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N. A. SVENDSEN ET AL
CUTTING ATTACHMENT FOR A SEWING MACHINE AND
CONTROL MECHANISM THEREFOR

3,418,954

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Sheet 1 of 3

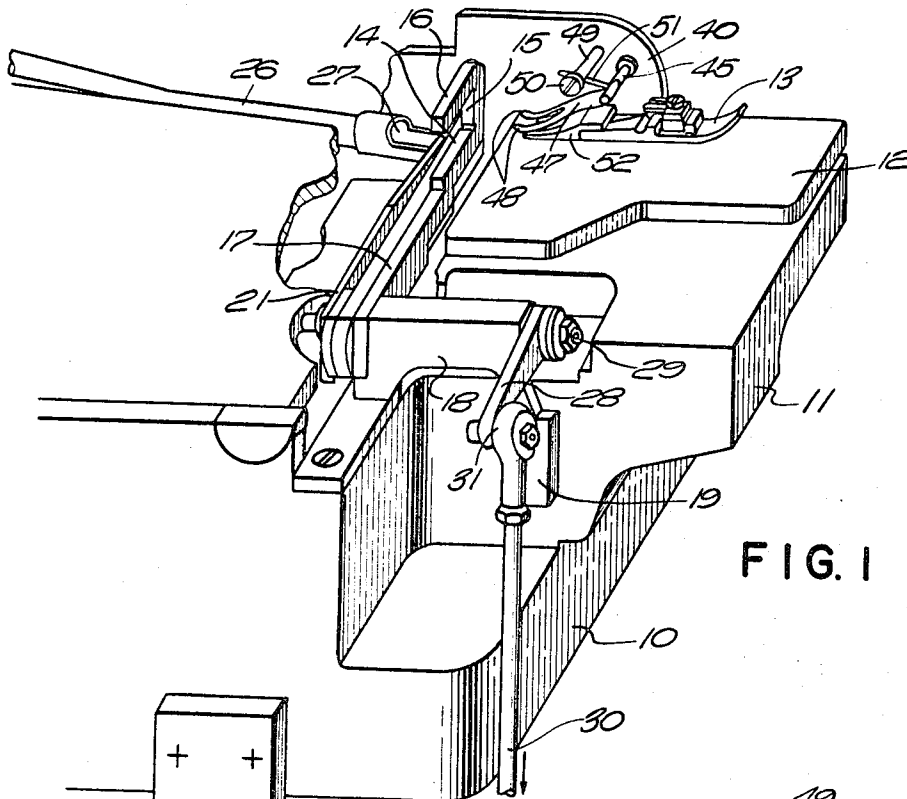


FIG. 1

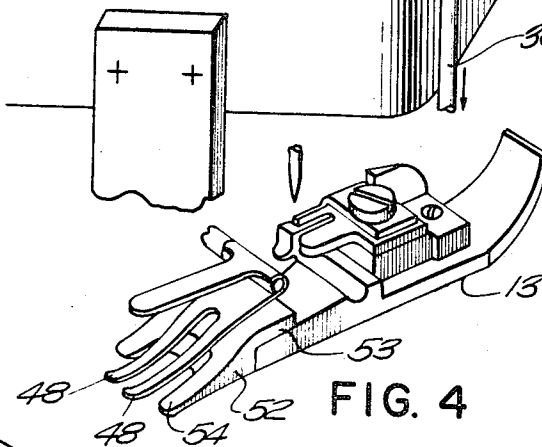


FIG. 2

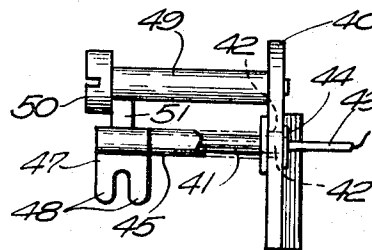


FIG. 3

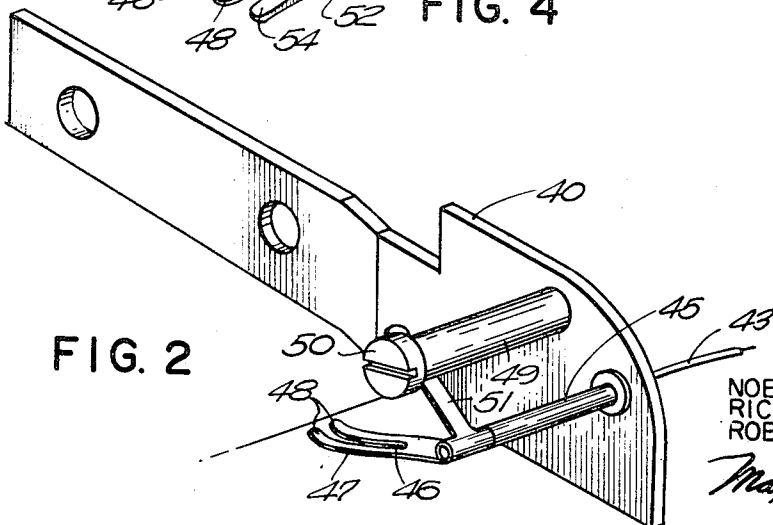


FIG. 4

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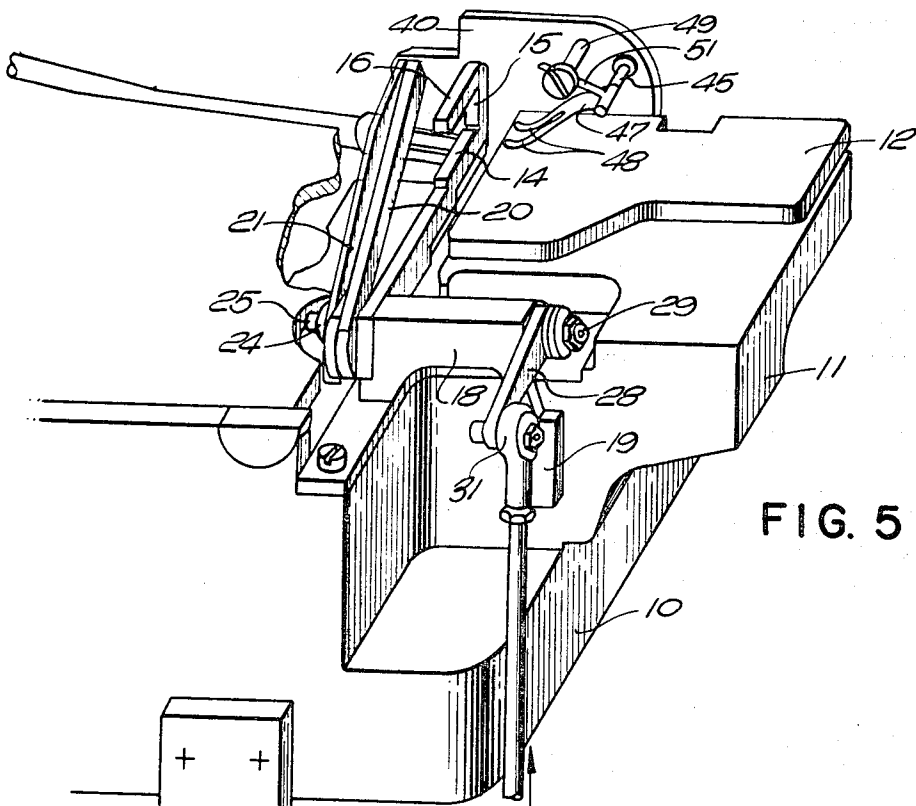


FIG. 5

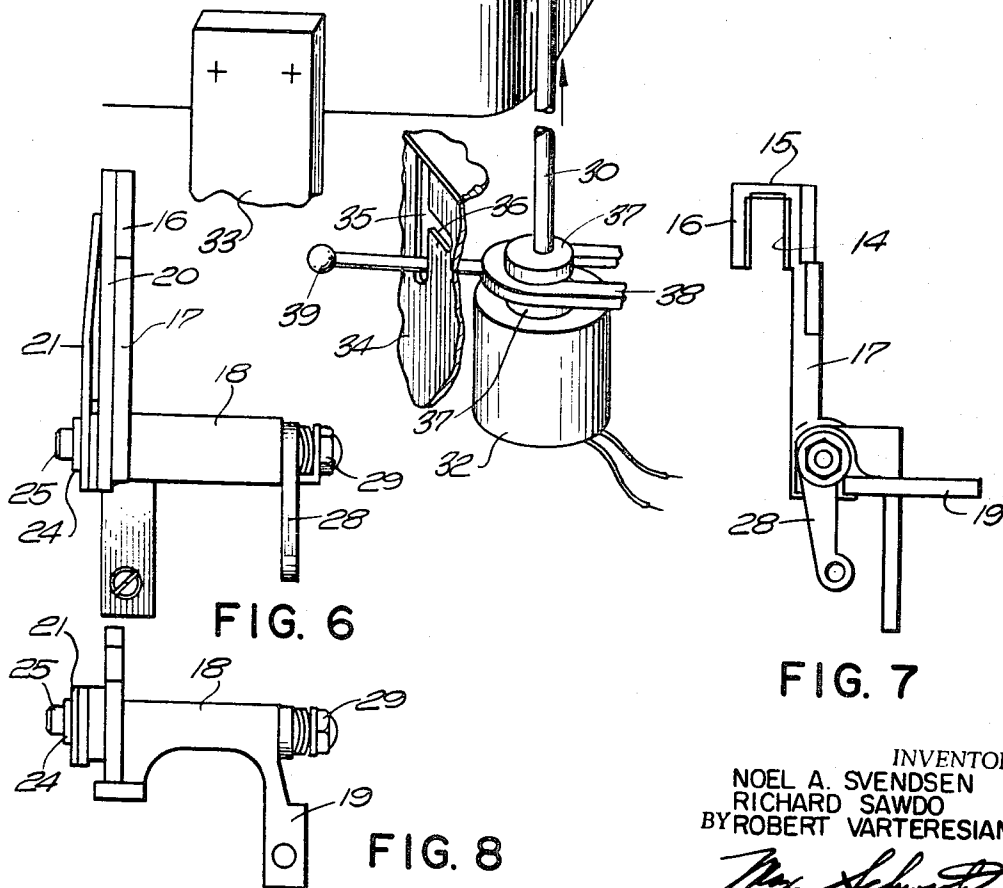


FIG. 6

FIG. 7

FIG. 8

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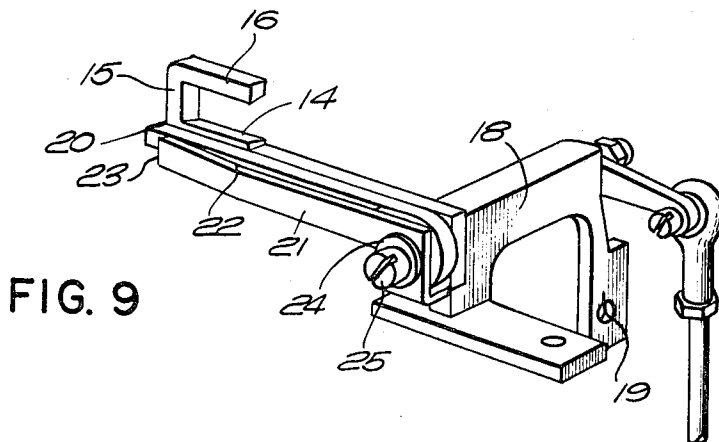


FIG. 9

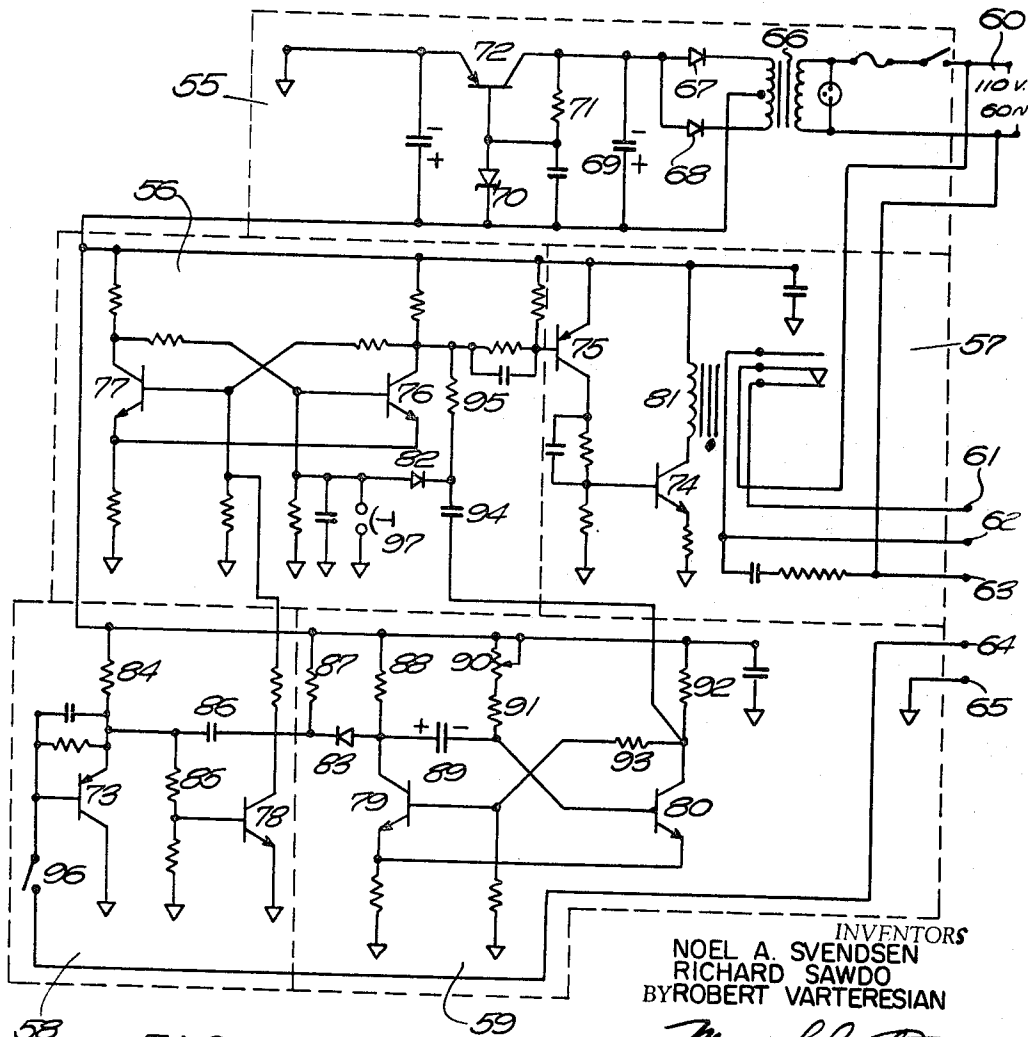


FIG. 10

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CUTTING ATTACHMENT FOR A SEWING MACHINE AND CONTROL MECHANISM THEREFOR

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6 Claims. (Cl. 112—252)

ABSTRACT OF THE DISCLOSURE

A cutting attachment for a sewing machine in which a pair of fixed, spaced, parallel cutting blades are alternately wiped by a movable blade. The movable blade is pivotally mounted at an extended end of the lower fixed blade. A lever arrangement permits a solenoid to pivotally actuate the movable blade. A sensing finger is mounted on the sewing machine and the work passes beneath the finger. An impulse is then sent to an electronic control circuit which actuates the solenoid. The control circuit has a time delay feature permitting adjustment of the position of the cut.

Our present invention relates generally to improvements in sewing machines, and particularly to a sensing device for a cutting attachment for cutting the thread, together with a novel control mechanism therefor.

Our present application constitutes a sensing and control device for the type of cutting attachment shown in U.S. Patent No. 3,252,438 issued May 24, 1966, and entitled, Cutting Attachment for a Sewing Machine.

In the patent hereinabove referred to, an automatic thread cutter is described which can be attached to a sewing machine for automatically cutting the lengths of thread which precede and trail after successive pieces of work going through the machine. In commercial sewing operations, successive panels or work pieces are fed through a machine and the separation thereof by the cutting of the threads becomes a time consuming operation. In patent No. 3,252,438 the sewing machine is equipped with an automatic cutting device for greatly increasing the efficiency of the sewing operation.

However, it has been found that due to the variations in the thickness, weight and consistency of the material passing through a sewing machine, the accumulation of lint, and other factors, the control mechanism occasionally missed and the thread was not properly cut. In high speed operations, the response of the cutting device must be instantaneous and accurate. Accordingly, the present invention constitutes a novel cutter mounting and novel control mechanism therefor which provides virtually trouble free operation at high speeds and which permits adjustment and control of the length of the thread extending from the work piece after the cutting operation. The control mechanism of the present invention permits close cutting of the thread to the work piece. To operate the novel control mechanism, the present invention also provides a novel delayed action circuit.

It is therefore a principal object of the present invention to provide a thread cutter for a sewing machine and a novel control device therefore.

Another object of the present invention is to provide a control device which permits adjustment of the length of the trailing thread after cutting.

A further object of the present invention is to provide a control mechanism which will greatly minimize the chances of the cutter missing.

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With the above and other objects and advantageous features in view, our invention consists of a novel arrangement of parts, more fully described in the detailed description following, in conjunction with the accompanying drawings, and more particularly defined in the appended claims.

In the drawings,

FIG. 1 is a fragmentary perspective view of a portion of a sewing machine equipped with a cutter embodying the present invention.

FIG. 2 is a perspective view of the sensing finger of the present invention and the mounting therefor.

FIG. 3 is an end view of the construction shown in FIG. 2.

FIG. 4 is a perspective view of the presser foot showing its relation to the sensing finger.

FIG. 5 is a view similar to FIG. 1 showing the cutter in raised position.

FIG. 6 is a top plan view of the cutter mounting.

FIG. 7 is a side elevation thereof.

FIG. 8 is an end view thereof.

FIG. 9 is a perspective view of the cutter assembly.

FIG. 10 is a diagram of the electronic control mechanism.

The present invention illustrates the use of a scissors type cutting mechanism responsive to the movement of a work piece at a predetermined point for operating the cutting mechanism. The machine illustrated in FIGS. 1 and 5 are overlock stitch machines. This type of machine, together with the overlock safety stitch machine, provide a chain stitch which trails from the edges of and joins the successive work pieces and must be cut off. The device can also be mounted on any other type of sewing machine where the cutting of the thread is a particular problem. The chain stitch machine is shown for illustrative purposes only.

Referring more in detail to the drawings, the sewing machine illustrated therein is provided with a base block 10 having a forwardly extending table portion 11 on which the base plate 12 is mounted. The presser foot 13 is mounted above the base plate 12 and the material passes from the front portion of the machine between the base plate 12 and the presser foot 13 and out at the rear of the plate 12. The cutting mechanism is mounted transversely across the machine in the path of movement of the work and directly behind the base plate 12 as shown in FIGS. 1 and 5.

The scissor action cutter is constructed in accordance with Patent No. 3,252,438 hereinabove referred to and the dimensions and shape of the various cutters are constructed as disclosed therein. A horizontal lower fixed cutter 14 is connected at the far end by an integral vertical portion 15 to a spaced parallel upper cutter 16 in the same plane vertically as the cutter 14. The lower cutter 14 is provided with an axially extending portion 17 for rigidly mounting the cutter to a block 18 extending at right angles from the end of the portion 17 as shown in FIGS. 1 and 9. The block 18 is mounted on the base of the machine, with a flat member extending downwardly at 19 bolted to the side of the table portion 11. The movable blade 20 is mounted rearwardly of the fixed blades 14 and 16 on a pivot shaft which is rigidly pinned to the movable blade 20 and extends through the block 18 and through the back end of the portion 17. This permits vertical pivotal movement of the movable blade 20 so that it wipes across the rear edges of the fixed blades 14 and 16 in the manner disclosed in the patent hereinabove referred to.

In view of the long sweep of the movable blade 20, the outer end of the pivot shaft is also provided with a spring member 21 having a bent portion 22 which causes

its end 23 to bear against the movable blade 20 and hold it inwardly against the fixed blades during its movement. The spring portion pivots with the blade 20. The tension of the spring portion 23 against the movable blade 20 can be varied by the construction shown in FIG. 9. A large washer 24 extends over the end of the flat spring mounted on the pivot shaft, and a flat adjustable screw 25 rides at the end of the pivot shaft and can provide pressure of the washer against the spring arm 21. Behind the cutters 14 and 16, a vacuum line 26 extends towards the cutters with its forward end having an L-shaped cut out portion 27 to provide a vacuum pull on the loose threads and to remove the threads from the vicinity of the cutter after cutting. The purpose and operation of the vacuum line 26 is also described in the patent hereinabove referred to.

Pivotal movement of the movable cutter 20 is provided by a short lever arm 28 mounted on the pivot rod extending through the block 18 by means of a nut 29, and a straight vertical operating rod 30, pivotally mounted at 31 to the outer end of the lever 28. Vertical movement of the operating arm 31 will cause pivotal movement of the lever 28 and pivotal movement of the movable blade 20 which will thus wipe across the outer edges of the fixed blades 14 and 16 to provide a scissor cutting action as described in the patent hereinabove referred to.

Now referring to FIG. 5, vertical movement of the control rod 30 is provided by the solenoid 32. The block 18 and the linkage 28 permits the rod 30 to be positioned vertically without a bend so as to provide unobstructed vertical movement of the solenoid 32. This can be accomplished by mounting a bracket 33 on the side of the machine for holding a small housing, not shown, for the solenoid 32. One wall of the housing 34, is provided with a vertical slot 35 having a horizontal portion 36 intermediate its ends. The rod 30, extending from the solenoid 32 is provided with spaced collars 37. A U-shaped member 38, pivotally mounted at its outer end (not shown) is provided with a manually engageable arm 39, which extends through the vertical slot 35. Normally, during the operation of the cutting device, the solenoid 32 will cause vertical reciprocation of the rod 30 to move the movable blade 20 from the raised position shown in FIG. 5 to the lower position shown in FIG. 1 and back again. This will cause vertical movement of the lever arm 39. However, if it is desired to operate the machine without the cutter, the lever arm 39 is manually grasped and raised until it is opposite the horizontal slot 36. This raises the operating rod 30 and moves the movable cutter blade 20 to its lowermost position shown in FIG. 1. The arm 39 is then moved laterally until it enters the slot 36. This locks the rod 30 in raised position and prevents the solenoid 32 from further movement of the cutter. The movable blade 20 is thus locked in its downward position out of the way and permits the work piece to slide over it through the cutter without movement of the cutter.

On most sewing machines, and especially on the lock stitch machine illustrated, the amount of space between the base plate 12 and the cutter is very short and movement of the cutter must be rapid and accurate. As the work piece passes beneath the presser foot 13, as shown in FIG. 1, there is very little room to insert a sensing device. In accordance with the present invention we utilize a vertically positioned plate 40 mounted along the side of the base platform 11. Extending at right angles from the plate 40 is an electrically conductive inner tube 41 which is mounted in a dielectric bushing 42 in an opening in the plate 40. This electrically insulates the plate 40 and its machine support from the inner tube 41. A jack 42' extends from the opposite side of the plate into the tube 41 and the electrical cord connection 43 is provided with a plug 44 for insertion into the jack 42' for making electrical contact with the inner tube 41.

We now provide an outer tube or sleeve 45 which is slidable over the tube 41 in contact therewith. The outer end of the sleeve 45 is provided with the sensing finger

device illustrated in FIGS. 2 and 4. The sensing finger comprises a thin resilient plate 46 which is bifurcated at 47 to form a pair of spaced arms turned slightly upwardly at their outer ends 48. The sensing finger extends downwardly towards the sewing machine plate 12 so that the arms formed by the bifurcation 47 resiliently engage the surface of the plate and making an electrical contact therewith. Slightly higher and to the rear of the tubes 41 and 45 we provide an eccentrically mounted bar 49 in spaced parallel relation to the outer and inner tubes 41 and 45 as shown in FIGS. 2 and 3 and provided with an adjustment screw head 50. The bar 49 is eccentrically mounted so that turning movement of the screw head 50 will cause the body portion 49 to move slightly towards or away from the tubes 41 and 45 depending on their relative positions. Adjacent the outer end of the outer tube 45 is a spring finger 51 which is angularly disposed to the sensing finger, 46.

In assembly, the spring portion 51 is moved downwardly towards the sensing finger 46 with a resilient spring action and the outer tube 45 is slipped over the inner tube 41 as far as it will go. Release of the spring portion 51 will now bring it beneath the eccentric bar 49 and against the shoulder of the screw portion 50 as illustrated in FIG. 3. This effectively prevents the sensing finger 46 from sliding outwardly and falling off the inner tube 41 and it is thus retained in position. Turning movement of the eccentric screw 50 and the barrel 49 increases and decreases the pressure on the spring portion 51 and therefore increases and decreases the pressure of the sensing portion 46 against the base plate 12.

Applicants have found that the use of the bifurcation 47 into the two legs 48 ensures proper electrical contact and virtually eliminates misses which may be caused by dust or lint. The sensing finger is thus readily changeable and removable and the contact area of the sensitive portion 46 may be varied for different materials. For example, with an open type of material the foot may be provided with a greater contact area so that it will not go through the opening in the material and will lie flatly on the material to ride on it. Furthermore, the position of sensing finger is of extreme importance. Since the space is very small, the sensing finger must be positioned back as close to the presser foot 13 as possible. However, because of the narrow sensing arms 48 pressing against a thin material there may be a tendency of the material to bunch up. This is eliminated by providing the rear portion of the presser foot 13 with an auxiliary plate 52 which abuts the rear of the presser foot 13 and is provided with a flat portion on 53 extending over the presser foot and which can be mounted on the rear of the presser foot. The plate 52 is provided with spaced arms 54 which flatten out and tend to hold the material between them flat and taut against the base plate 12. The arms 48 of the sensing fingers 46 extend between the spaced arms 54 of the portion 52 and the contact with the plate or with the cloth is made between the arms 54.

With the construction as illustrated in FIGS. 1 and 5, the distance from the edge of the cloth, where it contacts the sensing finger 48, to the cutter is approximately between $\frac{1}{16}$ and $\frac{1}{8}$ of an inch and the length of thread tailing from the front edge of the cloth will vary between $\frac{1}{16}$ and $\frac{1}{8}$ of an inch depending on the speed of the cloth. To the rear edge of the material passing through the machine, the adjustment is from 0" to approximately $\frac{3}{4}$ " in length, and this is accomplished by the circuit illustrated in FIG. 1. In normal position, illustrated in FIG. 5, the sensing finger is in electrical contact with the plate 12 and the movable blade 20 is in raised position. When the front edge of the cloth passes between the sensing finger and the plate 12 to lift the sensing finger, opening the electrical circuit, the blade 20 descends into the position shown in FIG. 1. This cuts the lead thread and allows the cloth to pass

through the cutter. As the rear edge of the cloth leaves the sensing finger, which again comes in electrical contact with the plate 12, the blade 20 moves upwardly into the position shown in FIG. 5 cutting the tail of thread at the back edge of the cloth.

To prevent the cutter from actually cutting the cloth instead of the thread when it moves upwardly at the rear end, the control circuit shown in FIG. 10 is provided with a delay timing action which permits the cloth to pass through the cutter before the blade moves upwardly. This delay timing action may be varied thus permitting variations in the length of the tail of thread permitted to remain on the cloth. This can be varied, from 0" to approximately 3/4" in length.

The circuit illustrated in FIG. 10 is divided into various component parts by the dotted lines for more readily understanding the function of each portion of the circuit. For example, the rectangular portion in dotted lines at the top comprises the power supply unit 55. Directly beneath that is the switching circuit 56, and adjacent that to the right is the relay driver 57. Beneath the switching circuit 56 is the sensing circuit 58 and beneath the relay driver 57 is the delay timing circuit 59. Power is supplied at 60 by plugging into a standard 110 v. AC 60 cycle line. Along the right side of the circuit are a series of terminals for connecting the control circuit to the device. The upper terminal 61 is merely a standby. The next two, terminals 62 and 63 are connected to the solenoid 32 for direct operation of the cutter. The next terminal 64 is connected to the wire 43 to the sensing finger 46, and the last terminal 65 is a ground terminal which may be connected to the machine or to the housing 34 for convenience. Operation of the circuit may now be described as follows:

The components of the power supply circuit are capable of supplying 350 ma., at 10 v. DC. It includes a capacitor input full wave rectifier consisting of a power transformer 66, rectifiers 67 and 68, and filter capacitor 69. The series regulator circuit consists of a Zener regulator 70, and current limiting resistor 71 controlling a series pass transistor 72.

With the delay circuit in its normal state, that is, with terminal 64 connected to the ground through the sensing finger 46, the trigger generator transistor 73 will be in its saturated mode or "on". The switching transistor 74, normally "off" is controlled through buffer amplifier transistor 75, by the collector-base coupled bistable multivibrator consisting of the transistor 76 normally "off" and a transistor 77 normally "on". Transistor 78 which generates the set trigger is normally "off". The collector-base coupled monostable, "off" delay generator, consisting of transistor 79 normally "off" and transistor 80 normally "on", generates the reset trigger pulse for switching the bistable multivibrator.

When the sensor contacts open by the entry of a piece of work, the transistor 73 switches from its "on" to its "off" state, switching the set trigger generator transistor 78 "on", flipping the bistable multivibrator to its set mode. With the transistor 76 now "on" the transistor 75 is driven into saturation turning the transistor 74 "on", energizing the switch 81 on the load. This operates the solenoid 32 and pulls the cutter 20 down. Due to the steering diodes 82 and 83, the delay generator remains in its normal state.

When the sensing contacts are closed after the passage of the work, the transistor 73 now switches back to its normal "on" state, allowing the transistor 78 to come out of saturation; thereby, conditioning the bistable multivibrator to accept a negative reset pulse. The purpose of transistor 78 is to prevent any spurious signals from generating a false reset trigger pulse and prematurely resetting the circuit when it is in its unstable state. This prevents cutting the cloth instead of the thread.

As the transistor 73 switches from its "off" to its "on" state, a negative going step is generated at the junction

of resistors 84 and 85. This negative step is now differentiated by the R-C combination of capacitor 86, and resistors 87 and 88. This negative trigger pulse is now accepted by the monostable multivibrator through its steering diode 83 and switched to its unstable state, with the transistor 79 "on" and the transistor 80 "off", and remaining there for a predetermined time. The delay time being a function of timing capacitor 89, variable timing resistor 90, in series with resistor 91. Upon returning to its original stable state, with the transistor 79 "off" and transistor 80 "on", a negative going step is generated at the junction of resistors 92 and 93, differentiated by capacitor 94-resistor 95 and accepted by the bistable multivibrator through its steering diode 82, resetting the bistable multivibrator to its normal state. The transistor 75 is now cut off, turning the switching transistor 74 "off", de-energizing the switch 81, and disconnecting the load and returning the circuit to its normal state. Thus de-energizing the solenoid 32 allowing the solenoid spring (not shown) to reset the solenoid plunger thus raising the cutter 20.

The switch 96, cutter mode, gives the operator the option of either manually (that is with the sensor contacts closed) or automatically controlling the cutter blade. Switch 97 resets, permitting a manual reset of the switching circuit.

We have thus provided a novel mounting of the cutters illustrated in the patent hereinabove referred to, together with a novel control mechanism, including a novel control circuit with a delay action. This will permit movement of the cloth through the cutters without danger of cutting the cloth and will permit accurate control of the tail of thread remaining at the front and rear edges of the cloth. The timing delay can of course be varied by varying the function of the timing capacitor 89 and the resistors 90 and 91 as hereinabove described. The novel construction and control mechanism permits high speed operation of a sewing machine without fear of the cutter missing due to the accumulation of lint or dirt. Actual tests indicate that the cutter operates properly at extremely high speeds where the operator feeds successive pieces of work continually through the machine. While we have illustrated a circuit utilizing a 110 v. AC line, it is obvious that the voltage or frequency of the power source can be varied by changing the value of the transformer 66, and the resistor and capacitor in the line to the terminal 63. Other advantages of the present invention will be readily apparent to a person skilled in the art.

We claim:

1. A sewing machine thread cutter comprising a pair of fixed blades, a movable blade adapted to alternately engage said fixed blades to provide a scissor cutting action for the thread, means for operating said movable blade, said fixed blades comprises a pair of spaced horizontal blades in a vertical plane, said fixed blades connected by an integral vertical portion at one end, a block mounted on the sewing machine, the lower blade of said fixed blades having an integral extended portion attached to said block, said movable blade having one end mounted on one end of a shaft extending through said block, said movable blade being vertically reciprocable to wipe across the faces of said fixed blades with a scissor action, and a spring member mounted adjacent said movable blade to urge said movable blade toward said fixed blades, an electronic control circuit for controlling said operating means, and a sensing device mounted on the machine for actuating said control circuit in response to movement of a work piece through the sewing machine, said sensing device including a resilient bifurcated sensing finger electrically contacting the sensing machine plate behind the sewing machine presser foot, said sewing machine plate being the grounded side of an electrical circuit, whereby a work piece passing beneath the presser foot will lift said finger away from said plate to break the contact therebetween, said control circuit activating said operating

means to move said cutter in one direction and then activating said operating means after a predetermined delay to move said cutter in the opposite direction.

2. A sewing machine thread cutter as in claim 1, wherein said movable blade is mounted adjacent one end to one end of a shaft, the other end of said shaft having a lever arm extending therefrom, a vertical rod having its upper end pivotally mounted on the free end of said lever arm, and a solenoid for vertically reciprocating said rod to pivot said shaft and cutter blade in response to an operating current from said control means.

3. A sewing machine thread cutter as in claim 1, wherein said controlling means comprises an electrical circuit having a power supply segment, a sensing segment, a switching segment responsive to said sensing segment, and a power output segment for sending a control pulse to said operating means.

4. A sewing machine thread cutter as in claim 2, wherein said rod is provided with spaced collars, a forked member extends between said collars, one end of said forked member being pivotally mounted, the other end of said forked member having a manually engagable handle, and means for locking said handle in a fixed position to prevent reciprocation of said rod.

5. A sewing machine thread cutter as in claim 1, wherein said controlling means comprises an electrical circuit having a power supply segment for supplying 350 ma. at 10 v. DC, a sensing segment for receiving a signal from said sensing device, a switching segment responsive to the sensing segment for directing a control current to

said operating means, and a delay timer segment for delaying the switching off of said control current on the signal of said sensing segment.

6. A sewing machine thread cutter as in claim 1, wherein said controlling means comprises an electrical circuit having a power supply segment for supplying 350 ma. at 10 v. DC, a sensing segment for receiving a signal from said sensing device, a switching segment responsive to the sensing segment for directing a control current to said operating means, and a delay timer segment for delaying the switching off of said control current on the signal of said sensing segment.

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