

Sept. 10, 1968

M. D. BOWERS ET AL

3,400,677

CONTROL DEVICE FOR SEWING UNITS

Filed May 1, 1967

4 Sheets-Sheet 1

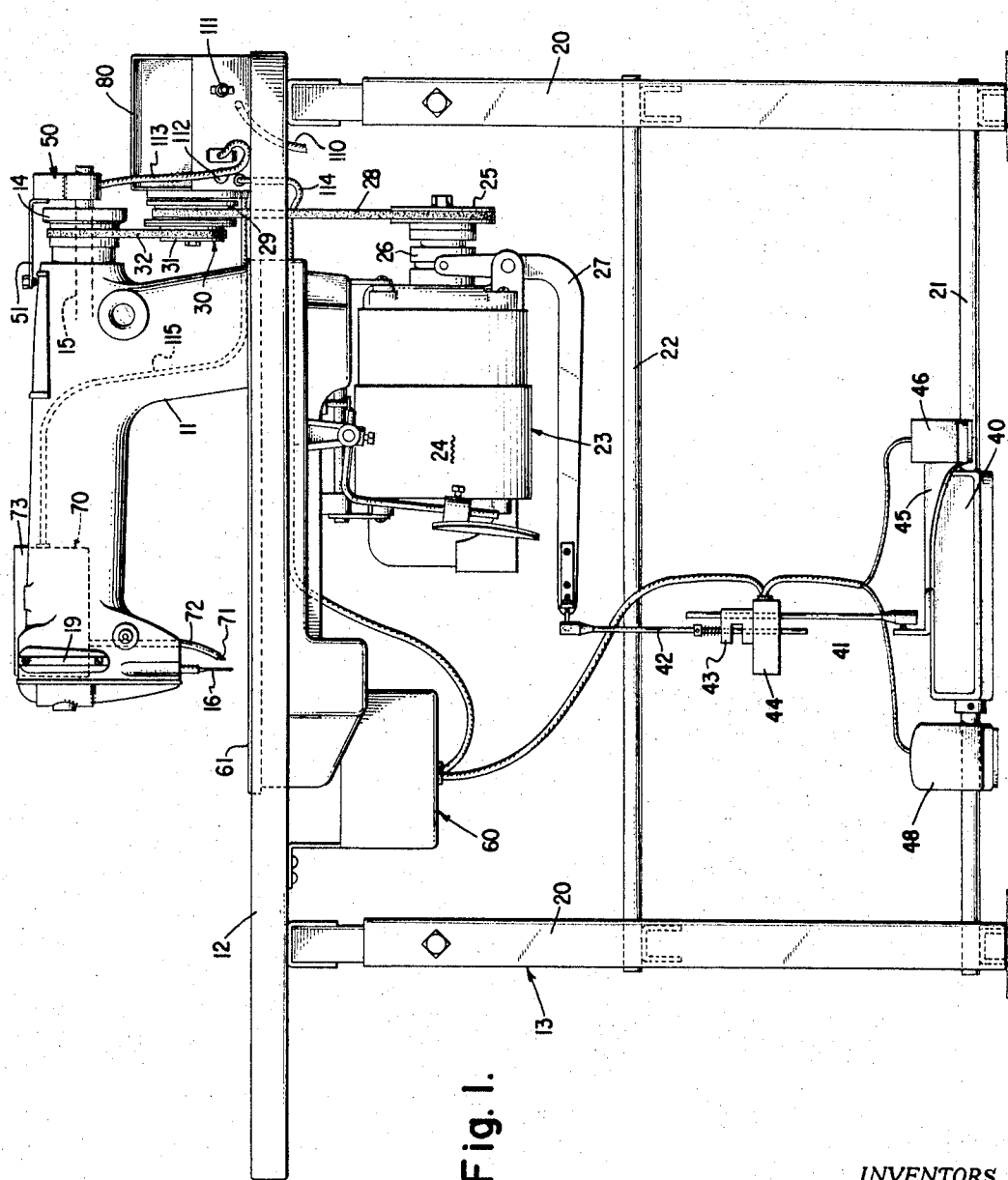


Fig. 1.

WITNESS

Nicholas Leszayak

INVENTORS.
**Lorenz A. Wendel and
Melville D. Bowers**

BY
Marshall J. Breen
ATTORNEY

Sept. 10, 1968

M. D. BOWERS ET AL

3,400,677

CONTROL DEVICE FOR SEWING UNITS

Filed May 1, 1967

4 Sheets-Sheet 2

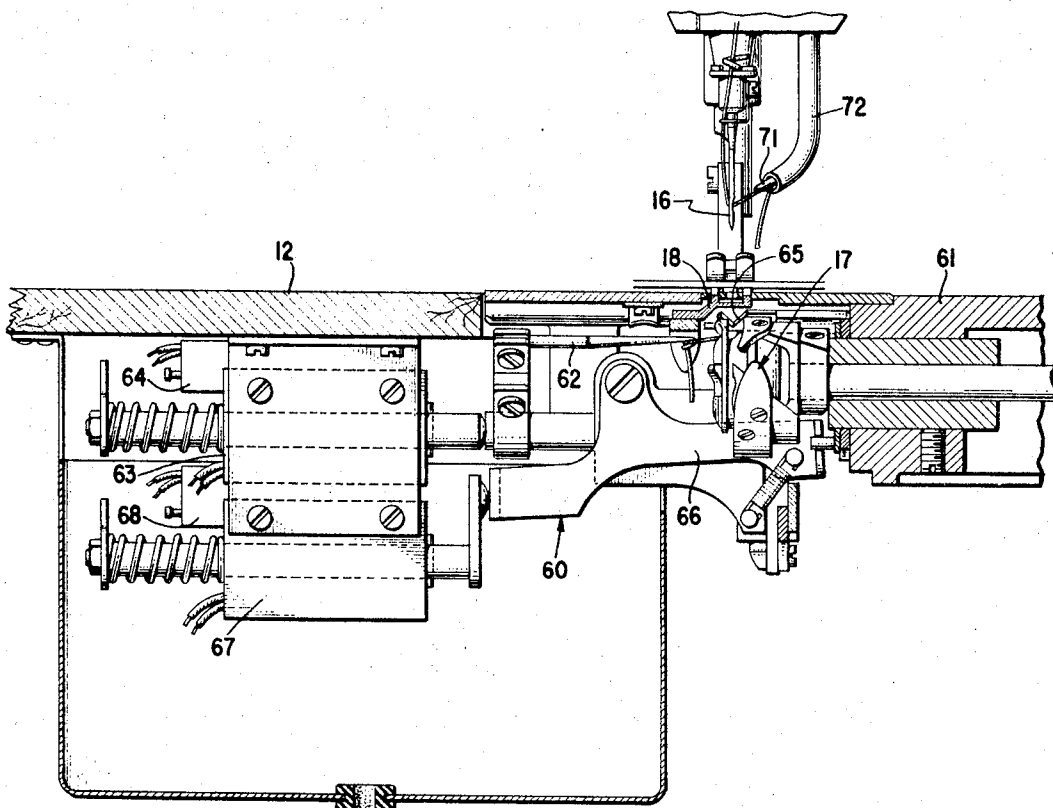


Fig. 2.

WITNESS

Nicholas Leszczak

INVENTORS
**Lorenz A. Wendel and
Melville D. Bowers**

BY

Marshall J. Beem
ATTORNEY

Sept. 10, 1968

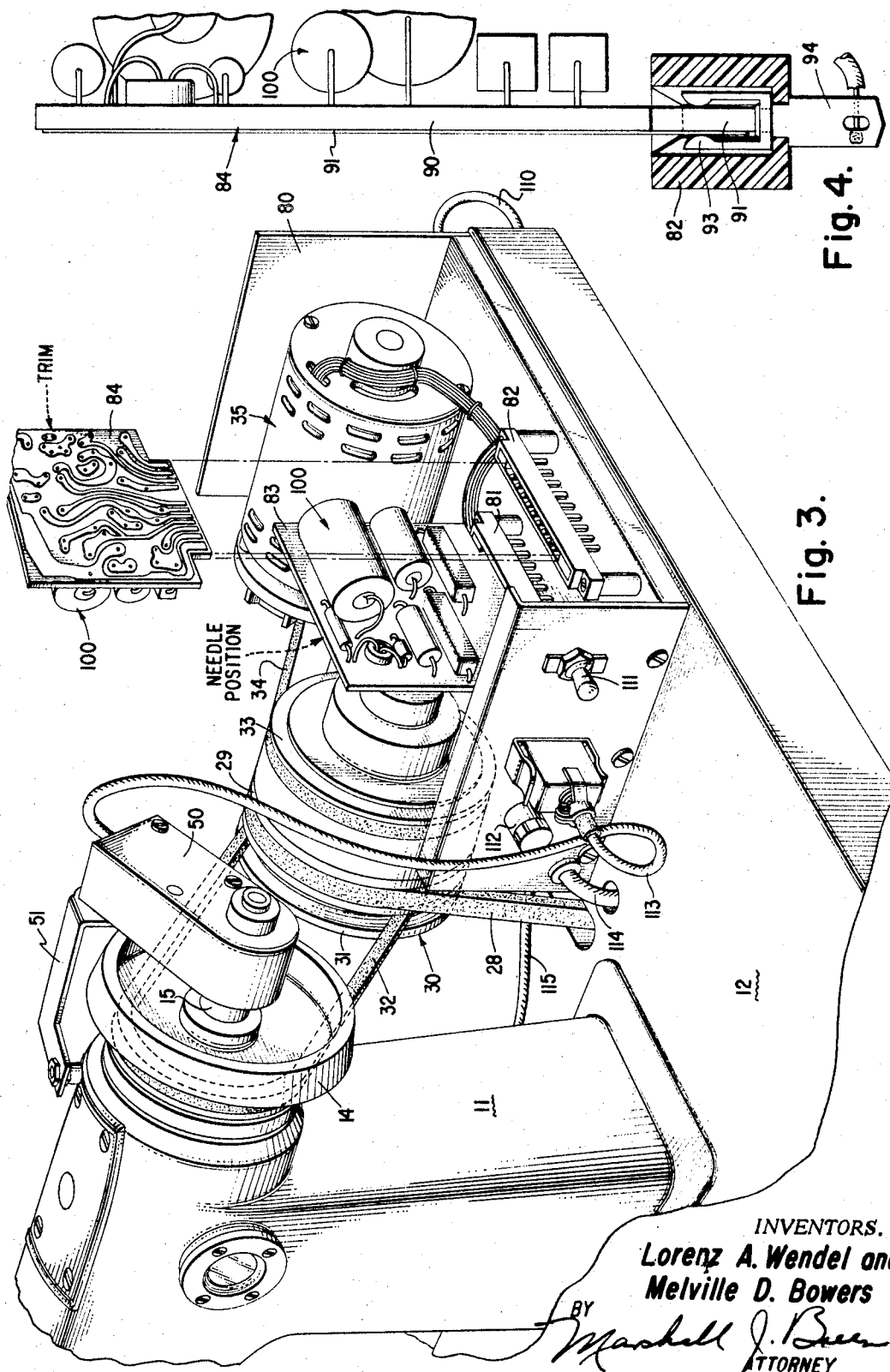
M. D. BOWERS ET AL

3,400,677

CONTROL DEVICE FOR SEWING UNITS

Filed May 1, 1967

4 Sheets-Sheet 3



Sept. 10, 1968

M. D. BOWERS ET AL

3,400,677

CONTROL DEVICE FOR SEWING UNITS

Filed May 1, 1967

4 Sheets-Sheet 4

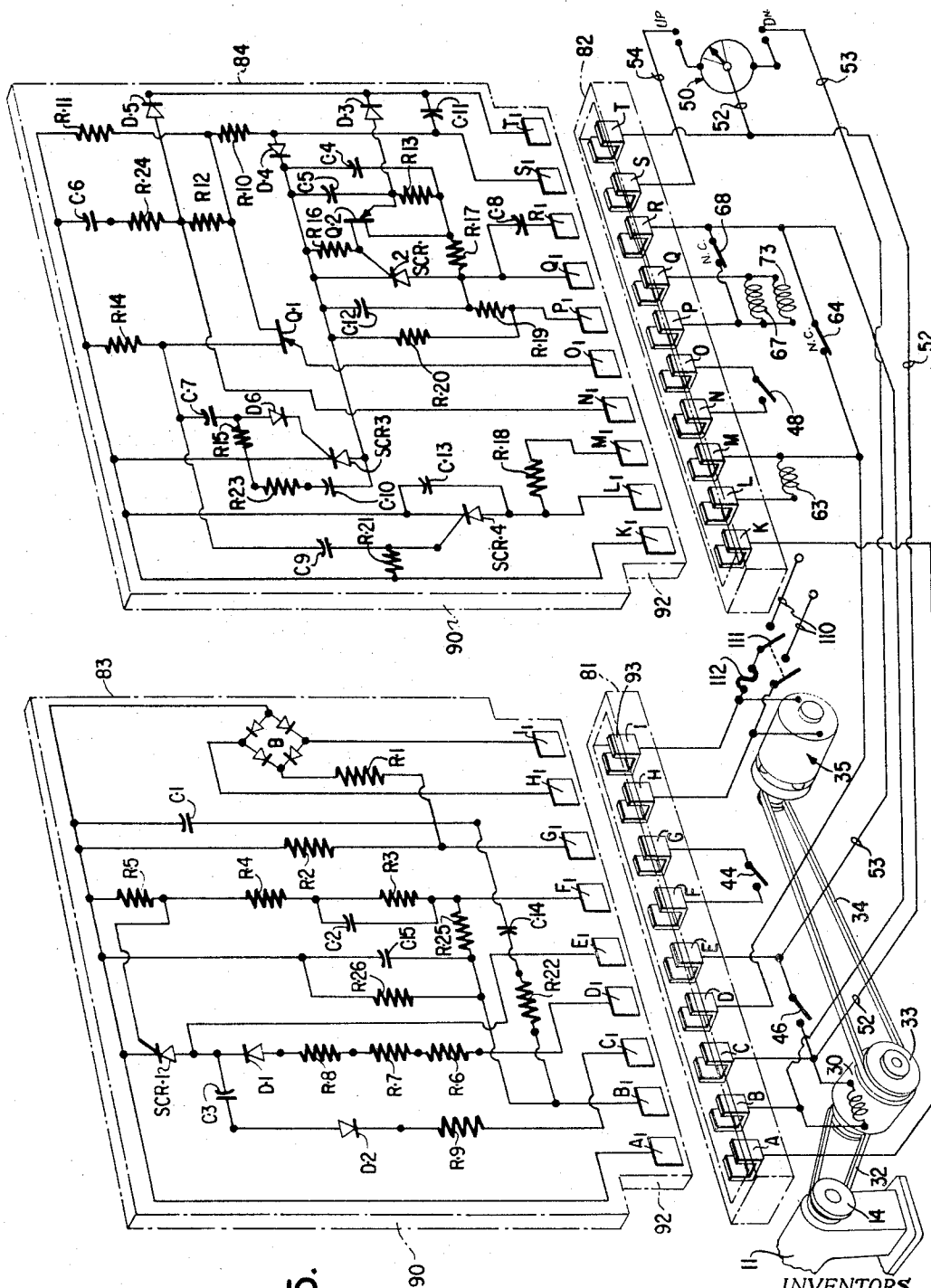


Fig. 5.

WITNESS

Nicholas Leszayak

INVENTORS
Lorenz A. Wendel and
Melville D. Bowers

BY

Marshall J. Breen
ATTORNEY

1

3,400,677

CONTROL DEVICES FOR SEWING UNITS

Melville D. Bowers, Montville, and Lorenz A. Wendel,
Somerville, N.J., assignors to The Singer Company,
New York, N.Y., a corporation of New Jersey
Filed May 1, 1967, Ser. No. 635,003
2 Claims. (Cl. 112-219)

ABSTRACT OF THE DISCLOSURE

A sewing machine is disclosed having electrically operated ancillary devices i.e., an underbed thread trimming device and a thread wiper, and an electrically operated needle positioner. Multisocket terminals are provided for two exchangeable circuit boards; one for controlling the operation of the needle positioner and the other for controlling the operation of the ancillary devices sequentially with the operation of the needle positioner.

Summary of the invention

This invention relates to sewing machine needle positioners, and more particularly, to a needle positioner which may also be used to control the actuation of ancillary devices on a sewing machine which require actuation sequentially with the positioning of the needle.

In commercial sewing operations, it frequently becomes necessary to exchange sewing machines in a power table to suit changes in sewing requirements. Where needle positioners are used in conjunction with the sewing machine operation it has been customary for the needle positioner to be fitted and adapted to a particular model of sewing machine so that a corresponding exchange of the needle positioner has also been required. Furthermore, an increasing number of ancillary devices are being introduced such as thread trimmers, and the like which require operations in a predetermined sequence with and dependence upon the operation of the needle positioner. Adaptations of needle positioners such as has been known heretofore to accommodate operation of such ancillary devices have further tailored the needle positioner for use only with a particularly fitted sewing machine. As a result, even an exchange of the same model sewing machine could frequently require a corresponding exchange of needle positioner.

It is an object of this invention to provide a sewing machine needle positioner which includes exchangeable circuit boards both for operation of the needle positioning function as well as for the function of operation of ancillary devices sequentially with the needle positioning. As a result the needle positioner need not be removed and exchanged from the power table upon an exchange of sewing machines but instead the change may be accommodated simply by an exchange of the appropriate circuit boards.

Description of the drawings

With the above and additional objects and advantages in view as will hereinafter appear, this invention will be described with reference to the accompanying drawings of a preferred embodiment in which:

FIG. 1 represents an elevational view of a sewing unit having the needle positioner of this invention applied thereto.

FIG. 2 represents a cross-sectional view taken longitudinally through the sewing machine and illustrating a thread trimming device applied thereto.

FIG. 3 represents a perspective view of the needle positioner of this invention with a unitary circuit board displaced from the multisocket terminal with which it is connected to the needle positioner.

2

FIG. 4 is an enlarged cross-sectional view taken substantially along line 4-4 of FIG. 3 showing the multisocket terminal with the unitary circuit board accommodated therein, and

FIG. 5 is a wiring diagram illustrating an electrical circuit which may be used with the needle positioner of this invention.

Detailed description

As illustrated in FIG. 1 of the drawings, the control device of this invention has utility with a sewing unit including a sewing machine 11 supported on the table top 12 of a power table indicated generally at 13.

The sewing machine illustrated in FIGS. 1, 2 and 3 is of a conventional high speed lockstitch type and is provided with a handwheel pulley 14 fast on a main shaft 15 by which the sewing machine may be driven. The stitch forming mechanism of the sewing machine includes an endwise reciprocating needle 16, a loop taker 17 cooperating with the needle, a work feeding mechanism of which a feed dog 18 is illustrated in FIG. 2, and a needle thread take-up device 19 all of which are operated in timed relationship from the main shaft 15 in a conventional manner so as to produce a seam of lock stitches.

The power table 13 includes spaced legs 20 between which extend cross brace rods 21, 22. Secured beneath the table top 12 is a power transmitter 23 which provides the main drive means for the sewing machine. The power transmitter 23 includes an electric motor 24, a drive pulley 25 and a clutch-brake device 26 controlled mechanically by way of an operating bell crank 27 selectively to connect the drive pulley 25 to the electric motor 24 or to disconnect the pulley from the motor and apply a friction brake thereto.

A belt 28 operatively connects the transmitter pulley 25 with a pulley 29 of an electric clutch device 30. Another pulley 31 of the electric clutch device is connected by a belt 32 to the handwheel pulley 14 on the sewing machine main shaft. A third pulley 33 of the electric clutch device accommodates a belt 34 which is driven by an electric motor 35 which provides an auxiliary slow speed drive means for the sewing machine operation of which will be described hereinbelow. When the electric clutch device 30 is deenergized, the pulleys 29 and 31 will be operatively connected and the power transmitter 23 will be coupled to the sewing machine so that the pulley 33 will be free thereof. When the electric clutch device is energized, the pulley 33 will be coupled to the pulley 31 and the pulley 29 will be free thereof. The electric clutch device 30, therefore, constitutes an electrically operated coupling means for selectively engaging either the main drive means 23 or an auxiliary drive means 35 with the sewing machine and it will be understood that any equivalent electrically operated coupling means may be used.

For controlling the power transmitter 23, a treadle 40 is pivoted on the cross rod 21 of the power table. A draw bar 41 connected to the treadle and a draw bar 42 connected to the bell crank 27 are joined by a limited extensibility coupling 43 so that by toeing the treadle, the clutch brake device of the power transmitter will connect the pulley 25 to the electric motor 24. In the unactuated position of the treadle, as with the operator's foot removed therefrom, the pulley 25 will be free of both the electric motor and the friction brake of the clutch brake device 26; and when the treadle is heeled, the pulley 25 will have the friction brake applied thereto.

A normally closed electric switch 44 is associated with the limited extensibility coupling 43 so as to be opened only while the treadle 40 is toed. Mounted on a bracket 45 on the treadle 40 is an electric switch 46 which is normally open but may be closed by the application of a force by lateral movement of the operator's foot which is

on the treadle 40. A pedal operated normally open electric switch 48 is also carried on the cross rod 21 and may be closed by depression by the other foot of the machine operator. The switches 44, 46, and 48 serve to provide operator influence for the control device of this invention as will be described in detail hereinbelow.

As illustrated in FIGS. 1 and 3, a sewing machine needle position sensing means which in the preferred embodiment takes the form of a commutator means 50 is supported on a bracket 51 secured to the sewing machine and is operatively connected to an extension of the sewing machine main shaft 15. The details of construction of the commutator means 50 are not illustrated herein since they may follow any conventional arrangement. Electric wiring from the commutator means 50 includes as illustrated in the wiring diagram FIG. 5, a common conductor 52 and two conductors 53 and 54 which are disconnected electrically from the common conductor 52 each for only a small angular range of main shaft position; the conductor 53 being disconnected during the down position of the sewing machine needle 16, and the conductor 54 during the needle up position. While in the preferred embodiment the needle position sensing means takes the form of a commutator 50, the sensing means may be of the slip ring type, may employ photoelectric cells, or magnetically operated switches, or may be of any other known type requiring only that it provide selective disconnection of the conductors 53 and 54 from the common conductor 52 during a brief interval of needle down and needle up position, respectively.

Referring to FIG. 2, a group of devices ancillary to the formation of stitches and indicated generally at 60 are illustrated together with electrical operating means therefor. The devices illustrated in FIG. 2 comprise means for automatically severing the sewing threads beneath the work supporting bed 61 of the sewing machine. The thread trimming devices may be constructed in accordance with the United States patent application Ser. No. 562,576, July 5, 1966 of Roger J. Ross to which reference may be had for a detailed description.

For an understanding of this present invention, it will be sufficient to understand that the thread trimmer includes a thread catching finger 62 which is reciprocable by means of a solenoid 63 toward the loop taker 17 where it is latched into a position in which it can seize both the needle and bobbin threads. A normally closed switch 64 is associated with the solenoid 63 and opened momentarily when the solenoid 63 is energized. A thread severing knife 65 is carried adjacent to the loop taker 17 and connected to an operating linkage 66 which is actuated by a solenoid 67. A normally closed switch 68 is associated with the solenoid 67 and opened momentarily when the solenoid 67 is energized.

Proper functioning of the thread trimming device 60 requires a specific sequence operation coordinated with a specific sequence of needle positions. The thread catching finger 62 must be moved toward the loop taker when the needle is positioned down and the knife 65 must be actuated after the needle bar subsequently has been raised to the up position. Furthermore, since the sewing threads will be severed by operation of the ancillary device 60, the operation preferably should take place only upon stopping of the sewing machine at the completion of a seam formation.

A device ancillary to the sewing process which may be used as an addition to the thread trimming device 60 or may be used separately is a needle thread wiper 70 illustrated in FIG. 1. The thread wiper comprises a flexible probe 71 guided in a tube 72 on the sewing machine and actuated by a solenoid 73 to project and retract the probe into and out of a position across the needle path. The operation of the needle thread wiper 70 requires coordination with the position of the sewing machine needle in that the wiper must be actuated only after the needle has been positioned and preferably only after stopping of the

sewing machine at the completion of a seam formation.

The control device of this invention for providing the sewing machine operator with capability of stopping the sewing machine with the needle in a predetermined position and additionally for providing operation of the ancillary devices sequentially with the needle positioning as shown in the FIGS. 1 and 3 includes an enclosure 80 secured on the table top 12 and encompassing the electric clutch device 30, the auxiliary slow speed drive motor 35 as well as wiring connections to a first and second multi-socket terminals 81 and 82 respectively.

As illustrated in FIG. 3, in which a portion of the enclosure 80 has been removed, each of the multi-socket terminals 81 and 82 is adopted to accommodate an exchangeable unitary circuit board 83 and 84 respectively. In FIG. 3, the circuit board 83 as shown accommodated into the terminal 81 while the circuit board 84 is illustrated removed from the terminal 82.

Preferably, each of the unitary circuit boards comprises a rigid planar non-conductive supporting lamina 90 formed at one side with a group of printed or deposited electrically conductive areas 91 which extend into evenly spaced array onto an extension 92 of the lamina to provide the male contacts cooperating with "U" shaped metallic clips 93 which are set into the multi-socket terminals 81 and 82 to provide the female contacts. Extensions 94 from the metallic clips 93 provide terminals to which conductors may be attached from the various electrical devices, switches etc. heretofore described. The various electrical components, which are indicated generally at 100 in FIGS. 3 and 4 and will be described with more detail below with regard to the wiring diagram of FIG. 5, may be carried on the supporting lamina 90 of the circuit boards and connected electrically with the various printed conductor areas 91.

In FIGS. 1 and 3, 110 indicates the lines from a source of power, 111 is an on-off switch in the lines 110, and 112 as a fuse also in the lines 110. Indicated at 113 are the leads 52, 53, and 54 between the commutator 50 and the needle positioner enclosure 80. Indicated at 114 is a harness including the leads (not numbered) from the electrical components 63, 64, 67 and 68 of the thread cutting device 60 as well as those leads from the operator influenced switches 44, 46 and 48, to the needle positioner enclosure, while 115 indicates a similar harness including the leads to the thread wiper operating solenoid 73.

In the wiring diagram of FIG. 5, those electrical leads and components which are not carried as an integral part of either of the circuit boards 83 and 84 are shown connected to the various metallic clip extensions 94 of the multi-socket terminals 81 and 82 and reference characters corresponding to those used hereinabove are applied thereto in FIG. 5. The clips 93 have been lettered and the corresponding extensions of the printed circuits on the circuit boards have been indicated by corresponding primed letters.

It will be appreciated that the specific choice of electrical components on the circuit boards 83 and 84 will depend upon the specific results which are desired to be obtained in any particular sewing unit. The circuit illustrated in FIG. 5, therefore, is by way of an example and it will be understood that an important advantage of this invention resides in the fact that an entirely different circuit board may be substituted for either or both of the circuit boards 83 and 84 quickly and easily if a different mode of sewing unit operation is required.

A detailed description of the circuits included on the circuit boards 83 and 84 in FIG. 5, therefore, will treat only these components necessary for an understanding of one specific mode of operation of the sewing unit.

In FIG. 5 standard symbols for the various electrical components have been used and in FIG. 5 the following reference characters have been applied: B indicates a full wave rectifier; R, resistors; C, capacitors; D, diodes; Q, unijunction transistors; and SCR, silicon control rectifiers.

5

When the operator stops the machine by relaxing or heeling the treadle, the switch 44 closes, producing a trigger pulse through C2 and R4 to SCR1. This allows SCR1 to turn on and current will flow in two paths, one path through the coil of the electric clutch 30, the commutator lines 52 and 53, the contacts B, B¹ and E, E¹ and the SCR1 to energize the coil of the electric clutch 30 until the needle down position is reached. The other path occurs through contacts B, B¹, the normally closed switch 64, contacts D, D¹ and R6, R7, R8 and D¹ unaffected by the commutator 50 to keep the SCR1 conducting. Current through the coil of the electric clutch 30 will couple the auxiliary slow speed motor 35 to the sewing machine 11 and the commutator 50.

Current through the coil of the electric clutch 30 will be interrupted by the commutator 50 in the down position of the needle and the transmitter will again be coupled to the sewing machine pulley 14 to stop the machine. If the machine has been rotating at a high speed, it may coast beyond the needle down position in which case current will again flow through the commutator 50 and the coil of the electric clutch 30 to reposition the needle down. SCR1 will have been kept in the conducting state by holding resistors R6, R7 and R8. This will repeat until the machine stops needle down.

Once the machine has stopped needle down, the operator can resume normal sewing by toeing the treadle. This engages the transmitter and opens switch 44 removing power from the control circuit boards. Current flow through SCR1 will be interrupted and the needle down cycle will be repeated only when the operator again releases the treadle.

If on the other hand the operator wants to sew at low speed after having gone to the needle down position, she can close the switch 46 by applying side pressure with her foot. This permits current to flow through the coil of the electric clutch 30 without regard for the commutator 50 and the machine will be coupled to the auxiliary slow speed motor 35. Upon reopening of the switch 46 current will continue to flow through the coil by way of the commutator 50 until it is interrupted by the commutator 50 again reaching needle down position.

The above operation of the needle positioner is, therefore, possible with only the circuit board 83 plugged into the multiset terminal 81 and irrespective of whether the circuit board 84 is plugged in.

To obtain operation of the ancillary devices 60 and 70, not only must the circuit board 83 be inserted into the multiset terminal 81 but the circuit board 84 must also be inserted into the multiset terminal 82. The operation of the trimming device 60 must be initiated by closure of the switch 48 by the operator. This command from the operator will not be executed until a time delay, as determined by R12, R24, and C6, has elapsed. This time delay is required to insure that the needle down position has been achieved. This is necessary since the machine may "coast" through the needle down position when needle down is called for, a time delay longer than the coast time is required for proper operation of the trimming mechanism. The timing capacitor C6 can only be charged through R12 when continuity through D5, the commutator 50, and SCR1 is broken by the commutator. If the machine does "coast" through the needle down position the capacitor will discharge through diode D5, the commutator, and SCR1. When the machine stops at the needle down position, capacitor C6 can be charged and will fire unijunction transistor Q1 when the switch 48 is closed.

A pulse from unijunction transistor Q1 will trigger SCR3 and SCR4. When SCR4 is triggered, current is supplied to the solenoid 63 of the thread catching finger 62 so that it can engage and hold the threads for trimming. When solenoid 63 reaches its limiting position it opens the normally closed switch 64 which removes current from not only the solenoid 63 but also from the hold-

6

ing resistors R6, R7 and R8 for SCR1 and the holding resistor R18 for SCR4. This will turn off SCR 4 so that solenoid 63 can return to its normal position letting the switch 64 close. SCR1 also turns off so that the needle down positioning circuit is deactivated.

When SCR 3 is triggered by unijunction transistor Q1, current is allowed to flow through the coil of the electric clutch 30 by way of the diode D4, contacts S, S¹, and the leads 52, 54 of the commutator 50, and the auxiliary slow speed motor 35 rotates the sewing machine to the needle up position. The current is interrupted by the commutator 50 in the needle up position to disengage the coil of the electric clutch 30 and couple the transmitter to the sewing machine.

Another time delay is required to insure that the needle has gone to the up position and is not coasting any more before the thread is cut. This is done in a similar fashion to the first time delay. Capacitor C5 is allowed to charge up after the commutator 50 has opened the circuit in the needle up position. When the capacitor C5 acquires sufficient voltage to fire unijunction transistor Q2, a pulse is passed to SCR2. This allows current to flow through the solenoid 67 which moves the knife to cut the thread and allows current to flow through the solenoid 73 which operates the thread wiper. At the limit of its travel solenoid 67 opens the normally closed contacts 68 and removes power from itself and from the resistor R20 and for the SCR2 and SCR3 thus turning off SCR2 and SCR3 to complete the cycle.

Having thus set forth the nature of this invention, what we claim herein is:

1. A needle positioning device for a sewing unit having a sewing machine, operator influenced control switches associated with said sewing machine, a main drive means and auxiliary slow speed drive means, electrically operated coupling means for selectively engaging either said main or auxiliary drive means to said sewing machine, and sensing means operatively associated with said sewing machine and responsive to the needle position thereof, said needle positioning device including a first group of electrical circuits and components connected electrically to said control switches, said electrically operated coupling means, and said sensing means for effecting actuation of said sewing machine by said auxiliary drive means into a predetermined needle position thereof, and means for operating ancillary devices on said sewing machine sequentially with said needle positioning device comprising, electrical operating means associated with said ancillary devices, a second group of electrical components and circuits carried on a unitary circuit board, and multi-terminal plug and socket means for simultaneously electrically connecting said control switches, said sensing means, said electrically operated coupling means, and said electrical operating means of said ancillary devices with said components and circuits of said circuit board, said circuit board being exchangeably accommodated into said plug and socket means.

2. A needle positioning device for a sewing unit having a sewing machine, a main drive means and auxiliary slow speed drive means for said sewing machine, operator influenced control switches associated with said sewing machine, electrically operated coupling means for selectively engaging either said main or auxiliary drive means with said sewing machine, and a sensing means operatively associated with said sewing machine and responsive to the needle position thereof, a first multiset terminal having contacts associated therewith, means electrically connecting said control switches, said electric clutch means, and said sensing means to contact on said first multiset terminal, a first unitary circuit board including electrical circuits and components exchangeably accommodated into said first multiset terminal for effecting actuation of said sewing machine by said auxiliary drive means into a predetermined needle position thereof, a second multiset terminal having contacts associated therewith,

means electrically connecting said control switches, said sensing means, said coupling means, and contacts of said first multiset terminal to contacts of said second multiset terminal, ancillary devices on said sewing machine, electrical operating means for actuating said ancillary devices, means electrically connecting said operating means to contacts of said second multiset terminal, and a second unitary circuit board including electrical circuits and components exchangeably accommodated into said second multiset terminal for actuating said ancillary devices sequentially with the needle positioning of said sewing machine.

References Cited

UNITED STATES PATENTS

2,055,031	9/1936	Hutchings	-----	318—162	XR
2,970,557	2/1961	Schwab et al.			
3,029,758	4/1962	Hurme et al.	----	112—219	XR
3,031,590	4/1962	Johnson et al.	-----	307—141	

10 PATRICK D. LAWSON, *Primary Examiner*.

H. HAMPTON HUNTER, *Assistant Examiner*.