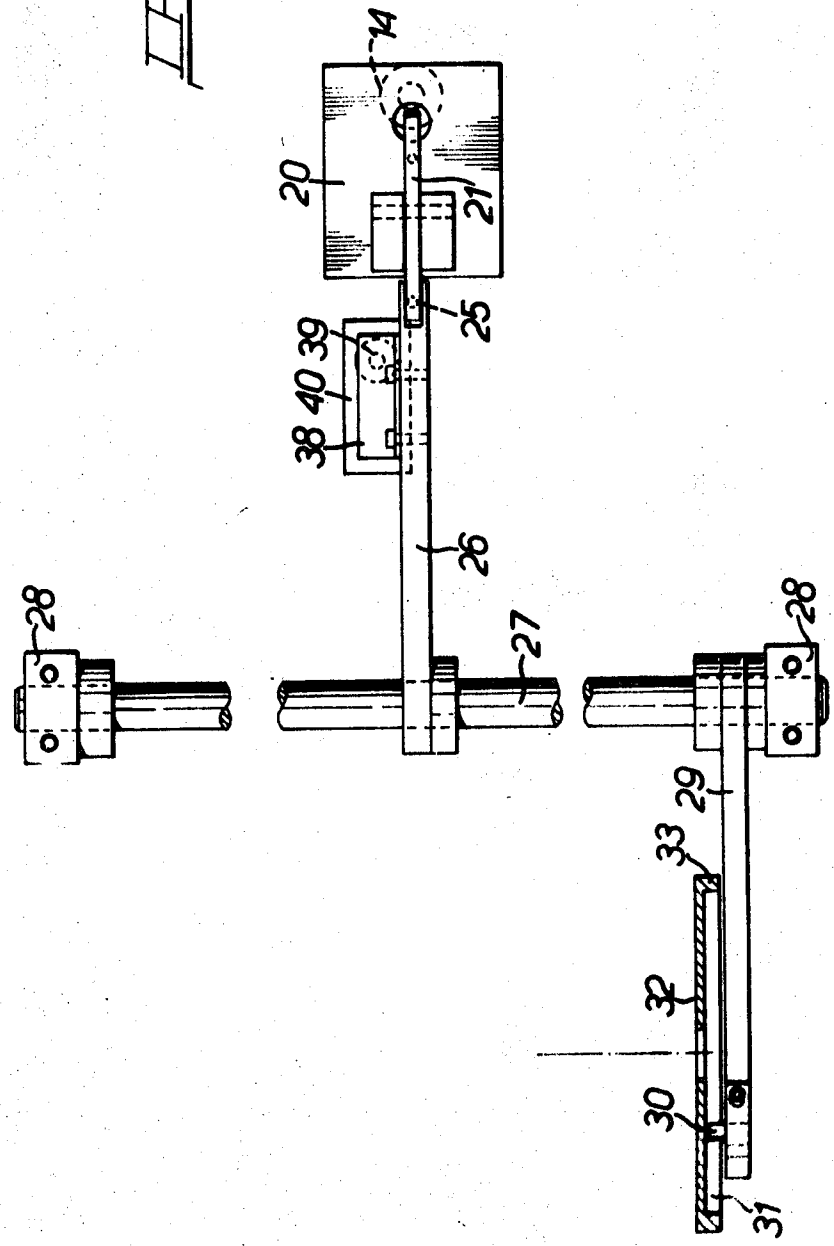


Fig. 2



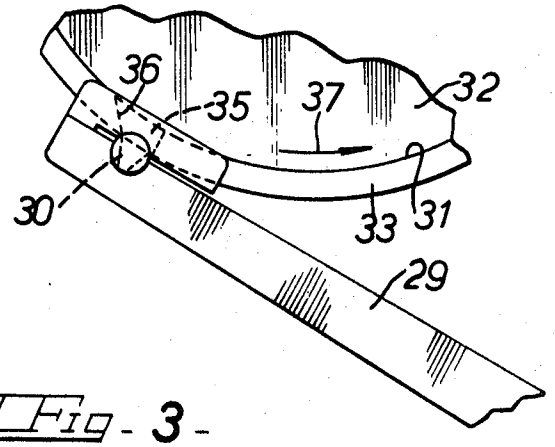


Fig. 3

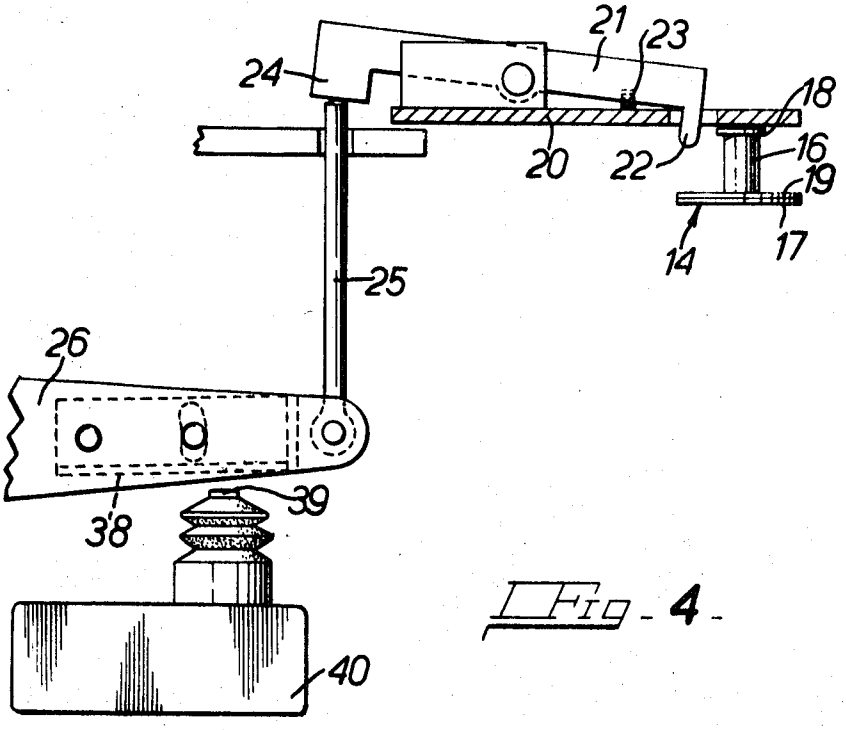


Fig. 4

SEWING MACHINES

This invention is concerned with improvements in and relating to sewing machines and in particular to sewing machines of the lockstitch type, that is of the type comprising driving means, a reciprocable needle carrier which is operated by the driving means and in use carries a needle with an eye through which the needle thread passes, and a bobbin holder which in use carries a bobbin which carries the bobbin thread, the arrangement being such that in use during the formation of each stitch the needle carries a loop of needle thread through the work, the bobbin thread is passed through the loop and the needle is withdrawn and the needle thread drawn tight. It is to be understood that the term thread used herein refers not only to cottons but all all other appropriate forms of sewing materials.

As the entire stock of bobbin thread has to pass through the loop of needle thread every time a stitch is made the quantity of bobbin thread which can be used is necessarily restricted. For example, one particular form of bobbin in current use holds when it is fully charged enough thread for only four yards of stitching. When the machine is in use the bobbin thread therefore becomes used up at regular intervals and has to be replaced. As the bobbin and bobbin thread are usually so positioned as to be hidden from the operator of the machine it may be that from time to time the operator continues to use the machine after the bobbin thread has been exhausted without noticing that there is no bobbin thread. As a result the work may have to be machined a second time.

The aim of the present invention is to provide apparatus enabling this difficulty and similar difficulties to be reduced or overcome. From one aspect the present invention consists in a lockstitch sewing machine including a bobbin holder capable of receiving a bobbin with a part movable to a signalling state when there is little or no thread on the bobbin but held in a normal position by the thread when there is more than a little thread on the bobbin, the machine being characterized in that it is provided with sensing means capable of sensing the position of the movable part of such a bobbin and operative to produce a characteristic signal when the part is in its signalling state.

The characteristic signal may be arranged to cause a warning lamp to be lit or a buzzer to sound, but preferably it is such as to cause the sewing machine to stop sewing, so that the empty or substantially empty bobbin can be removed and replaced with a bobbin charged with thread.

The sensing means may be of any suitable kind and may, for example, serve to detect changes to optical, electrical or magnetic properties resulting from the movement of the movable part of the bobbin, but preferably the sensing means is of a mechanical nature and serves to detect changes in the position of the movable part by physical contact with that part.

Although the sensing means may be operative continuously this may be difficult to arrange as the bobbin must pass through the loop of needle thread during the formation of each stitch. In a preferred arrangement, therefore, where the sensing means is of a mechanical nature, the sensing means is operative only intermittently, and operates at times when the loop of needle thread is not passing round the bobbin. Preferably the sensing means is operative only at intervals of a predetermined number of stitches.

From another aspect the present invention consists in a bobbin, in or for a lockstitch sewing machine of the kind outlined above, with a part movable to a signalling state when there is little or no thread on the bobbin, but held in a normal position by the thread when there is more than a little thread on the bobbin.

The arrangement may be such that the movable part does not move to its signalling state until there is no thread remaining on the bobbin, but preferably the arrangement is such that the movable part moves to its signalling state when a little thread still remains on the bobbin. In this way appropriate action can be taken, in response to the signal produced by the sensing means, before the thread is entirely exhausted. The term little thread is used to designate a quantity of thread small in relation to the total quantity of thread which can be loaded onto the bobbin, and in any case not more than one tenth of such total quantity.

In a simple and convenient arrangement the bobbin comprises a spindle onto which bobbin thread can be wound, the movable part being movable lengthwise of the spindle. The particular advantage of this arrangement is that the movable part remains in its normal position until most of the thread has been unwound from the spindle and that the movement of the movable part thus occurs relatively rapidly during the unwinding of the last layer of last few layers of thread wound onto the spindle. The invention will now be more particularly described with reference to the accompanying drawings, in which:

FIG. 1 is a rear elevation of sensing means and a bobbin characteristic of the present invention, and the outline of a conventional lockstitch sewing machine on which they are mounted;

FIG. 2 is a plan view corresponding to FIG. 1,

FIG. 3 is a view to a larger scale of part of the sensing means shown in FIG. 1, but with the components in different relative positions, and

FIG. 4 is a view to a larger scale of another part of the sensing means and the bobbin shown in FIG. 1, but again with the components in different relative positions, these corresponding to the positions of the components shown in FIG. 3. The outline of the machine is shown in chain-dotted lines in the accompanying drawings as the machine is of conventional construction. The machine is driven by an electric motor (not indicated) and has a bed plate **10**, pillar **11** and arm **12** of the usual kind. The arm has a vertically reciprocable needle carrier **13** which is use carries a needle (not shown) with needle thread passing through its eye.

The machine also includes a bobbin holder close to the lowermost point reached by the needle. The bobbin holder is shown as holding a bobbin **14** of novel construction onto which bobbin thread **15** is wound. In use, during the formation of each stitch the needle carries a loop of needle thread downwards through the work, and the loop is passed around the bobbin **14** so that the bobbin thread extends through the loop. The needle is then withdrawn and the needle thread drawn tight is complete the stitch.

The bobbin **14** comprises a central spindle **16** in the form of a short metal tube. The tube has an outwardly directed flange at each end, one flange, **17**, being broad and the other, **18**, being narrow. The bobbin also includes a movable part in the form of an annular plate **19** similar to the broad flange **17** and slidable lengthwise of the spindle **16**. The plate **19** is retained on the spindle **16** by the flanges **17** and **18**. When the bobbin thread **15** is wound onto the spindle **16** it holds the plate **19** against the narrow flange **18**, as shown in FIG. **1**, this being the normal position referred to above; but when there is little or no thread left on the bobbin the plate **19** is free to move towards the broad flange **17** as shown in FIG. **4**, and take up its signalling state. As will be apparent from the following description, particularly with reference to FIG. **4**, there is a range of positions of the plate **19** on the spindle **16** in which the plate **19** is in its signalling state, the range of positions extending upwards from the lowermost position of the plate (shown in FIG. **4**) to a position somewhat below the narrow flange **18**. The bobbin **14** is mounted with its spindle **16** vertical so that in use the annular plate **19** drops under the influence of gravity when the bobbin thread is substantially exhausted. The diameter of the central opening of the movable plate may be selected relative to the diameter of the spindle such that the plate may move downwardly to a signalling position while one or a few layers of thread remain on the spindle. The bobbin **14** is mounted on the bobbin holder which is immediately beneath a removable cover plate **20** which extends over the holder and the adjacent part of the bed plate **10**. The arrangement is such that the work passes to one side of the cover plate **20**.

A sensing arm **21** is pivotally mounted on the cover plate **20**, the arm extending generally horizontally from a position above the bobbin **14** towards the pillar **11**. The arm **21** is pivoted about a horizontal, transverse axis at its center to a bracket on the cover plate **20**. A finger **22** depends from that end of the arm **20** above the bobbin **14**, through a hole in the cover plate **20** and can be brought into contact with the movable annular plate **19** of the bobbin, when the plate is in its normal, uppermost position, on slight pivotal movement of the arm. A compression spring **23** urges the arm **21** to or towards the position shown in FIG. **1** in which the finger **22** is raised slightly above the movable plate **19** of the bobbin and an abutment **24** on the other end of the arm abuts the bed plate **10**.

Below the abutment **24** is a vertically extending rod **25**, the upper end of which extends through a hole in the bed plate **10** and the lower end of which is pivotally connected to one end of a lever **26**. The lever **26** extends horizontally beneath the bed plate **10** towards the pillar **11** and its other end is fixed to the central part of a shaft **27** mounted between bearing blocks **28** secured to the underside of the bed plate. A second lever **29** fixed to the rear end of the shaft **27** extends in an upwardly inclined direction, through an appropriate slot in the bed plate **10** of the machine. Its upper end carries a cam follower **30** which engages a cam surface **31** on a cam wheel **32** mounted on the pillar **11** for rotation about a horizontal axis parallel to the pivot axis of the shaft **27**. The cam surface **31** is afforded by the inner face of an axially directed peripheral flange **33** on the cam wheel **32**, and the cam follower **30** is urged into contact with it by a helical tension spring **34**, one end of which is connected to the lever **29** at a point near the cam follower and the other end of which is fixed to the bed plate **10**.

The cam wheel **32** is coupled to the drive of the machine in a manner such that in each successive cycle of ten stitches the cam follower **30** is held in a given position, against the action of the spring **34** while nine successive stitches are formed, but that the cam follower is free to move down under the influence of the spring at the formation of the 10 stitch. The cam follower **30** is in fact only free to move downwards while the needle is moving downwards so that the sensing finger **22** remains a short way above the bobbin **14** each time a loop of needle thread is formed and is being passed around the bobbin. When the cam follower **30** moves downwards the levers **26** and **29** pivot and raise the rod **25** which engages the abutment **24** and tilts the sensing arm **21**. If the bobbin **14** has more than a little thread on it the sensing finger **22** touches the annular plate **19** after a slight movement only of the associated mechanism. If, on the other hand, the bobbin **14** is empty or only has a little thread on it the sensing finger **22** and the remainder of the associated mechanism can perform much larger movements as shown in FIGS. **3** and **4**, though the sensing finger **22** remains spaced well above the lowermost position of the plate **19**. The flange **33** is formed with a through hole **35** which can be entered by the cam follower **30**. One side, **36**, of the hole **35** is inclined so that when the cam follower **30** enters the hole a small distance, as happens when the plate **19** is in its normal position and prevents much movement of the finger **22**, continued rotation of the cam wheel **32** in the direction of the arrow **37** raises the cam follower out of the hole. When the plate **19** is in its signalling state as shown in FIG. **4**, the finger **22** is able to move further, and the cam follower **30** passes right through the hole **35** whereupon the cam wheel can run on and continue to rotate without altering the position of the cam follower.

The lever **26** carries an adjustable stop **38** near the pivotal connection with the rod **25**, which stop cooperates with the operating member **39** of a microswitch **40** fixed below the stop. The operating member **39** is depressed in normal use and is only able to rise when the lever **26** rises in response to unrestricted movement of the sensing finger **22** indicating that the plate **19** is not in its normal position. The microswitch has contacts which are open when the operating member **39** is depressed, and which are so connected that when they are closed the motor which drives the machine is stopped so that sewing ceases and the bobbin **14** can be removed and replaced with another bobbin charged with thread. As the cover plate **20** must be removed to withdraw and replace the bobbin **14** the sensing arm **21** is likewise removed so that the finger **22** does not obstruct the removal and replacement.

I claim:

1. A lockstitch sewing machine including a bobbin holder and provided with a bobbin having a spindle on which bobbin thread can be wound and a part movable from a normal position to a signalling state, the presence of more than a little bobbin thread on the spindle, retaining the movable part in its normal position and thus preventing such movement, the machine also being provided with sensing means comprising a mechanical probe and operating means for causing the probe to approach the movable part of the bobbin intermittently when the machine is in use and to be spaced from such part when the bobbin thread is being passed through the loop of needle thread during the formation of each stitch, movement of the probe being restricted by engagement with the movable part of the bobbin when said movable part is in its normal position, such movement not being so restricted when the movable part is in its signalling state, and means operative to produce a characteristic signal when said probe approaches the movable part of the bobbin and its movement is not restricted by the presence of the movable part of the bobbin in its normal position, said movable part being in its signalling state.

2. A lockstitch sewing machine according to claim **1** in which there is a removable cover for the bobbin holder, the probe being mounted on said cover.

3. A lockstitch sewing machine according to claim **1** in which the operating means is such as to cause the probe to approach the movable part of the bobbin only at intervals, each interval being of a predetermined number of stitches.

4. A lockstitch sewing machine according to claim **1** in which the operating means comprises a rotatable cam coupled to the drive of the machine and having a hole, there being a cam follower operatively coupled to the probe in such a manner that the follower can enter the hole to only a limited extent when the movable part of the bobbin is in its normal position and the movement of the probe is restricted by the contact between the probe and the movable part of the bobbin, but the follower can enter the hole more deeply when the movable part is in its signalling state and the movement of the probe is no longer restricted by the presence of the movable part of the bobbin.

5. A lockstitch sewing machine according to claim **1** in which there is a broad outwardly directed flange at one end of the bobbin spindle and a stop at the other end thereof, the movable part of the bobbin comprising an annular plate similar in extent to the broad flange, slidable lengthwise of the spindle and being retained on the spindle by the flange and the stop.