Our present invention relates generally to improvements in sewing machines, and it relates in particular to an improved cutting mechanism employed in combination with a sewing machine.

This application constitutes a continuation-in-part of a copending application entitled, Thread Cutter, Serial Number 233,604, filed October 29, 1962, by Edward Freeman, Karl Tyas, Harry Firestein and Bert Greene, now Patent No. 3,188,992, issued June 15, 1965. This application also constitutes a continuation in part of our copending application entitled, Cutting Attachment for a Sewing Machine, Serial Number 384,223, filed July 21, 1964, now abandoned.

In machine sewing operations, particularly in the commercial mass production of garments or the like, it has been the conventional practice to successively sew successive similar panels or workpieces. These successive panels, as they emerge from the sewing machine head, carry trailing chains of stitches which are either cut with the emergence of each workpiece or are permitted to be joined with the next successive workpieces and are subsequently cut prior to the next operation on the particular workpiece. Also, in applying buckram, tape, or other materials to successive panels, it is necessary to cut the joined material both at the beginning and at the end of the sewing operation to separate the panels. In either case, the workpiece separating procedure is inconvenient and time consuming and thereby increases the cost of the end product. Various types of sewing machine cutters, both of the automatic and hand operated type, have been employed and proposed but these possess numerous drawbacks and disadvantages. The hand operated thread cutters offer little advantage over the manual threading of the thread whereas the automatic thread cutters are complex mechanisms whose general operation leave much to be desired. In addition, the various cutters heretofore proposed are not highly accurate in the positioning of the cutter. This is necessary where tape, buckram, or other material is being cut.

It is also essential that the cutter does not miss. In cutting thread, the cutters must be sharp and the movable cutter must bear against the stationary cutter with a true scissors action.

It is therefore, a principal object of the present invention to provide an improved cutter for sewing machines.

Another object of the present invention is to provide, in a sewing machine, an improved mechanism for cutting thread or material between successive workpieces in a neat and trim manner.

A further object of the present invention is to provide a cutting mechanism of the above nature characterized by its simplicity, ruggedness, reliability and versatility.

With the above and other objects and advantageous features in view, the 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 top plan view of a thread cutter embodying our present invention.

FIG. 2 is an enlarged sectional view taken along line 2-2 on FIG. 1.

FIG. 3 is an enlarged sectional view taken along line 3-3 on FIG. 1, the cutting element being illustrated in its advanced position.

FIG. 4 is a view similar to FIG. 3 the cutting element being illustrated in its retracted position.

FIG. 5 is a diagrammatic view illustrating the electrical network of the thread cutter.

FIG. 6 is an enlarged top plan view of another type of cutter more specifically designed for buckram or other material.

FIG. 7 is a front elevation thereof.

FIG. 8 is a perspective view of the cutter shown in FIGS. 6 and 7 attached to a sewing machine.

FIG. 9 is a view similar to FIG. 3 taken from the opposite side of the cutter.

FIG. 10 is a perspective view of the stationary blade member for the cutter shown in FIG. 9.

FIG. 11 is a section taken on line 11-11 on FIG. 9.

FIG. 12 is a section taken on line 12-12 on FIG. 9.

FIG. 13 is a view similar to FIG. 6 showing the shape and adjustment of the cutters.

In a sense, the present invention contemplates the provision, in combination with a sewing machine including means for advancing a workpiece along a predetermined path past a sewing needle, of a scissors type cutting member movable between an advanced and a retracted position across said path forward of the needle, and means responsive to the presence and absence of said workpiece at a predetermined point urging said cutting member alternately respectively to said advanced and retracted positions.

The form of invention illustrated in FIGS. 1 to 5 inclusive and 9 to 12 inclusive comprises a thread cutter. The cutting member is defined by a pivoted double edged blade swingable across the path of the workpiece and alternatively urged to an advanced and retracted position by a connected armature motivated by alternatively energized end to end solenoids. During its forward and return strokes, the blade cooperates respectively with upper and lower stationary blades so that cutting is effected in each stroke with a scissors action. The solenoids are connected to a source of current through a double throw switch which is actuated by a sensing element located in the path of the workpiece alternately to energize one or the other of the solenoids in the presence or absence of the workpiece in the sensing and cutting area.

FIGS. 1 to 5 inclusive illustrate a thread cutter mounted on a sewing machine as described in our copending application above referred to. In this form the sewing machine needle 10 is conventionally mounted on a reciprocating needle bar not shown. The sewing machine includes an L-shaped throat plate 11 secured to and extending laterally from the machine base plate 12, and provided with an inner transverse edge 13 confronting and spaced from the end edge of the base plate 12 to define therewith a longitudinally extending recess 14. Formed in the throat plate 11 are a pair of laterally spaced slots having the usual reciprocating feed dogs 15 registering therewith and a needle receiving opening.

A foot piece 16, having a curved front upwardly curved end 17, is located in vertical alignment with the throat plate 11 and is supported by a bracket arm 18 at its rear end. The bracket arm 18 and foot piece 16 are selectively movable between a raised position and a depressed position in engagement with the feed dogs 15 in the usual manner, and the footpiece 16 has a needle registering opening formed therein. In order to restrict the vertical movement of the workpiece in the sensing area, there is provided a guide arm 19 extending along the length of the opening 14 and substantially coplanar with the under-
face of the footpiece 16. Guide arm 19 registers with the opening 14 and is laterally spaced from edge 13 of the throat plate to delineate therewith a sensing area. A cutter assembly is mounted on a bracket 20 located below the sewing machine base plate adjacent to opening 14. The cutter assembly includes a stationary blade member 21 having a vertical end plate 22 suitably affixed to bracket 20 and a substantially U-shaped member projecting laterally from and formed integrally with plate 22 and including upper and lower stationary blades or blocks defining legs 23 and 24 respectively, which legs are connected by a remote vertical cross piece 25. The stationary blades or blocks 23 and 24 are horizontal, parallel and lie in a common vertical plane registering with an aperture in transverse alignment with and shortly forward of the sewing needle. The upper edge of the lower stationary block 24 lies immediately below the upper face of the sewing machine throat plate over which the work piece advances. The lower edge of the upper block 23 is spaced sufficiently above the throat plate level to permit the free passage of a work piece of the greatest thickness normally employed.

A lever 26 is swingably mounted on plate 22 by means of a screw 27 and springlock washer 28 which rotatably engages a hub plate 28 depending from an intermediate section of lever 26. Projecting laterally from hub plate 28 is a movable cutter blade defining leg 29 which slidably engages the forward faces of the stationary blocks or blades 23 and 24, and on the upward movement thereof cooperates with the upper edge of the upper block 23 to effect a shearing stroke therewith and on the downward movement thereof cooperates with the upper edge of the lower block 24 likewise to effect a shearing stroke therewith. A lever arm 30 projects from the plate 28 opposite the arm 29 and terminates in a depending 31.

To provide a proper scissor action to the cutter, the blades are constructed as more particularly illustrated in FIGS. 9 to 12 inclusive. It is essential that the edge of the movable blade 29 wipe across the edges of the upper and lower stationary blades 23 and 24 at an inward angle to produce a true scissor effect. To this end the thicknesses of the blades 23 and 24 are increased from end to end. For example, viewing FIG. 10, the member 21 may be .100" thick. The lower cutter blade 24, beginning at a point 24a, just below the free end of the upper blade 23, gradually increases in thickness to the outer end 24b by .008" where it is .108" thick. This increased thickness is wholly on one side to produce a tapered effect as seen in FIG. 10.

Now the bottom end of the vertical crosspiece 25 is dropped .006" to a thickness of .102". This is carried upward to the left end of the upper blade 23 as seen in FIGS. 9 and 10. The upper blade 23 then tapers in thickness toward the free right end by .008", the thickness at the end being .110".

With the above construction, the bottom fixed blade 24 tapers to an increased thickness away from the pivot point 27 of the movable blade 29, whereas the top fixed blade 23 tapers to an increased thickness toward the pivot point. This results in the movable blade first contacting the thin end of each fixed blade and then sweeping along its edge to the thick end to produce the desired scissor effect. FIG. 9 shows that at the end of its upward stroke. When it moves downwardly to the dotted line position, it first meets the right edge (thin) of the bottom cutter 24. Upward movement will first contact the left edge (thick) of the upper cutter 23. Note that the upper cutter blade 23 is .002" thicker than the lower cutter blade 24 to make sure of a firm contact because in its upward movement, the movable cutter blade 29 rides against the portion 21 as it contacts the upper blade 24. Located below the free end of the lever arm 30 is a pair of vertically axially aligned upper and lower solenoids 32 and 33 respectively, having associated therewith a plunger armature 34 formed of a magnetic material and slideable along the axis of the solenoids 32 and 33. A rod 35 projects axially upwardly from armature 34 and is connected to arm 30 by a link 36 pivoted at opposite ends to lug 31 and rod 35. It should be noted that electrical energization of solenoid 32 raises the armature 34 to swing the lever 26 clockwise as in FIG. 3, and to swing blade 29 to its depressed position, and the energization of solenoid 33 lower armature 34 accordingly to advance blade 29 to its raised position.

A double throw single blade switch 37 is mounted below the sewing machine base and includes a single arm 38 and upper and lower switch contacts 39 and 40, respectively, which are alternately engaged by arm 38. Arm 38 is resiliently sprung upwardly normally to engage the upper contact 39. An actuating button 41 projects through the top face of switch 37 and engages and is vertically correspondingly moveable with switch arm 38.

An actuating arm 42 is hinged at one end thereof to the face of switch 37 and bears on button 41 which normally resiliently urges arm 42 to a raised position. Arm 42 is provided with a vertically offset longitudinally extending portion 43 which terminates in an upwardly directed leg 44. Attaxed to leg 44 is a sensing member 45 which registers with opening 14 and includes a top work piece-engage member 46. Member 46 comprises a smooth round rod which has a forwardly upwardly inclined leading section joining an upwardly convex leading section and a substantially horizontal trailing section. In the absence of a workpiece over opening 14, arm 42 and sensing member 45 are urged by switch button 41 to their raised positions, while in the presence of a workpiece over opening 14 the sensing member 45 and actuating arm 42 are depressed by button 41 and reverse switch 37. A suction con 47 is provided with an intake opening directed forwardly toward the cutting blades and disposed below the throat plate.

As seen in FIG. 5, the switch blade 38 is connected by way of a main switch 48 to one terminal of a source of current, the other terminal of which is connected to the first terminals of the solenoids 32 and 33. The switch contact 39 is connected to the second terminal of lower solenoid 33 and switch contact 40 is connected to the second terminal of upper solenoid 32.

In operation, the workpiece W over opening 14 permits the advance of sensing member 45 to its raised position as seen in FIG. 2, whereby arm 42 and button 41 are in their raised positions and switch blade 38 engages contact 39. The current circuit to lower solenoid 33 is completed to energize solenoid 33 and pull armature 34 and rod 35 downwardly. Lever 26 is accordingly swung counterclockwise (FIG. 3) to swing blade 29 across blade 23 and sever any thread L located in its path, that is, the stitch chain trailing the energizing workpiece. As the leading edge of the next successive workpiece advances over opening 14 the workpiece depresses sensing member 45 to depress arm 42 and button 41. The switch blade 38 is thus switched into engagement with contact 40 to de-energize lower solenoid 33 and energize upper solenoid 32. Armature 34 is thereby raised to swing lever 26 clockwise (FIG. 3) and blade 29 downwardly across and below blade 23 (FIG. 9). The thread which is directly forwardly of the workpiece leading edge is severed and sucked into conduit 47.

It will thus be noted that it is not necessary for the cutter to be coked. It cuts both on its upstroke and downstroke and permits the operator, usually operating on piece work, to continue sewing steadily without stopping to wait for a cutter. Note also that in the position shown in FIG. 4 the work is moving through the space between the upper and lower stationary blades 23 and 24 with the movable blade in its down position out of the
way. When the work has passed the sensing finger, the blade swings upwardly into the position shown in FIG. 3 to sever the thread on its upstroke and ready to move downwardly to sever the thread close to the incoming piece of work. Thus by providing a double cutting action both on the upstroke and downstroke no time is wasted by the operator and the action is continuous from one piece to the next. Also, while the drive mechanism is illustrated as a pair of solenoids, a single solenoid can also be used to pull the movable blade in one direction with a spring return to move it back to the opposite direction. If desired other types of drives may be used either hydraulic or pneumatic such as is illustrated and described in the form shown in FIGS. 6, 7 and 8 herein after described.

The type of cutting device illustrated in FIGS. 1 to 5 and 9 to 12 inclusive is designed to cut thread or chain stitching. The cutter illustrated in FIGS. 6, 7, 8 and 13 is designed to cut tape, ribbon or wider materials such as buckram. However, the principle of operation is the same for both forms. It is not necessary for the operator to stop the machine to give time for the blades to cut thread or the buckram and then return to its original position. That is an old method which required two strokes for each cut. In accordance with our present invention one stroke is required before the machine can run in continuous operation while the blades are cutting either the thread, tape or buckram.

Furthermore, a true scissor action is provided to ensure the cutting action.

It is contemplated that the form shown in FIGS. 6, 7, 8 and 13 be also energized by some form of detector mechanism such as that illustrated and described in the form shown in FIG. 1 to 5 inclusive. Referring to FIGS. 6 and 7, we provide an elongated generally rectangular base 49 having integral vertical end wall portions at each end 50 and 51. Mounted in the wall portion 51 is a actuating cylinder 52 which is operated in the conventional manner (not shown) in response to a sensing mechanism such as that disclosed in FIG. 1 to 5 inclusive. The cylinder 52 is preferably pneumatic, but it can also be hydraulic or electrically operated. Extending rearwardly from the cylinder 52 is the piston 53. An actuating rod 54 is slidably mounted in aligned openings in the end walls 50 and 51 parallel to the cylinder 52 as illustrated in FIG. 6. A short lever arm 55 is clamped at right angles to the actuating rod 54 and its outer end is connected by a link 56 to the end of the piston 53. Thus reciprocation of the piston 53 will cause a similar reciprocation in the actuating rod 54.

The base 49 extends from a generally rectangular plate 57 having a raised end wall 58 parallel to the base 49. Spaced bearing strips 59 are screwed to the plate 57 and a shaft 60 is pivotally journaled adjacent the ends of the bearing strips 59. Adjacent one end of the shaft 60 is a vertically extending post 61 having a rod 62 extending from its upper end. A link 63 surrounds the rod 62 with a universal joint and is connected at its other end to the operating rod 54 as shown in FIG. 6. Now reciprocation of the rod 54 in response to the movement of the piston 53 causes a rocking motion of the posts 61 and the reciprocating movement of the shaft 60.

Mounted from the raised edge 58 of the plate 57 are a pair of fixed blades, an upper blade 64 and a lower blade 65. The blades 64 and 65 are spaced from each other in parallel relation as shown in FIG. 7. In the illustrated form these blades are in the form of flat strips as shown in FIG. 6. Mounted at the end of the shaft 60 is the movable blade 66. The blade 66 is similar to the blades 64 and 65 but has one end fixed to the end of the shaft 60 as shown in FIGS. 6 and 7 midway between the upper and lower blades 64 and 65.

With such construction, pivotal movement of the shaft 60 will cause movement of the movable blade either across the surface of the upper blade 64 as illustrated in FIG. 7 or downwardly across the edge of the lower blade 65 as shown in FIG. 8.

In the form illustrated in FIGS. 1 to 5 inclusive only a thread or chain stitch was being cut and it was not necessary for the movable blade to be held tightly against the fixed blades by other than its pivotal and scissor construction. However, since the cutting action in FIGS. 6, 7 and 8 is across a comparatively wider piece of material, it is essential that all along the cut the movable blade 66 be tightly positioned against the fixed blades 64 and 65. To this end we provide a lever arm 67 having one end mounted on the shaft 60 as shown in FIG. 6, and the other end provided with an adjustable screw 68 with the head of the screw bearing against the side of the movable blade 66. This holds the movable blade 66 tightly against the edge of the upper and lower fixed blades 64 and 65 during its movement and takes up any play in the mounting on the shaft 60.

In addition to the foregoing, scissor action may be provided by curving the blade 66 inwardly toward the fixed blades 64 and 65, as shown in FIG. 13. The blade 66 is designed so that beginning at its pivot on the shaft 60, it curves gradually inwardly toward the fixed blade as much as 1/4" in a length of 6". This ensures a wiping scissor action between the edge of the movable blade 66 and the edges of the fixed blades 64 and 65.

This scissor action may be enhanced by providing an adjustment of the fixed blades inwardly toward the bowed movable blade. Referring to FIG. 13, bolts 71 which lock the fixed blades in place, extend through enlarged openings 72 and 73. The left opening 72 is enlarged downwardly, in FIG. 13, and the right opening 73 is enlarged upwardly, permitting the fixed blades to move slightly in a clockwise direction so that the free ends move toward the movable blade 66. It has been found that due to the length of the blades, a small movement at the bolt end results in a larger movement, up to 1/4", at the free end. To make this adjustment, a jack screw 74 with a lock nut 75 extends through the portions 58 against the blades as shown in FIG. 13.

It should be noted that in the form illustrated in FIG. 3, the pivot of the movable blade is positioned below both fixed blades so that the downward movement of the movable blade provides a cutting direction opposite than the upward movement. In the form illustrated in FIGS. 6, 7 and 8, the movable blade is pivoted between the two fixed blades so that the cutting action and the power necessary to produce them is the same either on the up or down strokes. FIG. 8 shows the construction as applied to a buckram attaching machine or a sewing machine which attaches buckram to the top of drapes. As is well known in the art, the operator prepares the machine for work by mounting a roll of buckram 69 on a roller at the top of the machine. Then the buckram is inserted in a tube guide 70 after which it is placed between the front end feed and a few stitches run off. The operator now places the top raw edge of the drapery into a folder, which turns the raw edge and guides the material, and then leads the drapery into contact with the machine feed. Up to this point the operation is standard, but as the drapery proceeds through the machine it comes into contact with a detecting device such as illustrated in FIGS. 1 to 5 inclusive. In the form illustrated in FIGS. 6, 7 and 8, the detecting device operates a switch which electrically controls the pneumatic cylinder 52, which in turn moves the rod 54 and shaft 60 which causes the movable blade 66 to pass in a downward stroke from the upper stationary blade 64 to the lower stationary blade 65. As the sensing finger is kept in a depressed plane until the material passes the feeding mechanism. Now the detector rises and sequence is reversed causing the movable blade into an upward stroke, for the second cut. The timing of the movable blade strokes is such that it cuts the buckram at a predetermined point and the place of the cut can be adjusted to suit the needs of different manufacturing items.
Both forms of the invention illustrated herein provide a double cutter operated by a switch which detects the material as it enters and leave the feeding mechanism of the sewing machine. Because of the fact that the cutter operates on both the up and down strokes, the operator is not required to make any motion or effort to activate the cutter. Also, the device does not in any way interfere with the operator's work methods or with the speed of the machine. The form shown in FIGS. 1 to 5 inclusive is used generally for cutting threads or chain stitching. It is illustrated as electrically controlled but it can also be pneumatically or mechanically controlled. The form illustrated in FIGS. 6, 7 and 8 while showing its use or buckram merely shows that the general form of the invention can be used for cutting any type of thread or material on any type of sewing machine. The form shown in FIG. 8 will sever the buckram at a predetermined spacing from the leading and trailing edges of the drapery. Also, it is not necessary to stop the machine to give time for the blade to cut the buckram. Both forms therefore provide a considerable saving in time and effort. Both forms of the invention provide the cutters with a true scissors action by angling the cutters toward each other. Cutting failures are virtually eliminated and the cutter will operate efficiently at high speeds. Other advantages of the present invention will be readily apparent to a person skilled in the art.

We claim:

1. In combination with a sewing machine including means for advancing a workpiece along a predetermined horizontally extending path past a sewing needle, a cutting device comprising an upper fixed blade mounted above said predetermined path, a lower fixed blade mounted below said predetermined path, said blades being in horizontal parallel relation and in the same vertical plane, and a movable blade pivotally mounted on one side of said predetermined path, said movable blade comprising an elongated rectangular member having a squared cutting edge, at least one of the cooperating blades having means to provide a cutting action on the upward stroke against the edge of said upper fixed blade and a cutting action on the downward stroke against the edge of said lower fixed blade, said movable blade sliding along the edges of said fixed blades at an angle to the plane of the fixed blades to produce a scissors action.

2. The combination of claim 1, wherein the cutting edges of said fixed blades taper to increasing thicknesses in the path of said movable blade to provide a scissors action.

3. The combination of claim 1, wherein said fixed blades are integrally joined by a vertical member at their ends remote from said movable blade.

4. The combination of claim 3, wherein said lower fixed blade tapers to an increased thickness toward said vertical member and said upper fixed blade tapers to an increased thickness away from said vertical member to provide a scissors action with said movable blade.

5. The combination of claim 1, wherein said fixed blades are integrally joined by a vertical member at their ends remote from said movable blade, and said movable and fixed blades are of short lengths for cutting thread.

6. The combination of claim 5, wherein said fixed blades taper to increasing thicknesses in the path of said movable blade to provide a scissors action.

7. The combination of claim 5, wherein said lower fixed blade tapers to an increased thickness toward said vertical member and said upper fixed blade tapers to an increased thickness away from said vertical member to provide a scissors action with said movable blade.

8. The combination of claim 1, wherein said movable blade is bowed inwardly toward said fixed blades to provide a scissors action.

9. The combination of claim 1, wherein said blades comprise elongated flat strips said movable blade strip contacting said fixed blade strips in edge to edge relation, said strips being elongated for cutting tape or similar material.

10. The combination of claim 9, wherein said movable blade is bowed inwardly toward said fixed blades to provide a scissors action.

11. The combination of claim 1, wherein said fixed blades are adjustable at an angle toward said movable blade.

12. The combination of claim 11, wherein said movable blade is bowed inwardly toward said fixed blades to provide a scissors action.

13. The combination of claim 9, wherein said fixed blades are adjustable at an angle toward said movable blade.

14. The combination of claim 10, wherein said fixed blades are adjustable at an angle toward said movable blade.

15. The combination of claim 9, wherein said movable blade is pivotally mounted at one end to extend in a plane midway between said fixed blades.

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JORDAN FRANKLIN, Primary Examiner.

M. J. COLITZ, Assistant Examiner.