United States Patent

[11] **3,584,589**

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[54] **THREAD TRIMMER**
15 Claims, 9 Drawing Figs.

[52] **U.S. Cl.** **112/252,** 112/254
[51] **Int. Cl.** **D05b 65/00,** D05b 47/04
[50] **Field of Search** 112/252, 254, 255, 65

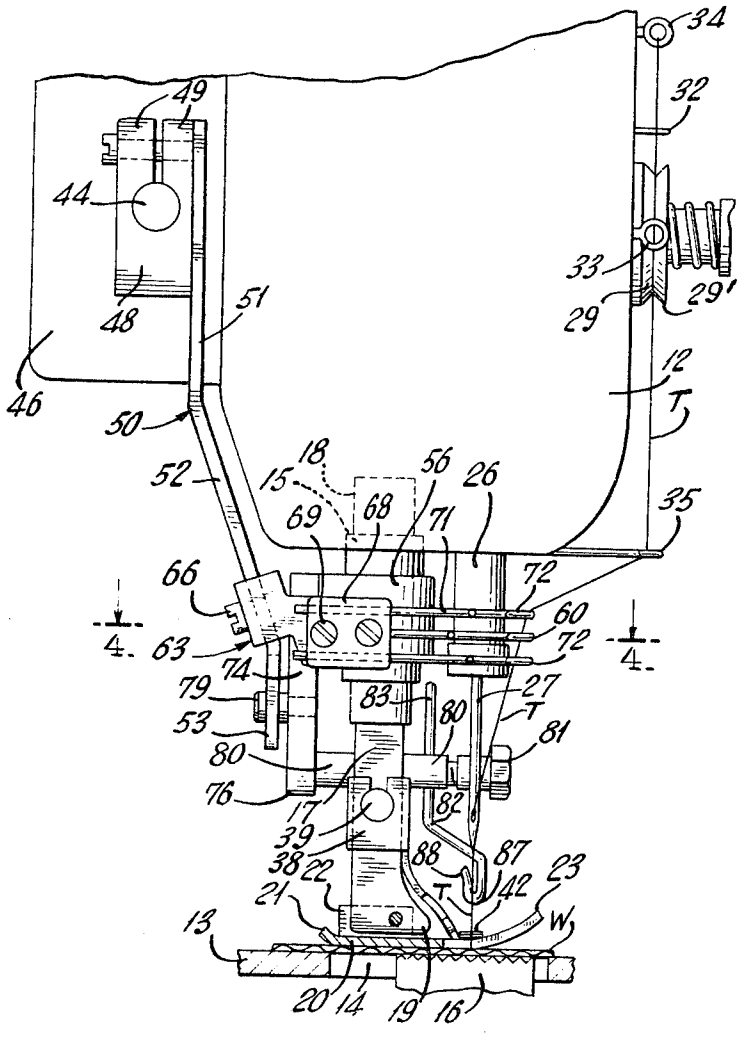
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Primary Examiner—James R. Boler
Attorney—William R. Liberman

ABSTRACT: A sewing machine automatic thread cutter comprises a detachable cutting edge positioned along the top border of the sewing machine foot piece slot, a thread pulling assembly positioned between the sewing machine thread tensioner and sewing needle and including a stationary thread guide flanked by a pair of movable thread guides, and a transversely movable hook for engaging the thread depending from the needle and drawing it across the cutting edge. An actuating rod is reciprocated by a solenoid and in its advance stroke releases the thread tensioner and advances the movable thread guides to draw thread from a source thereof and advances the hook past the thread tail, and in its return stroke returns the guides to relax the thread, reactivates the thread tensioner, and returns the hook which draws the thread across the cutting edge shortly following the tensioning of the thread.



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SHEET 1 OF 3

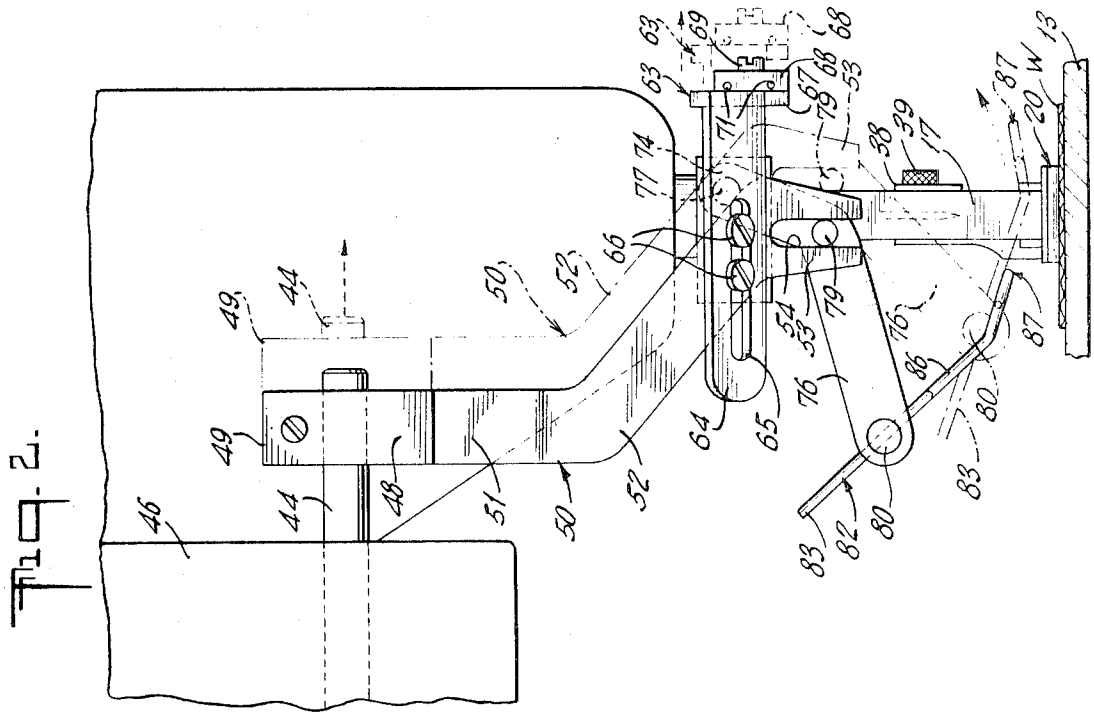


Fig. 2.

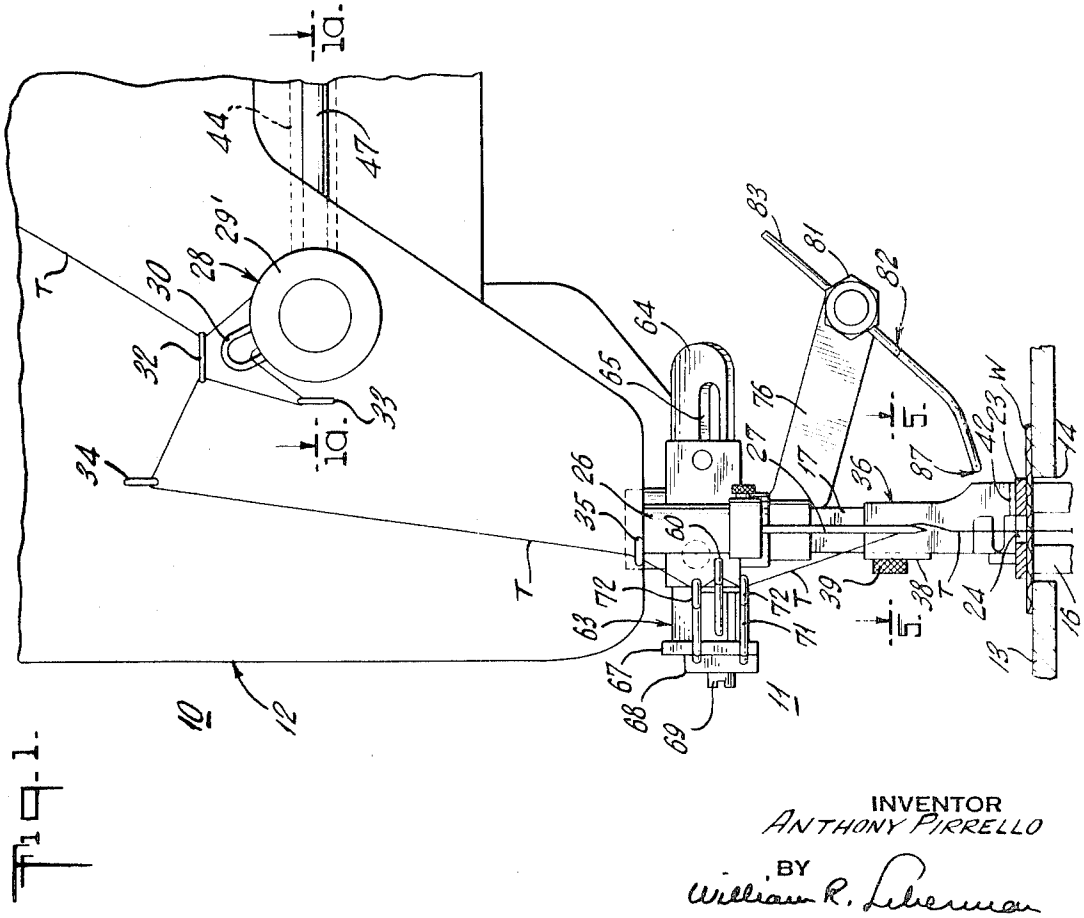


Fig. 1.

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Fig. 3.

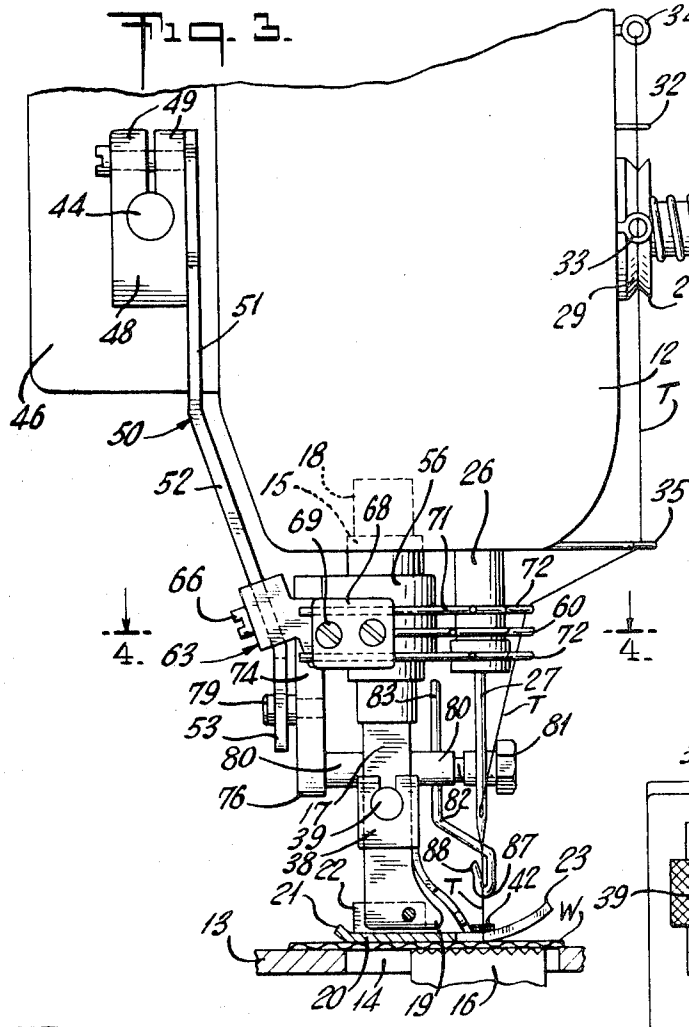


Fig. 4.

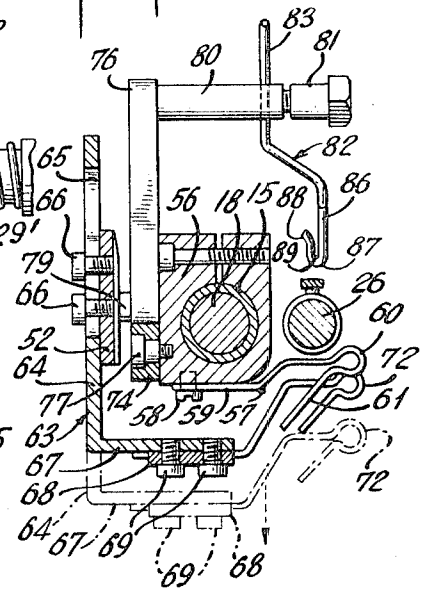


Fig. 5.

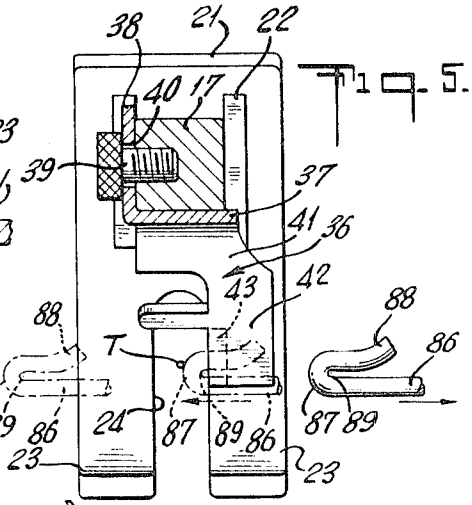


Fig. 6.

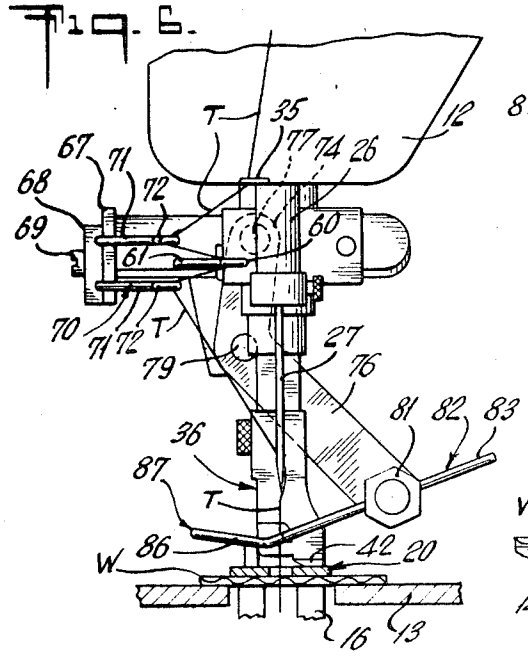
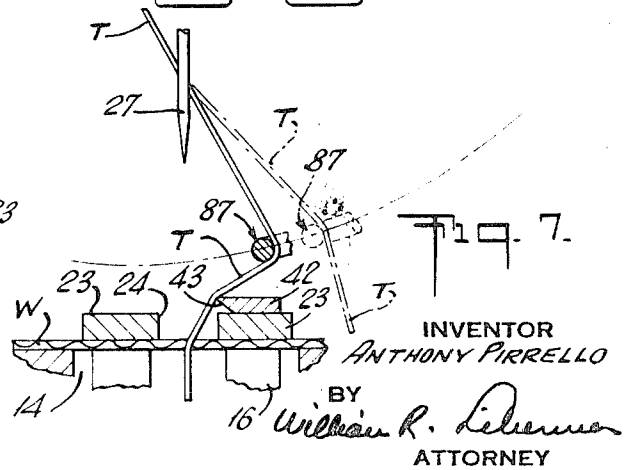


Fig. 7.



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Fig. 8.

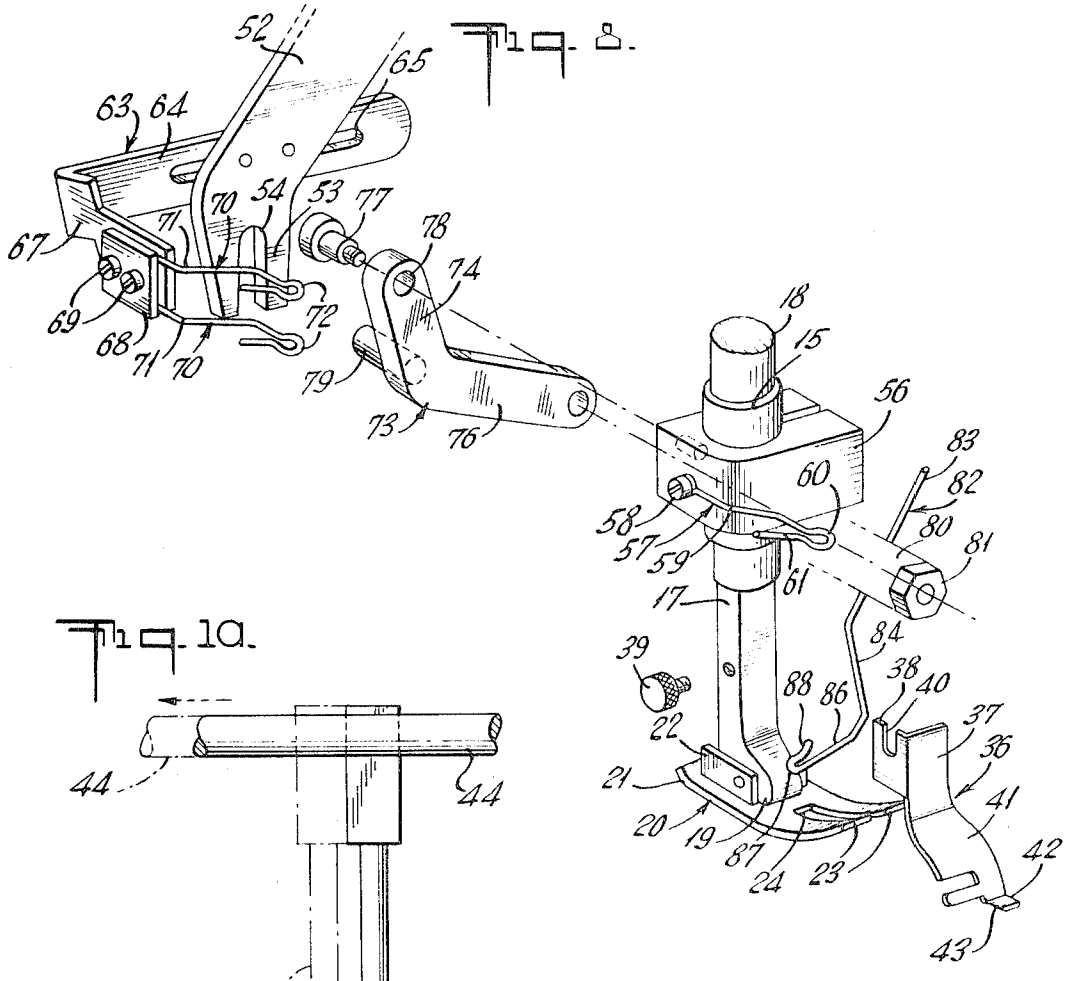
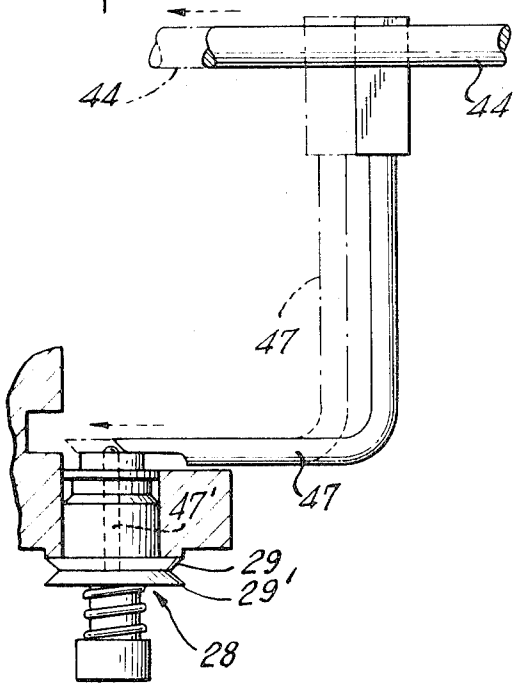


Fig. 10.



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THREAD TRIMMER

BACKGROUND OF THE INVENTION

The present invention relates generally to improvements in sewing machines and it relates particularly to an improved automatic thread cutter or trimmer in a sewing machine.

In commercial sewing procedures, a time consuming and highly inconvenient step is the severing of the sewing thread following a predetermined sewing operation, particularly the severing of the needle fed thread. Not only is this step in itself time consuming but it generally interferes with the normal sequence of operations. Many systems and mechanisms have been employed and proposed for effecting the automatic cutting of the sewing thread and although some of these operate in a satisfactory manner they possess numerous drawbacks and disadvantages. They are generally complicated and bulky structures which require which alterations and modifications of the conventional sewing machines, they are difficult to install, are expensive, of little adaptability, and otherwise leave much to be desired.

SUMMARY OF THE INVENTION

It is therefore, a principal object of the present invention to provide an improved sewing machine mechanism.

Another object of the present invention is to provide, in a sewing machine, an improved mechanism for automatically cutting the needle fed sewing thread.

Still another object of the present invention is to provide an automatic thread cutter which may be easily and rapidly installed in the conventional sewing machine with little or no modification or alteration of the basic sewing machine structure.

A further object of the present invention is to provide an improved mechanism of the above nature characterized by its reliability, ruggedness, low cost, ease of installation and wide versatility and adaptability.

The above and other objects of the present invention will become apparent from a reading of the following description taken in conjunction with the accompanying drawings which illustrate a preferred embodiment thereof.

In a sense, the present invention contemplates the provision in a sewing machine including a foot member having a recess, a needle, means for holding and for reciprocating said needle along a path between a retracted position and an advanced position through said foot member recess, guide means for leading a thread from a source thereof through said needle to a terminating thread tail extending from said needle, and threat tensioning means engaging said thread between said thread source and said needle, the improvement comprising a thread cutting element positioned on said member proximate said recess, first means for drawing said thread tail between said needle in a raised position and said foot member across said cutting element, second means movable between advance and retracted positions for drawing thread between said needle and tensioning means from said source during advance movement of said second means, and third means for actuating said first and second means in a predetermined sequence to advance said second means to draw thread trough said tensioning means from said source of thread, and thereafter retract said second means and actuate said first means to draw said thread between said needle and foot member across said cutting element.

In the preferred form of the improved threat cutting mechanism, the thread cutting element is detachably mounted atop a leg of the foot member with its cutting edge bordering the foot member slot. The first means for drawing the thread across the cutting edge includes a hook member mounted on a rocker arm and oscillated thereby transversely across the needle path below the raised needle, the hook having a cam-defining leg which deflects the thread during the hook forward stroke, the hook engaging the thread on its return stroke. The second means includes a stationary guide flanked by a pair of transversely movable guides which engage the thread along spaced points. The actuating means comprises a transversely reciprocating bar supporting a depending bracket arm upon which the movable thread guides are adjustably mounted and which has a vertically extending slot formed therein and the hook supporting rocker arm is an angulated element carrying a follower which slideably engages the bracket arm slot. The reciprocating actuating bar is provided with an end finger which cooperates with the tensioning device to release it during the actuating cycle and to reactivate it just prior to the thread being drawn across the cutting edge.

The improved thread cutting mechanism is rugged, simple and reliable and may be easily and rapidly installed in conventional sewing machines as well as many other types of sewing machines with little or no modification or alteration of the sewing machine and functions in a rapid and efficient manner in trimming the needle fed thread.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front fragmentary elevational view, partially in section, of a sewing machine embodying the present invention, the thread trimmer being shown in its normal retracted position;

FIG. 1*a* is a sectional view taken along line 1*a*—1*a* of FIG. 1;

FIG. 2 is a rear elevational view thereof, the cutting mechanism being shown by broken line in an advanced position;

FIG. 3 is a left-hand end elevational view thereof;

FIG. 4 is a sectional view taken along line 4–4 in FIG. 3;

FIG. 5 is a sectional view taken along line 5–5 in FIG. 1;

FIG. 6 is a view similar to FIG. 1, the thread trimming mechanism being shown in an advanced position;

FIG. 7 is an enlarged front sectional view of the thread severing mechanism shown during the retraction stroke thereof; and

FIG. 8 is an exploded front perspective fragmentary view of the thread trimming mechanism.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings which illustrate a preferred embodiment of the present invention, reference numeral 10 generally designates a suitably mounted sewing machine head of conventional construction on which is installed the improved automatic thread cutter or trimmer mechanism 11. The sewing machine head 10 includes an upper casing 12 which houses the sewing machine drive mechanism which is coupled to a drive motor through a suitable transmission and control arrangement. Positioned below the free end of machine head 10 is a plate 13 having a longitudinal aperture 14 therein along which a feed dog 16 oscillates. Located below plate 13 are the feed dog drive mechanism and a thread handling mechanism (not shown) of any known construction depending on the type of the sewing machine.

Vertically depending from the enlarged free end of casing 12 is a bar or post 17 whose lower part is of square transverse cross section and whose upper part 18 is cylindrical and slideably registers with a vertical bushing or sleeve 15. Coupled to bar 17 is a manually operable mechanism of known construction for raising and releasably holding said bar 17 in a raised position. Bar 17 terminates at its bottom in a forwardly enlarged base section 19 which stationary supports a presser foot 20 of conventional shape. Presser foot 20 includes a rear section 21 provided with transversely spaced vertical bracket plates 22 pivoted to post section 19 and upwardly curved at its rear end, and a pair of parallel, forwardly upwardly curved, transversely spaced longitudinal front legs 23 separated by a slot 24 overlying slot 14. A reciprocating vertical needle bar 26 depends from the free end of casing 12 forwardly of post 17 and releasably supports a needle 27 in vertical alignment with slots 14 and 24, said needle bar 26 being driven synchronously with feed dog 16 and the bottom thread handling mechanism.

Mounted on the front face of casing 12 proximate its free end is an adjustable, releasable, thread tensioning device 28 which includes a pair of centrally apertured stationary and movable coaxial tensioning discs 29, 29' respectively provided with relatively outwardly flared peripheral borders and supported for axial movement and spring urged toward each other at adjustable pressure. Associated with tensioning device 28 is a peripherally located spring loop thread guide 30, thread guides 32 and 33 located above and on the left of tensioning device 28, a thread guide 34 vertically reciprocating in synchronism with needle bar 26 along a path to the left of thread guide 33, and a thread guide 35 supported at the bottom of casing 12 forward of needle bar 26. The sewing machine described above is of generally conventional construction and does not, per se, form part of the present invention. Advantageously associated with the sewing machine is an automatic needle positioner of known construction which automatically positions needle bar 26 in its raised position upon the stopping of the sewing machine drive.

The thread trimming and cutting mechanism 11 comprises a replaceable knife member 36 which is separably mounted on post 17 and includes a vertical upper leg 37 superimposed on the front face of post 17 and provided with an integrally formed rearwardly directed side bracket arm 38 abutting a corresponding side face of post 17. A releasably thumb screw 39 registers with a slot 40 formed in the upper part of bracket arm 38 and engages a tapped transverse bore in post 17 to releasably secure knife member 36 to post 17. Depending from upper leg 37 and integrally formed therewith is a curved forwardly downwardly inclined resilient arm 41 which projects forwardly of head 19 to a point on presser foot 20 shortly forward of the rear end of slot 24. A blade element 42 is integrally formed with and projects forwardly from the bottom of arm 41 and overlies and abuts the top face of the right-hand presser foot leg 23. The inner edge of blade element 41 substantially coincides with the inner edge of right-hand foot leg 23 and is bevelled at its underface to form a cutting edge 43 disposed above the upper face of underlying leg 23.

The thread cutter actuator includes a transversely extending rod 44 suitably supported on casing 12 for transverse axial reciprocating motion, actuator rod 44 being connected to the armature of a suitably housed actuating solenoid 46, or the drive of any other reciprocating actuating means, rod 44 being normally urged to a retracted right-hand position, as viewed in FIG. 2, and being advanced and retracted with the energization and deenergization of solenoid 46 respectively. A transverse tension release finger 47 provided with a tapered or cam-shaped free end 47' directed toward thread tensioning device 28 is coupled to actuator rod 44 to move therewith and to engage and release the movable disc 29' through the depression of release pin 47' on the forward stroke of actuator rod 44, and to disengage and reactivate tension device 28 upon the return stroke of rod 44. It should be noted that interlock switch means are provided in the known manner, to permit the energization of solenoid 46 only when needle bar 26 is in its raised condition.

A coupling clamp block 48 including a split cylindrical bore which engages rod 44, and a pair of opposing legs 49 tightened by leg interconnecting screws is releasably mounted on the free left-hand end of actuator rod 44. Secured to the front face of and depending from clamp block 48 is a driver arm 50 including an upper vertical section 51, and a forwardly outwardly inclined lower section 52 which terminates in a depending vertical leg 53 disposed behind post 17 and having a vertical slot 54 formed therein.

A screw tightened clamp block 56 having a split cylindrical vertical bore is mounted on and releasably engages bushing 15. A stationary first wire thread guide member 57 is mounted on the left-hand face of block 56 by a screw 58 engaging a tapped bore in block 56 and an eye at the rear end of an angular horizontal leg 59 which is directed forwardly and to the right. A thread guide defining first loop 60 is formed at the front end of leg 59 and has a rear opening thereto from which diverges the forward end of arm 59 and an end leg 61 to define a threading throat. The first thread guide loop 60 is disposed slightly forward of and to the left of the lower section of needle bar 26 when it is in its raised position.

A bracket 63 is mounted on the lower rear face of lower arm section 52 for transverse adjustment thereon and includes a transverse arm 64 abutting the rear face of lower arm section 52 and having an elongated slot 65 formed along the length thereof. A pair of transversely spaced locking screws 66 have threaded shanks registering with slot 65 and engaging tapped bores in arm lower section 52. Integrally formed with and projecting forwardly from the left end of arm 64 is a mounting arm 67 lying in a vertical plane. A clamp plate 68 provided with vertically spaced parallel grooves extending along the length thereof is located along the left outer face of arm 67 and is releasably tightened thereto by a pair of screws 69 passing through openings in clamp plate 68 and engaging tapped bores in arm 67.

A pair of upper and lower movable parallel second thread guide members 70 similar in configuration to stationary first thread guide member 57 include horizontal mounting arms 71 whose rear ends are releasably clamped between arm 67 and clamp plate 68 in corresponding grooves therein above and below tightening screws 69. Vertically aligned thread guide defining loops 72 are formed at the front ends of mounting arms 71 and are similar to thread guides 60. Upper and lower thread guides 72 are at levels equally vertically spaced above and below the level of stationary thread guide 60 and when actuating rod 44 and arm 50 are in their retracted positions movable thread guides 72 are slightly to the left of stationary thread guide 60, as seen in FIG. 1, the spacing being adjustable by means of support bracket 63 and lock screws 66.

The mechanism for drawing the thread across the cutting edge 43 comprises a lever 73 including a pair of angularly related arms 74 and 76. Lever arm 74 extends vertically and lever 73 is rockably mounted to the rear face of clamp block 56 by a pivot screw 77 having a threaded shank engaging a tapped bore in the rear face of clamp block 56 and a cylindrical pivot and enlarged head section engaging a correspondingly shaped stepped bore 78 in the upper end of lever arm 74. A follower defining pin 79 projects rearwardly from the elbow section of lever 73 into sliding engagement with slot 54, and arm 76 is inclined downwardly to the right from the lever elbow.

A longitudinally extending horizontal rod 80 is mounted on the free end of lever arm 76 and projects forwardly to a point at a level between and to the right of presser foot bar 17 and needle bar 26. A transverse bore is formed in rod 80 proximate its forward end and a tapped axial bore extends from the forward end of rod 80 to said transverse bore. The tapped axial bore is engaged by a lock screw 81.

A wire formed thread drawing hook member 82 includes an upper coupling arm 83 which is inclined upwardly to the right and slideably engages the transverse bore in mounting rod 80, and is releasably adjustably locked in position by screw 81 bearing thereon. An integrally formed arm 84 extends from the lower end of coupling arm 83 and is inclined downwardly and forwardly to the left and joins an integrally formed arm 86 projecting transversely to the left and being less inclined to the horizontal than arm 84. Arm 86 terminates in a thread engaging hook 87 defined by the outer end section of arm 86 and a leg 88 projecting rearwardly and to the right from the end of arm 86 and joined thereto by a curved elbow 89. The rear face of elbow 89 and leg 88 define a cam surface, the forward section of which is disposed shortly forward of the path of needle 27, as seen in FIGS. 3 to 5, and the right or trailing opening to hook 87 traverses a path intersecting that of needle 27 between the raised needle position and the presser foot 20.

Considering now the operation of the improved thread trimmer 11, in normal operation, the thread T traverses a path from the spool, cone or other source of thread, downwardly through guide 32, clockwise between tension discs 29 and successively through guides 33, 32, 34 and 35. As thread T leaves

guide 35 it traverses a slightly zigzag path through guide 60 and retracted guides 72 a little to the left of needle 27 and then passes through the eye of needle 27 and into a sewn workpiece W held by presser foot 20 against plate 13 and feed dog 16. In the dormant condition of trimmer mechanism 11, as shown in FIGS. 1 to 5, actuator rod 44 and tension release finger 47, movable thread guides 72 and thread hook 87 are in retracted right-hand positions.

In performing the thread trimming operation, solenoid 46 is successively energized and deenergized when the needle 27 is in a raised position to advance and retract actuator rod 44. With the advance of actuator rod 44 to the left, finger 47 advances to release tensioning device 28 and the drag thereof on thread T trailing thread drawing guides 60 and 72; movable thread guides 72 are advanced to the left by driver arm 50 to draw thread T from the source thereof through released tensioning device 28 by reason of the increase in the length of the path of thread T between tensioning device 28 and needle 27 and the low retardation on the travel of the thread from its source; and hook 87 is advanced by the swinging lever 73 to the left, the hook leg 88 deflecting the thread T between needle 27 and workpiece W rearwardly during its passage past thread T, the thread T resiliently returning to its initial position following the forward passage of hook 87. Upon deenergization of solenoid 46 actuator arm 44 is retracted to the right to retract hook 87 which engages thread T and pulls it across knife edge 43 which effects the severing of thread T, thread guides 72 are retracted to their initial position and tension release finger 47 disengages tensioning device 28 to return it to its thread tensioning condition. It should be noted that hook member 82 is so adjusted relative to tension release finger 47, that tension release finger 47 disengages and reactivates tensioning device 28 and reestablishes tension on thread T shortly before hook 87 draws thread T into engagement with knife edge 43. Moreover, the hook 87 is provided with a narrow slot at its base of such configuration as to retain the end of thread T after it has been severed and pulls the thread away from the presser foot 20 so that it will not be trapped under the presser foot and thereby leave a long tail at the start of the next sewing operation.

While there has been described and illustrated a preferred embodiment of the present invention, it is apparent that numerous alterations, omissions and additions may be made without departing from the spirit thereof.

What I claim is:

1. In a sewing machine including a foot member having a recess, a needle, means for holding and for reciprocating said needle along a path between a retracted position and an advanced position through said foot member recess, guide means for leading a thread from a source thereof through said needle to a terminating thread tail extending from said needle, and thread tensioning means engaging said thread between said thread source and said needle, the improvement comprising a thread cutting element positioned on said foot member proximate said recess, first means for drawing said thread tail between said needle in a raised position and said foot member across said cutting element, second means movable between advance and retracted positions for drawing thread between said needle and tensioning means from said source during advance movement of said second means, and third means for actuating said first and second means in a predetermined sequence to advance said second means to draw thread through said tensioning means from said source of thread, and thereafter retract said second means and actuate said first means to draw said thread between said needle and foot member across said cutting element.

2. The sewing machine of claim 1, including means for releasing said thread tensioning means during the drawing of thread through said thread tensioning means by said second means.

3. The sewing machine of claim 1, including means for releasing said thread tensioning means for an interval between the advance of said second means and the drawing of said thread across said cutting element by said first means.

4. The sewing machine of claim 1, wherein said thread drawing second means comprises a pair of first and second thread guides engaging said thread along longitudinally spaced points between said tensioning means and said needle and actuatable by said thread between advanced widely transversely spaced thread drawing positions increasing the path of said thread between said tensioning means and said needle and retracted, relatively proximate, transverse positions.

5. The sewing machine of claim 4, comprising a pair of said first guides engaging said thread on opposite sides of said second guide and synchronously transversely movable relative to said second guide.

6. The sewing machine of claim 1, wherein said first means comprises a hook member movable along a transverse path between said foot member and said needle in its retracted position, said third means reciprocating said hook along said transverse path with the actuation of said first means in a forward stroke bypassing said thread tail and a return stroke engaging said thread tail and drawing it across said cutting element.

7. The sewing machine of claim 6, wherein said hook member includes a cam defining outer leg oblique to said transverse path for urging said thread tail sidewise of said hook member on the open side thereof during said forward stroke thereof.

8. The sewing machine of claim 7, wherein said hook member includes angularly related legs delineating a bight for releasably engaging said thread tail upon retraction of said hook member.

9. The sewing machine of claim 1, wherein said foot member is bifurcated to form a pair of forwardly directed arms separated by a recess-defining slot, said cutting element being located atop one of said arms and having a cutting edge bordering said slot.

10. The sewing machine of claim 9, including a support post connected to and projecting upwardly from said foot member, an arm connected to and extending upwardly from said cutting element and engaging said post, and means releasably securing said cutting element arm to said post.

11. The sewing machine of claim 9, comprising means for releasably securing said cutting element to said foot member.

12. The sewing machine of claim 1, wherein said second means comprises a first stationary guide member and a second transversely movable guide member engaging said thread at points spaced along said thread between said thread tensioning means and said needle, said first means comprises a hook member movable along a transverse path between said foot member and said needle in its retracted position, and said third means comprises a transversely reciprocable rod, a bracket arm secured to and depending from said rod and supporting said second guide member, a rocker arm mounted for rocking about a forwardly rearwardly extending axis, said hook member being mounted on said rocker arm proximate an end thereof, and means coupling said rocker arm to said bracket arm for oscillating said arm with the reciprocation of said rod.

13. The sewing machine of claim 12, including means for transversely adjusting the position of said second guide member on said bracket arm.

14. The sewing machine of claim 12, including means for adjusting the position of said hook member on said rocker arm.

15. The sewing machine of claim 12, wherein said bracket arm has a vertically extending slot formed therein and said coupling means comprises a follower mounted on said rocker arm and slideably engaging said slot.