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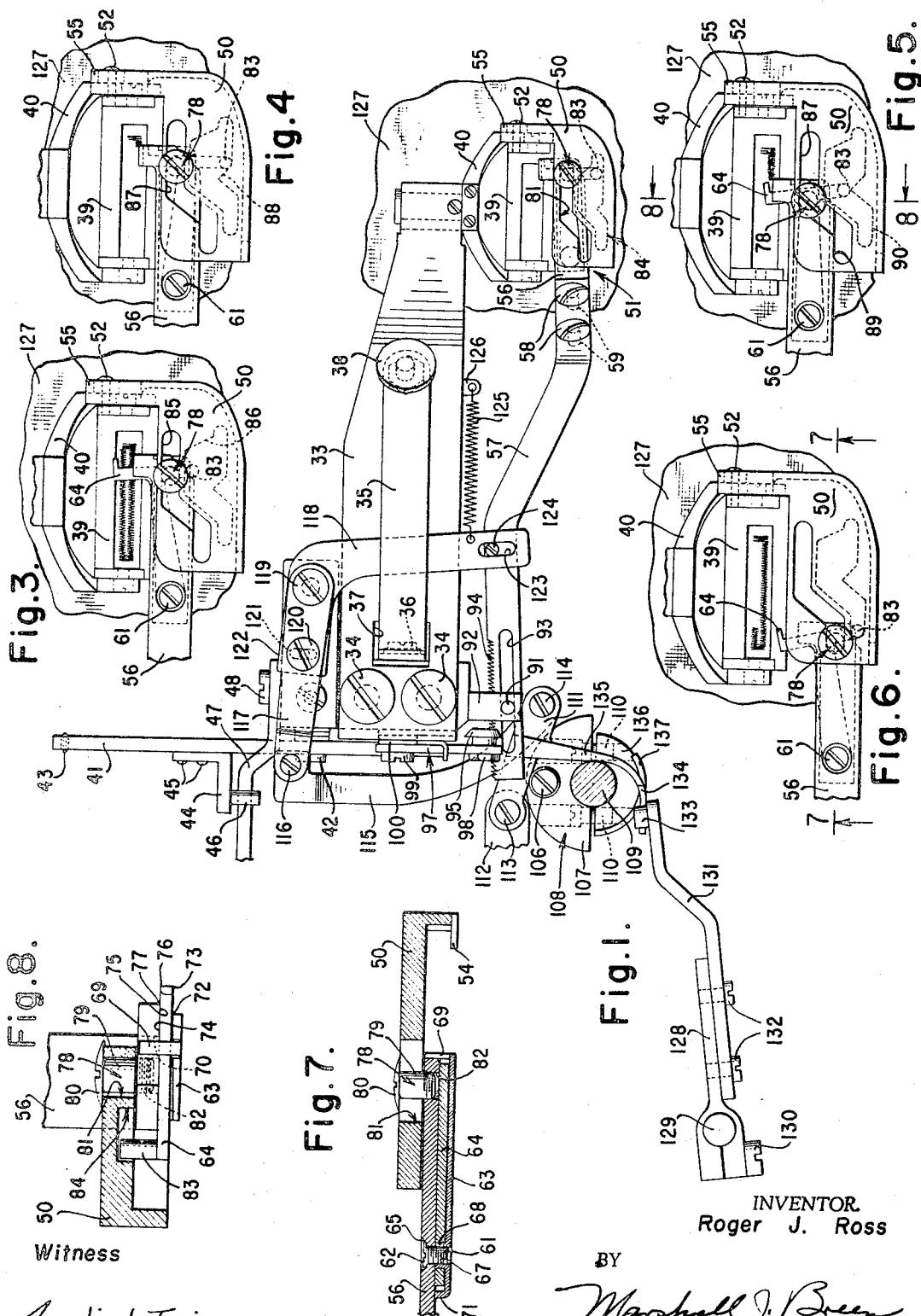
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NEEDLE THREAD CUTTERS AND THREAD END CLAMPS

Filed Aug. 2, 1967

2 Sheets-Sheet 1



Witness

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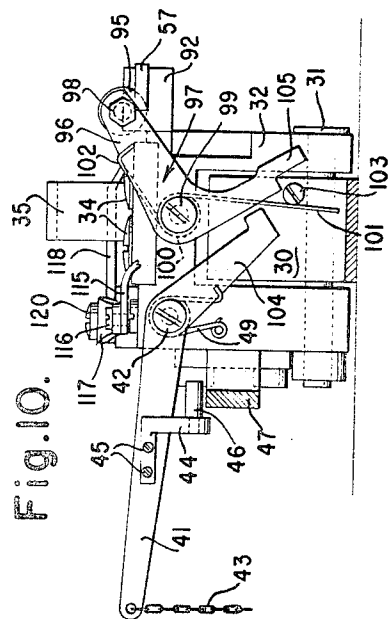
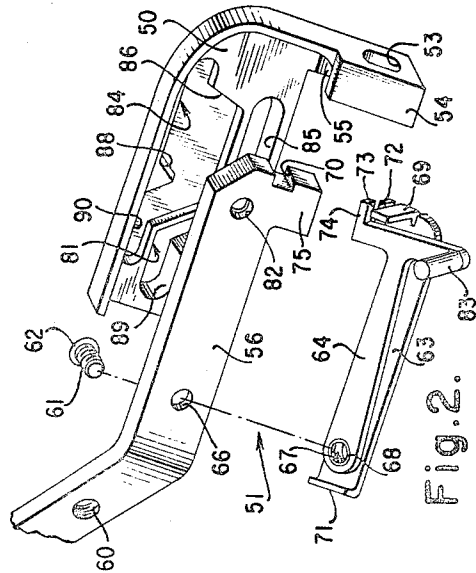
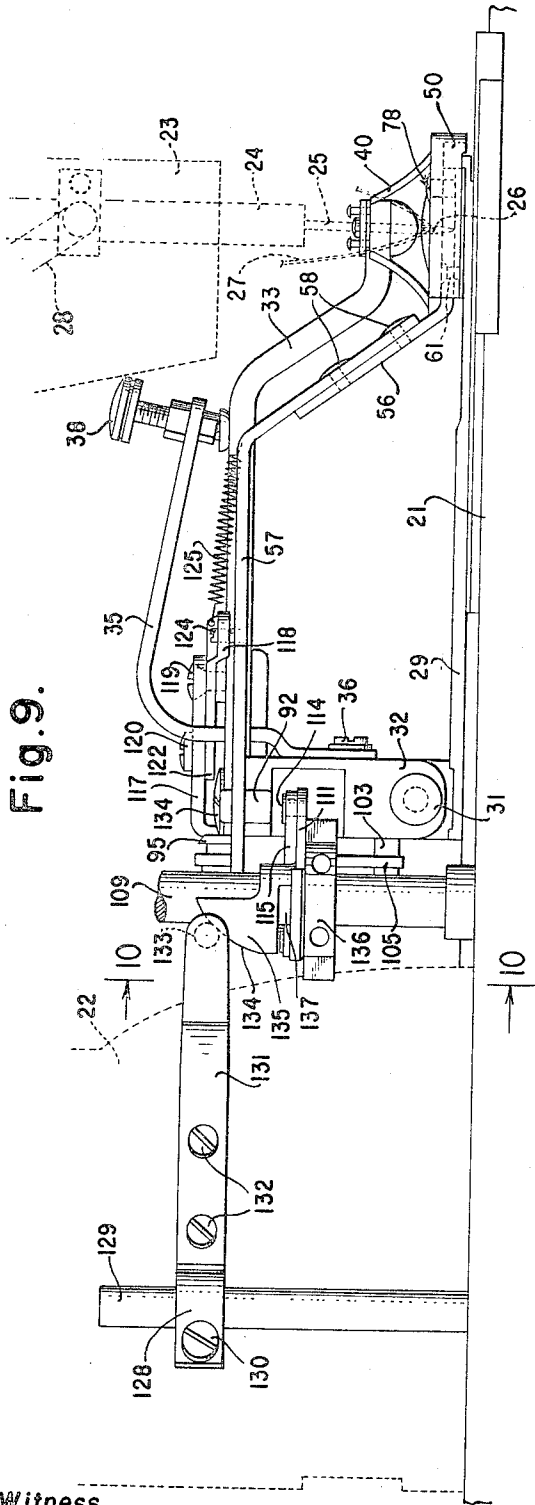
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2 Sheets-Sheet 2



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NEEDLE THREAD CUTTERS AND THREAD END CLAMPS

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ABSTRACT OF THE DISCLOSURE

A control cam having two cam tracks is connected to the free end of a buttonhole clamp on a buttonhole sewing machine. The cam tracks act upon cam followers on two thread cutter blades on the free end of a shiftable thread cutter arm for cutting and clamping needle thread. The thread cutter arm has a ratchet and pawl at the end opposite from the thread cutter blades.

Background of the invention

(1) *Field of the invention.*—The invention relates to thread cutters and thread end clamps for buttonhole sewing machines.

(2) *Description of the prior art.*—In order to avoid unsightly thread ends protruding from an article of fabric, after sewing a buttonhole, it is important to cut the needle thread as closely as possible to the fabric and then to hold the cut end of the needle thread from the needle so that it will be covered by the initial side zigzag stitches of the next buttonhole sewing cycle. In order to accomplish the foregoing operations efficiently, an automatic thread cutter and thread end clamp must be provided. However, automatic thread cutters and thread end clamps have many inherent problems. The thread cutter and thread end clamp must be precisely controlled in order to cut the thread at the right time and close to the fabric and then clamp the cut end of the thread and correctly position it so that it will be covered by the initial side zigzag stitches of the next buttonhole cycle, all while avoiding interference with the stitch forming reciprocating movement of the needle. Heretofore, one of the major problems has been to accomplish the foregoing more precisely by stabilizing the automatic thread cutter and thread end clamp at a location close to the stitching point.

Summary of the invention

It is therefore a primary object of the invention to provide an improved needle thread cutter and thread end clamp which is stabilized at a location close to the stitching point.

Another object of the invention is to provide a combined needle thread cutter and thread end clamp in which one of the thread cutter blades forms part of the thread end clamp.

Another object of the invention is to provide an improved means for shifting a needle thread cutter and thread end clamp both close to the stitching point and externally.

Other objects and a fuller understanding of the invention may be had by referring to the description and claims taken in conjunction with the accompanying drawings.

Brief description of the drawings

FIG. 1 is a top plan view of the combined automatic needle thread cutter and thread end clamp of the invention mounted on a buttonhole clamp;

FIG. 2 is a partially disassembled perspective view of the two thread cutter blades and the control cam;

FIG. 3 is an enlarged detail view of the buttonhole

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area of FIG. 1 near the end of a buttonhole cycle just before the cutting of the needle thread;

FIG. 4 is a view following FIG. 3 right after the beginning of the next buttonhole cycle with the cut end of the needle thread held by thread end clamp and covered by the initial side zigzag stitches;

FIG. 5 is a view following FIG. 4 right after the thread cutter blades have been opened to release the clamped cut end of the needle thread;

FIG. 6 is a view following FIG. 5 with the buttonhole cycle a little more than half completed;

FIG. 7 is a cross sectional view taken substantially along the line 7-7 in FIG. 6;

FIG. 8 is a cross sectional view taken substantially along the line 8-8 in FIG. 5;

FIG. 9 is a left side elevational view of the combined automatic needle thread cutter and thread end clamp of FIG. 1 showing the safety device; and

FIG. 10 is a view taken substantially along the line 10-10 in FIG. 9.

Description of the preferred embodiments

With reference to the drawings, the invention is illustrated incorporated in a buttonhole sewing machine having a frame including a work supporting bed 21, a standard 22 at one end of the bed, and a sewing head 23 overhanging the bed.

Mounted in the sewing head is a needle bar 24, and connected to the needle bar is a needle 25 having an eye 26. Thread 27 is carried by the eye of the needle, and endwise reciprocation is imparted to the needle bar by a link 28.

A buttonhole clamp is mounted on the work supporting bed. The buttonhole clamp includes a base 29 which is manipulated in a buttonhole sewing pattern by a conventional mechanism which is not shown.

Mounted on the base is a lug 30 for a horizontal hinge pin 31, and pivotally mounted on the horizontal hinge pin is a bifurcated block 32. A clamp arm 33 is connected to the top of the bifurcated block by two screws 34, and a cantilever spring 35 is connected to the front of the bifurcated block by a screw 36. The cantilever spring extends upwardly through a hole 37 in the arm and then over the arm. A thumbscrew 38 at the free end of the cantilever spring transmits force from the cantilever spring to the arm, and provides an adjustment feature for the force transmitted to the arm. A clamp check 39 is mounted on the free end of the arm by a clamp check holder 40. For opening the clamp, a lever 41 is pivotally connected to the rear of the bifurcated block by a pivot screw 42, and a chain 43 extends downwardly from the free end of the lever to a conventional foot pedal which is not shown. A bracket 44 connected to the lever by two screws 45 carries a horizontal pin 46. The horizontal pin bears against the top of the free end of a second lever 47 which is connected to the side of the bifurcated block by a screw 48. A torsion spring 49 on the pivot screw of the first lever biases the horizontal pin against the top of the second lever.

Connected to the clamp check holder 40 at the free end of the arm of the buttonhole clamp is a control cam 50 for a thread cutter and thread end clamp which is indicated generally at 51. The control cam is connected to the clamp check holder by a screw 52 which extends through a slotted clearance hole 53 in the control cam. The slotted clearance hole provides a lateral adjustment feature for the control cam relative to the clamp check holder. Pivotal movement of the control cam about the screw is prevented by two flanges 54 and 55 on the control cam which embrace the top and bottom of the clamp check holder.

The thread cutter and thread end clamp includes a thread cutter arm 56 which is connected to the free end of an extension 57 of the thread cutter arm by two screws 58 having threaded portions 59 which extend through clearance holes in the extension into tapped holes 60 in the arm. Mounted on the free end of the thread cutter arm by a screw 61 having a flat head 62 are a stationary thread cutter blade 63 and a movable thread cutter blade 64. The head of the screw seats in a countersink 65 in the arm so as not to interfere with the control cam as the arm is shifted relative to the control cam. The screw extends through a clearance hole 66 in the arm into a tapped hole 67 in a circular boss 68 on the stationary blade. The movable blade is pivotally mounted on the circular boss, and the stationary blade is held stationary by a lug 69 on the free end which seats in a notch 70 in the free end of the arm. A transverse flange 71 is formed at the other end of the stationary blade. Since the stationary blade is connected to the arm by the screw at an intermediate portion of the stationary blade, the free end of the stationary blade is biased against the movable blade by a leverage action of the screw and the transverse flange. The stationary blade has a thread cutting surface 72 along an upper edge, and the movable blade has a thread cutting surface 73 along a lower edge. Thread clamping surfaces 74 and 75 are formed by an upper surface of the movable blade and a lower surface of the thread cutter arm. Bevels 76 and 77 are formed along an upper edge of the movable blade and a lower edge of the thread cutter arm so as not to cut the thread at that point.

The thread cutter arm is connected to the control cam by a cam follower 78 in the form of a screw having a shoulder 79 and a head 80. The screw extends through a first cam track 81 in the control cam into a tapped hole 82 in the thread cutter arm. The shoulder of the screw follows the cam track, and the head prevents the control cam and the thread cutter arm from becoming separated. The cam follower acts as a cam follower for the stationary blade since the stationary blade moves with the thread cutter arm. A second cam follower 83 on the movable blade follows a second cam track 84 in the control cam. The second cam track is closed at the top. The cam tracks have first cam surfaces 85 and 86 which act upon the cam followers to close the thread cutter blades and second cam surfaces 87 and 88 which act upon the cam followers to open the thread cutter blades. Third cam surfaces 89 and 90 open the thread cutter blades still further.

The extension 57 of the thread cutter arm is mounted on a vertical pin 91 held by a bifurcated lug 92 extending from the side of the bifurcated block 32. The vertical pin extends through a longitudinal clearance slot 93 in the extension. Formed along the side of the end of the extension opposite from the thread cutter and thread end clamp is a ratchet 94. The ratchet mates with a pawl 95 in the form of a screw. The pawl is connected to an arm 96 of a bell crank 97 by a nut 98, and the bell crank is pivotally mounted on the rear of the bifurcated block by a pivot screw 99. Mounted on the pivot screw is a torsion spring 100 having two limbs 101 and 102. One of the limbs of the torsion spring bears against the side of a screw 103 in the rear of the lug 30 upon which the bifurcated lug is mounted and the other limb is hooked over the top of the bell crank to bias the pawl against the ratchet. An extension 104 of the lever 41 which opens the buttonhole clamp strikes a second arm 105 of the bell crank to disengage the pawl from the ratchet.

Retraction of the extension 57 of the thread cutter arm is imparted by a cam 106 on one half 107 of a collar 108 which is clamped to a vertical shaft 109 by two screws 110. The vertical shaft revolves once during each buttonhole cycle. For a portion of each revolution, the cam bears against a cam follower 111 which is pivotally mounted on an ear 112 on the standard by a pivot screw

113. Pivotally connected to the free end of the cam follower by a pivot screw 114 is a link 115. The other end of the link is pivotally connected by a pivot screw 116 to the free end of a lever 117 which is pivotally mounted along with a second lever 118 on top of the bifurcated block by a pivot screw 119. A screw 120 in an intermediate portion of the first lever 117 seats in a groove 121 in an extension 122 of the second lever to provide a lost motion feature between the two levers. A slot 123 in the free end of the second lever 118 embraces a screw 124 on the extension of the thread cutter arm to transmit shifting motion to the extension of the thread cutter arm. A tension coil spring 125 between the free end of the second lever and an ear 126 on the side of the clamp arm 33 biases the extension of the thread cutter arm in the locking direction of the ratchet as opposed to the releasing direction.

In order to initially move the thread cutter and thread end clamp out of the way of the needle in preparation for the succeeding buttonhole cycle and to position the cut end of the needle thread downstream relative to the direction of sewing in an article of fabric 127, a clamp 128 is connected to a vertical slide rod 129 by a screw 130, and an extension 131 is connected to the clamp by two screws 132. A cam 133 on the free end of the extension bears against a cam surface 134 on an extension 135 of the thread cutter arm when the vertical slide rod 129 is shifted downwardly by a mechanism which is not shown.

Formed on the circumference of another half 136 of the collar 108 on the vertical shaft is a safety device in the form of an arcuate segment 137 of a circular flange. The arcuate segment blocks the extension 135 of the cam follower during a portion of each revolution of the vertical shaft to prevent premature thread cutting even though the pawl may have released the extension 57 of the thread cutter arm.

In operation, at the end of a buttonhole cycle, the lever 41 is pulled downwardly by the chain to open the buttonhole clamp as the horizontal pin 46 bears against the top of the free end of the second lever 47 to raise the clamp arm by pivoting the bifurcated block 32 about the horizontal hinge pin 31.

Simultaneously, the extension 104 of the lever 41 strikes the arm 105 of the bell crank 97 to disengage the pawl 95 from the ratchet to release the extension of the thread cutter arm. Immediately following, as shown in FIG. 3, the coil spring 125 shifts the thread cutter and thread end clamp 51 toward the head end of the machine and the first cam surfaces 85 and 86 of the cam tracks act upon the cam followers 78 and 83 to close the thread cutter blades to cut the needle thread between the thread cutting surfaces 72 and 73 along the upper edge of the stationary blade and along the lower edge of the movable blade. The cut end of the needle thread is held clamped between the thread clamping surfaces 74 and 75 formed by the upper surface of the movable blade and the lower surface of the thread cutter arm.

Before the beginning of the next buttonhole cycle, the thread cutter and thread end clamp is initially retracted against the action of the tension coil spring by downward movement of the slide rod 129 which causes the cam 133 on the extension of the clamp on the slide rod to bear against the cam surface 134 on the extension 135 of the cam follower 111. The foregoing movement moves the thread cutter and thread end clamp out of the way of the needle for the beginning of the next buttonhole cycle. As shown in FIG. 4, the cut end of the needle thread is held downstream relative to the direction of sewing so that the cut end is covered by the initial side zigzag stitches of the next buttonhole cycle.

Further retraction of the thread cutter and thread end clamp against the action of the tension coil spring is accomplished by the cam 106 on the vertical shaft 109 as

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the cam bears against the cam follower 111. During retraction, as shown in FIG. 5, the thread cutter blades are first opened by the second cam surfaces 87 and 88 on the cam tracks to release the cut end of the needle thread. As shown in FIG. 6, the thread cutter blades are then opened still further by the third cam surfaces 89 and 90 on the cam tracks in preparation for the next thread cutting operation.

During a portion of each buttonhole cycle, the arcuate segment 137 on the collar 108 on the vertical shaft 109 blocks the extension 135 of the cam follower 111 so that the thread cutter and thread end clamp cannot be actuated even though the pawl 95 may have been disengaged from the ratchet on the extension of the thread cutter arm. The arcuate segment provides a safety feature to prevent untimely cutting of the needle thread in the middle of a buttonhole cycle.

Although the invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention.

Having thus set forth the nature of this invention, what is claimed is:

1. A combined needle thread cutter and thread end clamp for a buttonhole sewing machine having a work supporting bed, a sewing head overhanging the work supporting bed, a needle bar for a needle having an eye for thread mounted in the sewing head, means for imparting reciprocation to the needle bar, a buttonhole clamp on the work supporting bed, and means for closing and opening the buttonhole clamp, said combined needle thread cutter and thread end clamp comprising a thread cutter arm, two thread cutter blades, means for mounting the thread cutter blades at the free end of the thread cutter arm, a control cam having two cam tracks connected to the free end of the buttonhole clamp, cam followers at the free ends of the thread cutter blades contacting the cam tracks, and means for shifting the thread cutter arm so that the thread cutter blades are actuated by the cam tracks at the end of a buttonhole cycle for cutting the needle thread between the eye of the needle and an article of fabric on the work supporting bed and for clamping and positioning the cut end of the needle thread from the needle downstream relative to the direction of sewing until after the next buttonhole cycle has begun.

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2. The combined needle thread cutter and thread end clamp for a buttonhole sewing machine of claim 1 in which the thread cutter arm has a ratchet at the end opposite from the two thread cutter blades, a pawl mates with the ratchet, biasing means bias the thread cutter arm in the locking direction of the ratchet as opposed to the releasing direction, and means are provided for disengaging the pawl from the ratchet.

3. The combined needle thread cutter and thread end clamp for a buttonhole sewing machine of claim 1 in which the cam tracks have first cam surfaces which act upon the cam followers to close the thread cutter blades for cutting and clamping the needle thread and second cam surfaces which act upon the cam followers to open the thread cutter blades for releasing the needle thread and preparing for the next cycle.

4. The combined needle thread cutter and thread end clamp for a buttonhole sewing machine of claim 3 in which the cam tracks are sinuous grooves in the cam arranged substantially parallel to the shifting movement of the thread cutter arm and means are provided for holding one of the cam followers in one of the cam tracks.

5. The combined needle thread cutter and thread end clamp for a buttonhole sewing machine of claim 3 in which the thread cutter blades are pivotally mounted on the lower surface of the free end of the thread cutter arm for scissorlike action, the lowermost thread cutter blade is stationary, the other thread cutter blade is movable, thread cutting surfaces are formed on the upper edge of the stationary thread cutter blade and the lower edge of the movable thread cutter blade so that the needle thread is cut between the upper edge of the stationary thread cutter blade and the lower edge of the movable thread cutter blade, and clamping surfaces are formed on the upper surface of the movable thread cutter blade and the lower surface of the thread cutter arm so that the cut end of the needle thread is held clamped between the upper surface of the movable thread cutter blade and the lower surface of the thread cutter arm after the thread is cut and until the thread cutter blades are opened.

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