United States Patent

Bosken et al.

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[45] **May 2, 1972**

[54] **SEWING MACHINE HAVING CONTACTLESS POSITION CONTROL MEANS**

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[52] **U.S. Cl.** ..... **112/219 A,** 112/252, 250/233

[51] **Int. Cl.** **D05b 69/22**

[58] **Field of Search** ..... 112/219 A, 219 R, 67, 220, 112/252; 250/233, 231 SE

[56] **References Cited**

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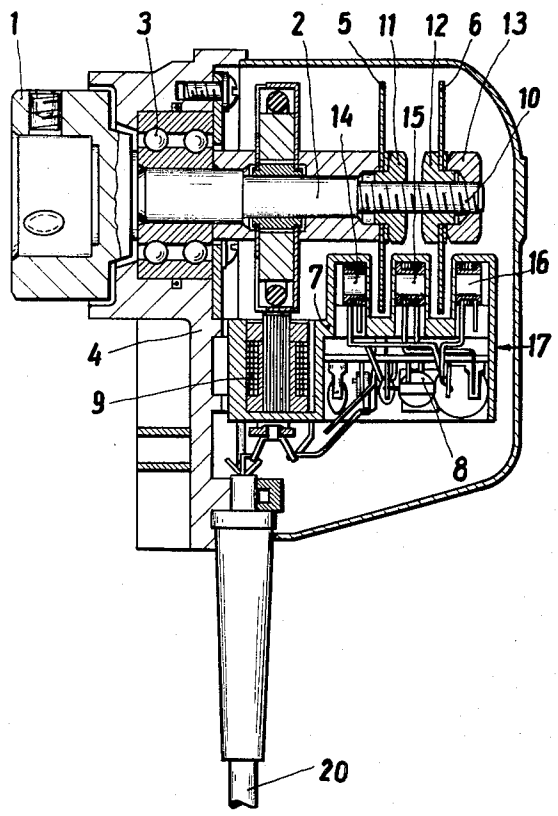
[57] **ABSTRACT**

Sewing machine having contactless position control means operating with one or more rotating shield blades where the control means for operating a thread cutter has an additional displaced phase shield blade sector that is effective to determine the stopping of the sewing machine in relation to the position determined by the control means.

7 Claims, 7 Drawing Figures



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3 Sheets-Sheet 1

Fig. 2

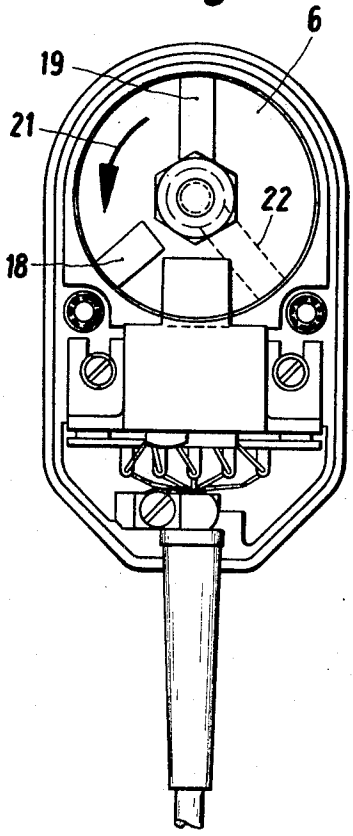


Fig. 1

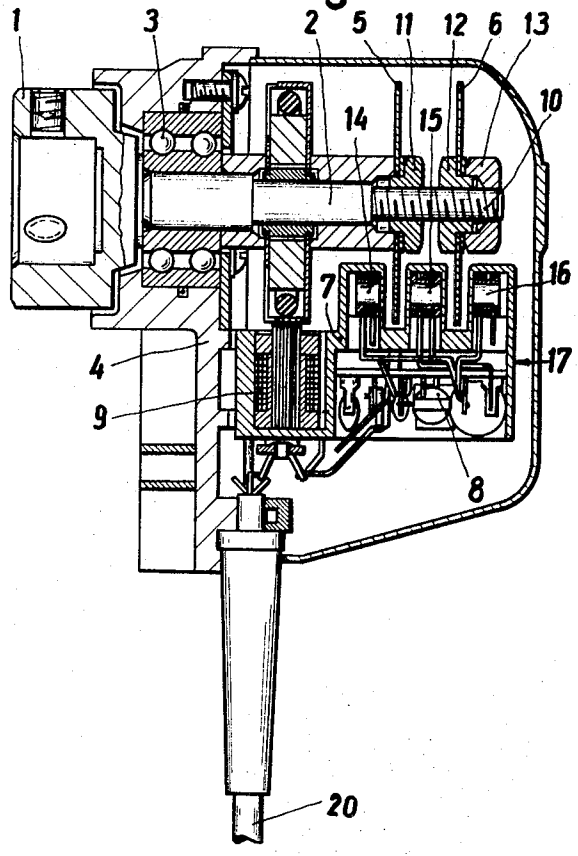
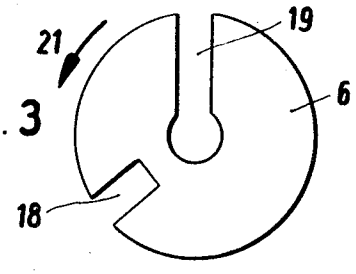


Fig. 3



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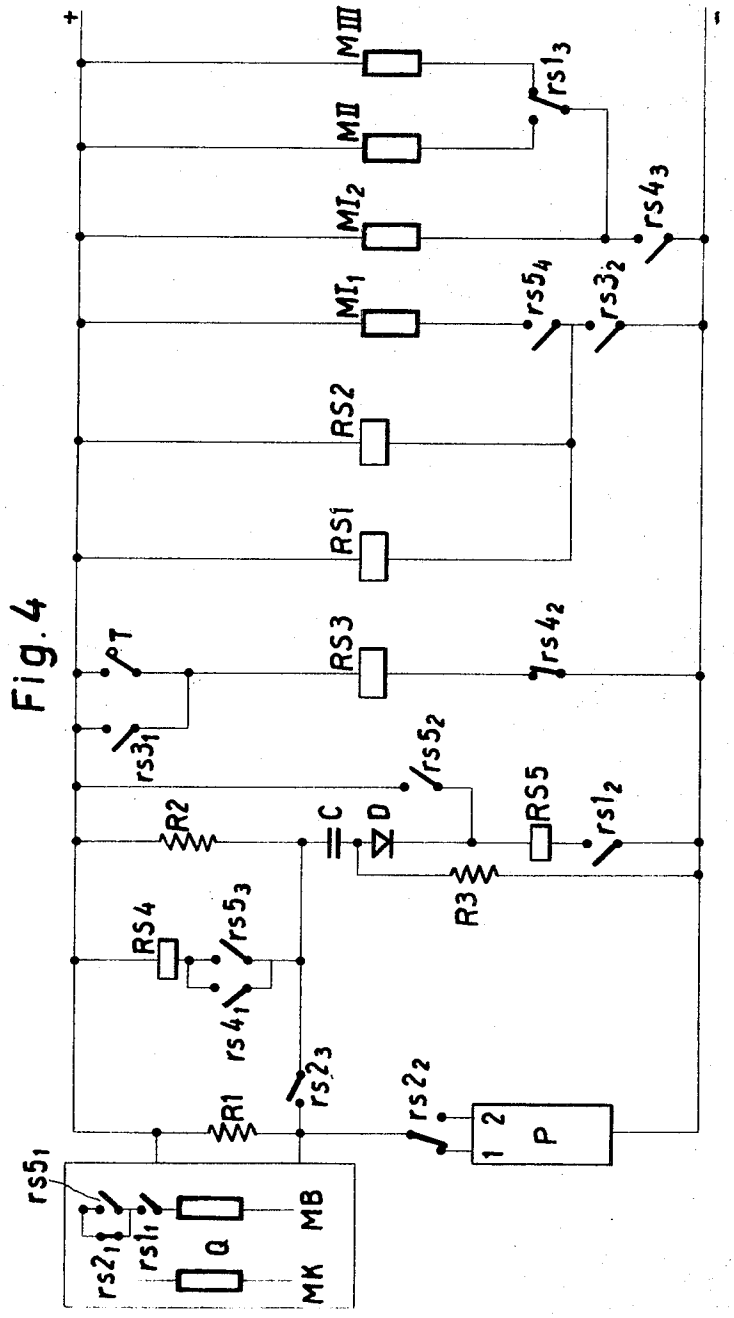

Fig. 4

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Fig. 5

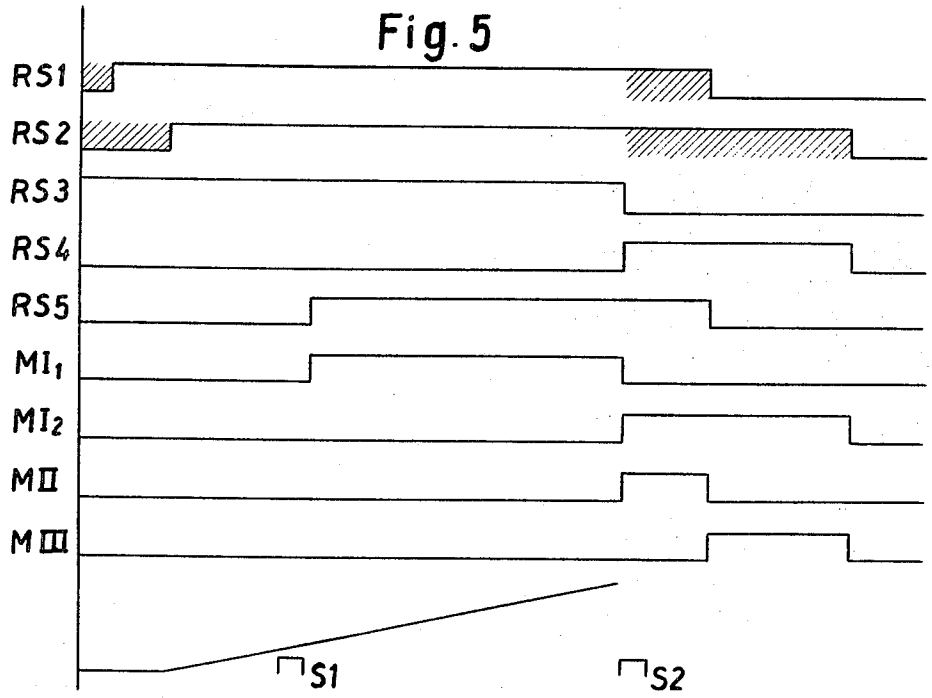


Fig. 6

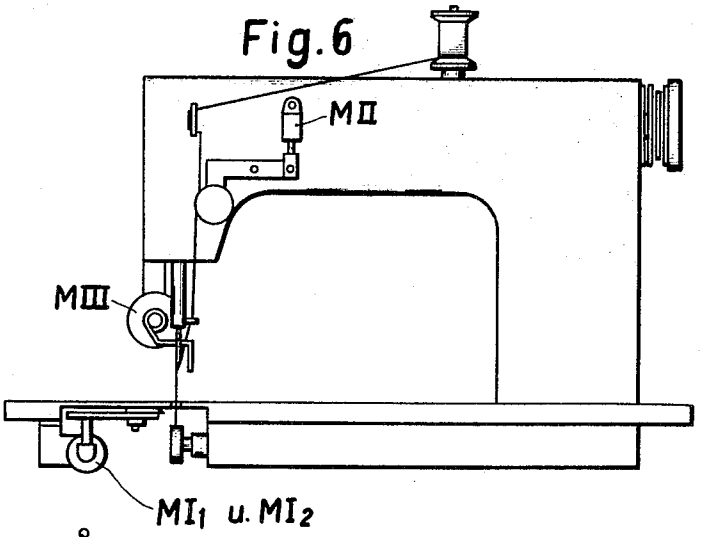
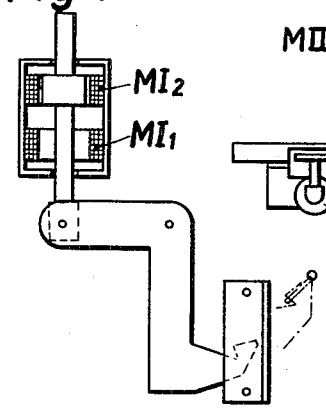


Fig. 7



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SEWING MACHINE HAVING CONTACTLESS POSITION CONTROL MEANS

BACKGROUND OF THE INVENTION

In sewing machines having thread cutters, it is necessary to guide the cutter in a manner that it does not collide with the needle of the machine during the thread cutting operation. The cutter may, therefore, only be actuated when the needle of the sewing machine is on the way from the lower position to the upper position above the level of the stitch plate. It is difficult to meet this requisite, especially with rapidly operating sewing machines, where the stopping pauses of the machine should be shortened as much as possible. These difficulties are avoided in accordance with the invention which makes possible a particularly effective control of the thread cutter.

The invention involves as a prerequisite the use of a sewing machine which includes a position control or determining means for stopping when the needle is in a predetermined position, which has a rotating shield blade, for example a blade that has a perforation or slot. An arrangement of this type is disclosed in the application Ser. No. 768,725, now U.S. Pat. No. 3,563,195, dated Feb. 16, 1971, of one of the inventors in the present case. This shield blade serves for alternately interrupting and opening or also to bridge or separate a path of rays or lines of forces of an electromagnetic field in synchronism with the periodic needle movements, whereby a control element can be made to respond, which influences the running of the machine. In addition, it is also necessary by means of a control arrangement for the number of rotations to provide a constant positioning or setting velocity of the machine during the stopping and thread cutting operation.

SUMMARY OF THE INVENTION

In accordance with the invention, a sewing machine of this type is arranged so that its position control means includes an additional shield blade sector for guiding or controlling a thread cutter. If the position control means is designed for example with a rotating slotted blade, the controlling shield blade sector may be in the form of an additional blade slot which may advantageously be provided in the same shield blade which controls the stopping of the sewing machine after the cutting operation while the needle is in the uppermost position.

The controlled part of the control means can forward the impulses produced by the passage of the effective shield blade sector in the light ray or field to an electrically operated thread cutter drive means, and operate the same at the proper point of time and/or block the same against inadmissible operation in an unsuitable position of the sewing machine needle.

When a plurality of shield blade disks are employed they may be rotatable relative to one another for accurate mutual angular positioning. They may also be arranged in a manner that the effective control sector in one of the blades may optionally be covered or shielded by another disk or blade.

Suitably the control impulses are not directly supplied to the drive means for the thread cutter, but by way of a relay circuit by means of which the control operations are further refined and adapted to the practical requirements.

BRIEF DESCRIPTION OF THE DRAWINGS

An embodiment of the invention with the slotted blades is illustrated in the accompanying drawings in which

FIG. 1 shows in a longitudinal section the control head containing the control means with two shield blades,

FIG. 2 shows an end view of the control head with the cover removed,

FIG. 3 shows a shield blade in plan view with two slots displaced relatively to one another,

FIG. 4 is a circuit diagram of a relay arrangement which transmits the control impulses to the drive for the thread cutter,

FIG. 5 is the time schedule of the relay arrangement,

FIG. 6 is a schematic illustration of the sewing machine with a front view of the thread cutter, and

FIG. 7 is a plan view of the thread cutter drawn to a somewhat larger scale.

DESCRIPTION OF THE INVENTION

In accordance with FIGS. 1 and 2 the control head includes a connecting socket 1 provided with an inner shaft 2 which can be connected by means of the socket to the end of the shaft of the sewing machine. The shaft is journalled in a base plate 4 which is mounted in a ball bearing 3. The shaft 2 also supports the rotating part of the control device that comprises two shield blades 5 and 6 and whose stationary parts 7, 8 and 9 are mounted on the base plate 4 or are directly carried thereby.

The end of the shaft 2 disposed opposite the socket 1 is provided with a thread 10 on which nuts 11, 12 and 13 are threadedly mounted which carry and clamp into position the shield blades 5 and 6. The shield blades project between elements 14, 15 and 16, to be described later, of the signal receiver 17 of an optical or electrical or electronic indicating device, which when a lot in a blade passes through causes the signal receiver to transmit a setting signal to the lead 20.

FIG. 3 shows the shield blade 6 with two slots 18 and 19 that are angularly displaced relative to one another by about 130°. The slot 18 which advances or runs ahead in the direction of rotation as indicated by arrow 21, on passing through the signal receiver effects the emission of a first signal S1 to the thread cutter, whereby the same is caused to move below the stitch plate with a specially shaped cutter. As the top position of the needle is reached a second signal S2 is emitted which is caused by the slot 19 in the blade, and thereby the cutter is pulled back and the thread is cut.

The slots 18 and 19 in the blade can also be seen in FIG. 2, There the slot 22 of the blade 5 which determines the low position of the needle, and which runs ahead of the slot 18 of the blade 6, is indicated in dashed lines.

What has been said about the basic arrangement of the blade slots applies in the same sense also for shield blades having differently constituted and effective control sectors. For example, the shield blades can be provided with inserts or sectors of material having different shielding characteristics instead of the slots 18, 19 and 22 described above.

Suitably the blades are arranged for angular displacement relative to one another in order to better adapt the control of the thread cutter to its special requirements, so that the control head described is usable for different thread cutting systems.

The circuit diagram in accordance with FIG. 4 calls for a thread cutter having four magnets, illustrated by way of example in FIGS. 6 and 7, which itself is not the subject of the present application. Its exciter coils are identified as MI_1, MI_2, MII and MIII, and they are operable in the periodic sequence illustrated in FIG. 5. They are controlled by means of the multi-stage relay arrangement reflected by the schedule. The individual relays are identified as RS1 to RS5 and their contacts as $rs1_1$ to $rs5_1$, $rs5_2$, etc. The control device or position definer P is coupled with the sewing machine shaft, and Q indicates a circuit arrangement, which is not described here in detail, for controlling the sewing machine by means of an electromagnetic coupling and an electromagnetic brake that connect the machine with the continuously rotating drive motor, and where the coupling and the brake are provided with field coils MK or MB. A system of this type is disclosed in U.S. Pat. No. 3,407,910 to Alfred Heidt, one of the present applicants. The circuit in accordance with FIG. 4 in addition contains resistors R1, R2 and R3, a capacitor C, and a series connected diode D, as well as a manually operable switch in the form of a key T.

The time schedule in FIG. 5 shows the sequence in which the five relays RS1 to RS5 and the four field coils MI_1 to MIII have to be operated. In the lowermost part in the schedule in-

dicates the movement of the sewing machine shaft W, which progresses in accordance with the positioning speed, and the time position of the signals S1 and S2 caused by the passage of the shield blade slots **18** and **19**.

Prior to starting the thread cutting operation the machine is located in the lower needle position. The operation is initiated by operating the key T which connects relay RS3 into the circuit. The relay holds itself by way of contact $rs3_1$. Relays RS1 and RS2 are connected by means of contact $rs3_2$. After a short pull-up time delay RS1 switches over. These delay periods are indicated in FIG. **5** by hatching.

When relay RS1 switches over, the coil MB of the magnetic brake is connected by way of contact $rs1_1$. In addition contacts $rs1_2$ and $rs1_3$ closes. The relay RS2 closes later than relay RS1 after termination of its delay period. Contact $rs2_1$ opens the magnet brake. Contact $rs2_2$ cuts in the second control disk **6** of the position definer P. Since the machine at this point is in the lower needle position, the blade slot **19** for the upper needle position is outside of the position definer field, and therefore ineffective, so that the position definer allows no current to pass in the position **2** of contact $rs2_2$. As a result there is no potential drop across resistor R1. Thus, the circuit conditions assumed here result in that the coupling coil MK pulls up and sets the sewing machine in motion. Besides the relay RS2 closes the contact $rs2_3$. The first slot **18** of the second disk **6** on passing through the position definer or donor P, no braking takes place as a result of the signal arising at the resistor R1, because the relay contacts $rs2_1$ and $rs5_1$ that are ahead of the brake are open.

The condenser C is charged by way of resistors R2 and R3. Since the position donor does not allow current to pass at **2**, C discharges by way of contact $rs2_2$, position donor P, contact $rs2_3$ and resistor R3.

The diode D at this time prevents any discharge by way of relay RS5. Upon exit of the slot **18**, charging of the condenser C by way of R2, D and RS5 takes place. The parallel resistor R3 is so proportioned that it does not interfere with this function.

Now relay RS5 is cut in and holds itself by way of its contact $rs5_2$. The simultaneously closing contact $rs5_1$ makes possible an action on the brake by means of the position donor. The contact $rs5_3$ which likewise closes connects relay RS4 with the position donor, so that it can be controlled by it. With contact $rs5_4$ the magnet MI_1 is operated which actuates the thread cutter. As the second slot **19** passes through the braking is initiated by the signal across resistor R1. In addition RS4 pulls up, holding itself by its contact $rs4_1$. Contact $rs4_2$ disconnects relay RS3. Contact $rs4_3$ cuts in the magnet coils MI_2 and MII. Now RS1, RS2 and MI_1 are disconnected by contact $rs3_2$. Upon expiration of the time delay of relay RS1, contact $rs1_3$ disconnects magnet coil MII and connects magnet coil MIII. In addition relay RS5 is disconnected by way of contact $rs1_2$. This effects the disconnecting of the brake and thereby the release of the shaft of the sewing machine for manual displacement. Upon expiration of the disconnecting delay of relay RS2, relay RS4 is disconnected by means of contact $rs2_3$. Thus also magnet MIII, which has been supplied by way of contact $rs4_3$, becomes devoid of current.

The arrangement described makes it possible to control the thread cutter by only two signals S1 and S2 from the position donor, where the signal S2 corresponds to the same top needle position in which the sewing machine is stopped. The position donor therefore needs to be arranged only for emitting the intermediate signal S1. For this an additional blade sector is sufficient, thus with slotted blades only one additional slot in the same blade which already has the slot that is associated with the top position of the needle.

The operation of the thread cutting magnets in the required accurate sequence is effected by the multiple-stage relay circuit. Mechanical interlocking with the driving system for the needle or the looper is not necessary. Different needle cutter systems can be subsequently installed in any sewing machine and controlled by position donors that require only small changes.

In the following some essential features of the examples described above are summarized, which are also applicable to thread cutters having a different number of operating magnets and other sequences of response.

The manual switch or key controls a pre-relay RS3, at whose operating contact $rs3_2$ the coils of relays RS1 and RS2 are connected which respond in time sequence, which in steps, partly directly and partly by way of further relays RS4 and RS5, effect directly the connecting of the magnet coils MI_1 to MIII. The operating contacts of the further pre-relays these and RS5 are connected ahead of these magnet coils, which in turn are in communication with the receiving system **17** of the position donor and are caused to respond by its output signals S1 and S2.

The relays RS1 and RS2 which control the thread cutter include additional contacts $rs1_1$ and $rs2_1$ for controlling the brake or its coil MB that stops the sewing machine.

At least one of the pre-relays, RS5 in this case, is connected to a condenser C which is discharged through the control means as the aforementioned intermediate signal S1 is released by way of the field coil of the pre-relay and causes it to respond.

The circuit can be adapted to different thread cutting systems while retaining the foregoing features.

Also the arrangement of the shield blades can be varied by adding additional blades. If, for example, a cover blade having its own slot is arranged parallel to the slotted blade and turnable relative thereto, then the slot of the first blade can optionally be covered completely or partially, and its effectiveness can be changed or made ineffective.

Having now described our invention with reference to the embodiment illustrated, what we desire to protect by letters patent of the United States is set forth in the appended claims.

We claim:

1. In a sewing machine having a coupling and a brake and comprising a needle bar head, a needle bar supporting a needle and reciprocably movable relative to said needle bar head, a thread cutter mounted proximate said needle, a drive shaft having one end operatively connected to said needle bar; a brushless synchronizer including a control head comprising a control shaft portion at the other end of said drive shaft, shielding means including at least one shield blade mounted on said shaft portion and having a control sector effective to stop the sewing machine in a predetermined upper position of the needle, control circuit means having an operating part disposed proximate said shielding means, and having a part controlling the operation of said coupling and said brake and a cutter control part for operating said cutter, said shielding means including an additional control sector in said one shield blade arranged in phase displaced relationship with said control sector effective to operate said cutter control part, a separate shield blade having a third sector for effecting stopping of the machine when said needle is in lowermost position, said additional sector being provided in said at least one shield blade having said control sector for stopping the machine in an upper needle position, and a key in said control circuit operative to initiate a thread cutting operation while said needle is in said lowermost position.

2. Sewing machine in accordance with claim **1**, where said additional sector is displaced by an angle of approximately 130° relative to said at least one sector for stopping the machine in an upper needle position.

3. Sewing machine in accordance with claim **2**, including a signal receiving system having circuit elements proximate and shielded by said shield blades and comprising a plurality of relays operatively connected to said circuit elements and having relay contacts, electromagnetic means for operating said thread cutter including a plurality of magnet coils connected to said relay contacts.

4. Sewing machine in accordance with claim **3**, comprising a pre-relay and a manual switch for initiating the thread cutting operation, said pre-relay having a working contact, a plurality of sequentially operated relays having coils operatively connected to said working contact and operative to energize said magnet coils of said thread cutter.

5. Sewing machine in accordance with claim 4, including additional pre-relays connected to said magnet coils of said thread cutter and operatively related to said signal receiving system to respond to the output signals thereof.

6. Sewing machine in accordance with claim 5, where said sequentially operated relays are provided with additional contacts operatively connected to actuate said brake.

7. Sewing machine in accordance with claim 6, including a condenser connected to said signal receiving system by way of the coil of one said pre-relays and responsive to a signal emitted by said receiving system to discharge and actuate said pre-relay.

* * * * *