July 21, 1964 R. REEBER ETAL 3,141,432

THREAD-TRIMMING MECHANISM FOR SEWING MACHINES

Filed April 25, 1963

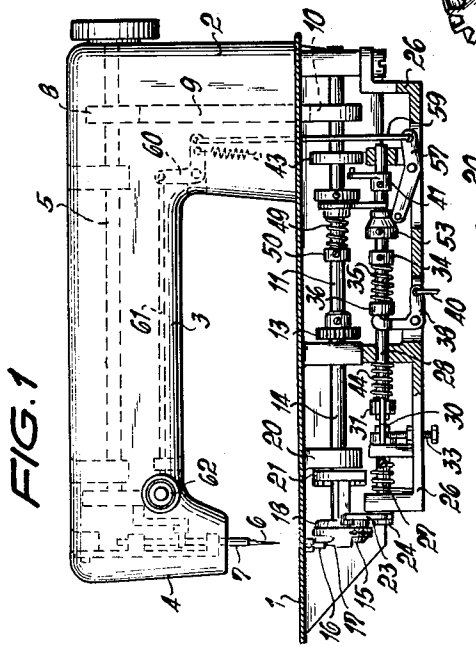


FIG. 1

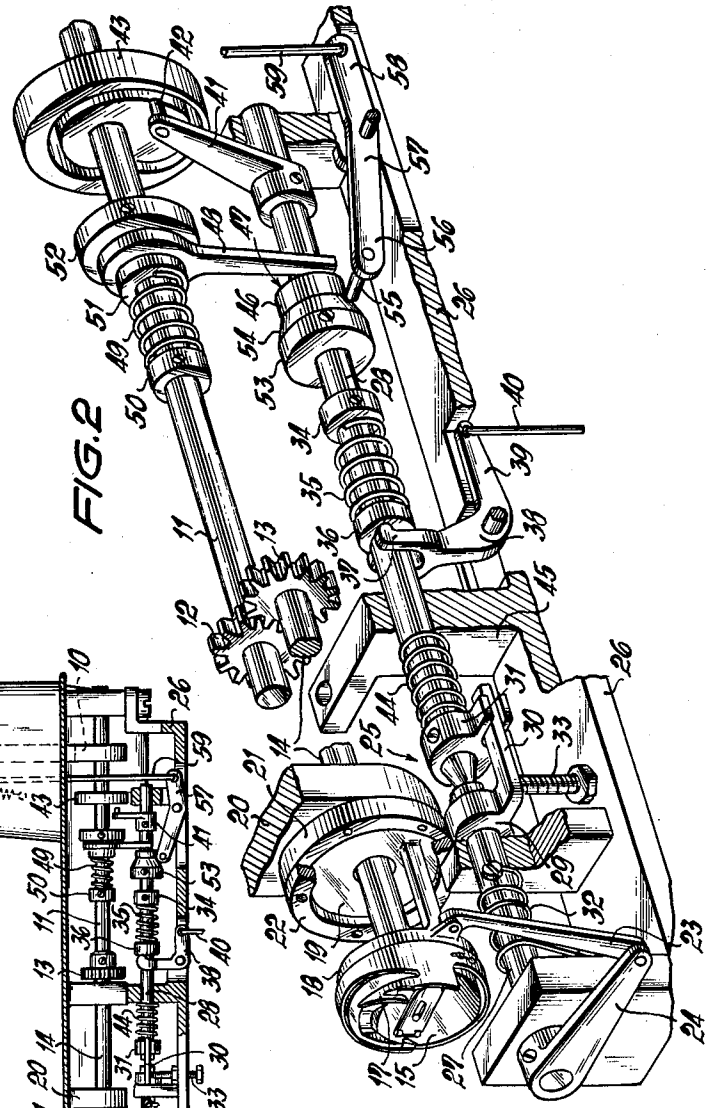


FIG. 2

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United States Patent Office 3,141,432 Patented July 21, 1964

3,141,432

THREAD-TRIMMING MECHANISM FOR SEWING MACHINES

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Filed Apr. 25, 1963, Ser. No. 275,621
Claims priority, application Germany Apr. 26, 1962
12 Claims. (Cl. 112—252)

The present invention relates to thread-trimming mechanism for sewing machines, more particularly, though not limitatively, of the type described in copending patent application Serial No. 215,317, filed August 7, 1962, entitled Thread-Trimming Mechanism for Lock Stitch Sewing Machines, by Kristen Hedegaard, joint inventor of the instant application, said co-pending application having been assigned to the same assignee as the instant application and being included herewith in this application by reference.

There is described in said copending application thread-trimming mechanism for lock stitch sewing machines of the general construction comprising a stitching or throat plate, a reciprocating needle above said plate and a cylindrical rotary hook or looper mounted below said plate and having a needle thread seizing beak for cooperation with said needle in the formation of lock stitches in a manner well known. The trimming mechanism for the simultaneous cutting of the needle and looper threads essentially comprises an arc-shaped catch-thread and cutting blade disposed closely adjacent to the outer surface of and mounted for oscillating or to and fro movement coaxially with said looper in the peripheral direction towards and away from said beak, respectively, in respect to a predetermined starting position, to thereby trap and simultaneously cut the looper thread and the work limb of the needle thread loop in cooperation with a stationary cutting knife engaging said blade. The latter is provided with a point-like or arrow-shaped projection extending in the direction of the looper beak and being adapted to deflect the take-up limb of the needle thread loop and to enter the space enclosed by said limb, on the one hand, and by the looper thread and work limb of said loop, on the other hand, in the predetermined position of the looper upon drawing out the needle thread loop by said beak during a stitching or needle operating cycle of the sewing machine. As a consequence, the looper thread and the work limb of the needle thread loop are separated from the take-up limb of said loop during the first half-cycle operation of said blade in the direction towards said beak. The catch-thread and cutting blade being mounted between the loop taker and work feed dog or dogs of the machine of conventional construction may be actuated either manually or by the power drive of the machine, in the manner described in greater detail in both said copending application and in the following.

The catch-thread and cutting blade is furthermore provided with a lateral hook-shaped projection pointing in the direction opposite to said first projection or away from said beak, whereby to provide a re-entrant recess to guide and trap the separated looper and needle threads during the second operating half-cycle of said blade in the direction away from said beak. During the latter movement, a stationary cutting knife cooperating with said blade causes a severing or cutting of the trapped looper and needle threads, substantially without affecting the take-up limb of the needle thread. As a consequence, an adequate projecting length of the needle thread will be left by the thread cutting operation by simultaneously releasing the thread tension of the machine, to ensure a safe initiation of the following stitching operation.

Thread-trimming mechanism of the type described in the foregoing has the advantage, among others, of requiring a minimum of mounting space which, in turn, results in the elimination of interference with the design and operation of the conventional stitch-forming tools, including the loop taker, work feed dogs, etc. Moreover, the throat or stitching plate remains substantially unobstructed or free from any elements or parts of the thread-trimming elements, in such a manner as to enable said mechanism to be readily and structurally embodied in conventional sewing machines, while affording a ready exchange of the throat plate for the carrying out of different types of sewing operations.

In the operation of a thread-trimming device of the above and other known types, operation of the catch-thread device or cutter is usually effected by the aid of an operating lever or the like control member. For this purpose, it is necessary to first arrest the machine in a predetermined needle position and subsequently to actuate said lever for the initiation of the thread-trimming operation.

A main object of the present invention is the provision of improved mechanism for the control of a thread-trimming device, preferably, though by no means limitatively, of the type referred to herein and described in the aforementioned copending application, whereby the operating or control member of the thread cutter may be actuated or pre-set while the machine is still in operation, or prior to the completion of a sewing operation, in such a manner as to initiate the final cutting operation and severing of the threads after completion of the sewing operation or stoppage of the machine by simply restarting the same to operate the cutting device. In other words, the invention involves generally the storing of an operating or control impulse, while the machine is still in operation, to automatically initiate the thread cutting operation after stoppage and restarting of the machine upon completion of a sewing operation.

Such a control or presetting of the thread-trimming mechanism while the machine is still in operation has the advantage, among others, of eliminating a special control operation, that is, the setting of the trimming device between the stoppage of the machine or end of the sewing operation and re-starting to operate the thread cutting device. This will enable an increase of the operating speed or efficiency of the sewing cycles, especially in connection with industrial or mass production sewing operations.

Another object of the invention is the provision of thread-trimming mechanism and control means therefor of the type referred to which is simple in design and will require a minimum of mounting space, to enable its structural embodiment in or use as an accessory of conventional sewing machines.

The invention, both as to the foregoing and ancillary objects, as well as novel aspects thereof, will be better understood from the following detailed description, taken in reference to the accompanying drawing forming part of this specification and wherein:

FIG. 1 shows, by way of example, a front elevation of a sewing machine having embodied therein improved thread-trimming mechanism constructed in accordance with the principles of the invention; and

FIG. 2 is an enlarged partial perspective view showing more clearly the construction of the control mechanism of the thread-trimming device embodied in FIG. 1.

Like reference numerals denote like parts in both views of the drawing.

With the foregoing objects in view, the invention involves generally the provision of a sewing machine having a reciprocating needle, a drive shaft operably con-

nected thereto and an oscillating thread-trimming device to cut the thread at the end of a sewing operation, with operating mechanism for said device comprising essentially releasable coupling or motion-transmitting means connecting said device with said shaft and being adapted to convert rotary motion of said shaft into reciprocating motion of said device for effecting a thread-trimming operation during a predetermined fractional period of a needle operating cycle, such as during the drawing out of the needle thread loop by the rotary hook or looper of the machine, in the manner described and shown in greater detail in said copending application, although it will be understood that the invention applies generally to any type of oscillating thread-trimming means or device. In order to achieve the novel effects and results of the invention, said mechanism further comprises first resilient biasing means, such as in the form of a biasing spring or the like, to normally urge said coupling means to a position of disengagement of said device from said shaft, and adjustable stop means operable in response to rotation and stoppage, respectively, of said shaft, whereby to prevent engagement of said coupling means during rotation of said shaft, that is, while the machine performs a sewing operation, on the one hand, and to enable coupling upon stoppage of said shaft at the completion of the sewing operation, on the other hand. There is further provided for this purpose resilient energy storage means, in the form of a compression spring or the like, being fitted with operating means (control lever, foot pedal, etc.), to temporarily bias said coupling means in the direction opposite to the bias by said first resilient means. As a consequence, the coupling means will be automatically operated to engaged position for the initiation of a thread-trimming operation by pre-setting or tensioning of said storage spring or the like energy storage device during the operation of the sewing machine and by subsequent restarting after completion of the sewing operation.

Although the control mechanism of the invention is especially suitable for use in connection with thread-trimming devices of the type referred to hereinabove and described in the said copending application, it will become apparent that the underlying concept of pre-setting and subsequent automatic operation of the thread-trimming device may be employed with equal advantage in connection with different types of oscillating thread cutters for trimming either or both of the needle and looper threads of a conventional sewing machine.

In a thread-trimming device having a cutter which simultaneously serves to withdraw, prior to the thread-trimming operation, an adequate length of the needle thread necessary for the secure starting of the next following stitching operation, it is necessary to reduce the thread tension prior to the initiation of the thread-trimming operation. Accordingly, an improved feature of the invention consists in the provision of further means operable simultaneously with said stop means, to release the thread tension prior and during the thread-trimming operation, as will become further apparent from the following detailed description in reference to the drawing.

Referring to the latter, the numeral 1 FIG. 1, denotes the base of a conventional sewing machine supporting an upright 2 from which extends a horizontal arm 3 terminating in a sewing head 4. Rotatably mounted within the arm 3 is the arm or drive shaft 5 of the machine being operably connected in a known manner with the reciprocating needle bar 7 mounted within the head 4 and carrying a needle 6. Secured to the shaft 5 is a first pulley 8 which serves to drive a further (looper) shaft 11 mounted in the base 1 by way of a transmission belt 9 and counterpulley 10. Shaft 11, in turn, serves to drive, through a pair of transmission gears 12, 13, FIG. 2, the horizontal looper shaft 14 also disposed within the base 1 and serving to operate a rotary hook or looper 15 cooperating with the needle 6 in the formation of

lock stitches, in a manner well known to those skilled in the art.

Mounted coaxially with the looper 15 is an arcuate catch-thread and cutting blade 17 adapted to cooperate with a stationary knife or cutter 16, FIG. 1, secured to the base 1. To this end, the blade 17 is secured to a ring-shaped carrier 18 which is connected to a disk 19 through a brace or rod 18', said disk being in turn rotatively supported within a ring 21 secured to a wall 20 connected to or forming part of the base 1 of the machine. In order to prevent axial displacement of the disk 19, there is provided a retaining ring 22 secured to the edge of ring 21. Further connected to the carrier 18 is a link 23 which is in turn linked to a crank 24 secured to the end of the first section 27 of an auxiliary rockshaft 25 arranged parallel to the looper shaft 14. Shaft 25 being journalled in a carrier or support 26 secured to the base 1 comprises a pair of shafts or sections 27 and 28, rockshaft 27 connected to the crank 24 and carrying a radial extension 29 being restricted against axial displacement and rockshaft 28 being arranged for axial adjustment or displacement by virtue of the slidable or equalizing coupling connection between said shafts comprising a fork-like radial extension 31 of the shaft 28 engaging a coupling dog or bar 30 extending from extension 29 of the shaft 27 in a direction parallel to the axis of the shafts. Section or rockshaft 27 is surrounded by a coil spring 32 having one end secured to said shaft and having its opposite end propped against or engaging the support 26, in such a manner as to urge the cutting or trimming blade 17 to a normal or inoperative position defined by an adjustable stop screw 33 mounted in the support 26 and engaging the arm 30 of the extension 29.

Secured to the section or rockshaft 28 being adjustable in the axial direction is a first ring or stop 34 having a front edge engaged by a compression spring 35 surrounding said shaft, the opposite end of said spring engaging a sleeve 36 freely slidably mounted upon the shaft 28. Sleeve 36 is, in turn, engaged by the forked end 37 of one arm of a bellcrank control lever 38 rotatably mounted upon the support 26 and being provided with a chain, pull rod or the like 40 extending in a downward direction from the remaining lever arm 39. Connected to the lower end of the rod 40 may be a foot pedal (not shown) for the control or pre-setting of the thread-trimming device, in the manner described in further detail in the following.

Secured to the opposite end of the rockshaft 28 is a further crank 41 carrying a follower pin 42 adapted to cooperate with a grooved cam disk 43 which is secured to the looper shaft 11, to convert rotary motion of said shaft into rocking motion of the shafts or sections 27 and 28 by the proper design or shape and relative position of the groove of the disk 43. A compression spring 44 surrounding the shaft 28 and engaging the extention 31, on the one hand, and a wall 45 of the support 26, on the other hand, serves to normally urge the pin 42 into a position of disengagement from the cam disk 43, as shown in the drawing.

Secured to the rockshaft 28 is a further stop 46 having a front edge 47 which is engaged by the end of a blocking or control lever 48. Both the front edge 47 and the lever may be provided with slightly bevelled surfaces, to avoid jamming or locking during operation. Lever 48 is rotatively supported by the looper shaft 11 and engages a friction disk 52 mounted upon said shaft by the action of a compression spring 49 encircling said shaft and having one end arranged to engage a stop or set ring 50 upon the shaft and having its opposite end engaging an intermediate ring or washer 51 interposed between the ring-shaped supporting end of the lever 48 and the friction disk 52.

Stop 46 has a shoulder 53 including a bevelled portion 54 which is engaged by a pin 55 secured to one arm 56 of a double lever being pivoted upon the support 26. Linked to the remaining arm of the lever 56 is a vertical

pull rod **59**, FIG. 1, connected at its upper end to one arm of a bellcrank lever **60** pivotally mounted in the upright **2** of the sewing machine. Further linked to the remaining arm of the lever **60** is a horizontal connecting rod **61** arranged with its free end engaging the release pin of a conventional thread tension device **62** for the upper or needle thread of the sewing machine.

The operation of the thread-trimming device aforedescribed is as follows:

While the sewing machine is still in operation, rod **40**, FIG. 2, is pulled downwardly by depressing a foot pedal or actuation of an equivalent operating member, whereby to cause the left end of spring **35** upon shaft **29** to be displaced towards the right, to compress the spring and to pre-set or store a control impulse for the operation of the thread-trimming device upon completion of the sewing operation. While the machine is in operation, the control lever **48** is urged against the shaft **28** as a result of the torque thereon through the coupling with the friction disk **52**, whereby to block axial displacement of said shaft and coupling of pin **42** with the cam **43** by the stop **46** engaged by the end of the lever **48**. During this time, the spring **35** remains under tension, to store enough resilient energy for the subsequent coupling of the shaft **28** with the looper shaft **11**.

If now the machine is stopped in any known manner by arresting the drive shaft **5**, shaft **11** upon stoppage is rotated to a slight extent and in a direction opposite to the preceding (operating) direction, as a result of the elastic energy stored in the belt **9**. This brief reverse rotation of the shaft, in turn, causes a lifting of the lever **48** out of the path of the stop **46**, thus allowing the spring **35** to expand and to cause the shaft **28** to be coupled with the shaft **11** by the follower pin **42** entering and engaging the groove of the cam disk **43**. The required rotation of the lever **48** to release the stop **46** is found to amount to only 1.5° to 2.5°, that is, about $\frac{1}{180}$ of a full revolution. This slight angular displacement is well within the free play between the shafts **5** and **11** normally existing in accordance with customary manufacturing tolerances. Furthermore it has been found that the elastic energy stored in the belt **9** of conventional design upon stoppage of the driving pulley **8** is sufficient to effect the required rotation of the lever **48** to release the rockshaft **28**.

In the thread-trimming mechanism shown by the drawing, the oscillating movement for the operation of the catch-thread and cutting blade requires a full revolution of the looper shaft **11**. Continued rotation or re-starting of the machine will, therefore, result in a rocking or oscillating movement being imparted to the rockshaft **28** depending upon the shape or design of the groove of the disk **43**. This movement is, in turn, transmitted to the rockshaft **27** by way of the sliding coupling **30, 31**, thus in turn operating the trimming blade **17** by way of the crank **24** and link **23**.

Simultaneously with the axial displacement of the rockshaft **28**, the bevelled surface **54** of the stop **46** causes the pin **55** to be displaced in the downward direction, whereby to rotate the double lever **57** in counterclockwise direction and to lift the pull rod **59**. As a consequence, the connecting rod **61** is displaced towards the left or the head **4** by way of the bellcrank lever **60**, to release the thread tension **62**.

Upon subsequent release of the foot pedal, the control lever **38**, after completion of the thread-trimming operation, is returned to its starting position, whereby the spring **44** having been compressed during the axial displacement of the shaft **28** is allowed to expand, to return shaft **28** to its initial or starting position and to disengage the pin **42** from the cam disk **43**.

Instead of the lever **48** being operated through frictional coupling by the rotation of said shaft **11** and the residual elastic tension of the belt **9**, respectively, in the manner described, said lever may be controlled by any other suitable means suggesting themselves to those skilled in the art. As an example, lever **48** may be supported by a fixed pivot and operated between its blocking and deflected positions by the energization and de-energization of an electromagnet or solenoid in synchronism with the control of the main operating current in the case of an electrically controlled sewing machine. In other words, during the operation of the machine, lever **48** is deflected by the solenoid into a position of engagement with the stop **46** and shaft **28**, in the manner shown, while an interruption of the main operating current and stoppage of the machine will result in a deflection of the lever in the opposite direction or away from said stop, to thereby cause engagement of the follower pin **42** with the cam **43**, in the manner described. During the subsequent thread-trimming operation, lever **48** slides upon the shoulder **53** to be returned to a position of engagement with the stop **46** during the following sewing operation. In the case of a continuously driven machine designed for mechanical starting and stopping, the solenoid actuating the lever **48** may be controlled through a centrifugal switch mounted upon the shaft **11**, to again block and release shaft **28** in dependence upon the rotation and stoppage, respectively, of shaft **11**, in a manner as will be readily understood from the foregoing.

In the foregoing the invention has been described with reference to a specific illustrative device. It will be evident, however, that variations and modifications, as well as the substitution of equivalent parts and elements for those shown herein for illustration, may be made without departing from the broader scope and spirit of the invention as set forth in the appended claims. The specification and drawing are accordingly to be regarded in an illustrative rather than in a restrictive sense.

We claim:

1. In combination with a sewing machine having a reciprocating needle, a drive shaft operably connected thereto, and an oscillating cutting device to trim the thread at the end of a sewing operation, operating mechanism for said device comprising a first rockshaft, linkage means operably connecting the same with said device, a second rockshaft coupled with said first rockshaft in axially slidable relation thereto, drive means comprised of an elastic belt, a driving member therefor connected to said shaft and a driven member, releasable coupling means operable by axial shifting of said second rockshaft, to connect the same with and to disconnect it from said driven member, said coupling means adapted to convert rotary motion of said drive shaft into oscillating motion of said rockshafts with the oscillating phase predeterminately related to the rotation of said drive shaft, first resilient biasing means to normally urge said second rockshaft to a position of disengagement from said driven member, stop means for said second rockshaft controlled by said driven member to be operated in one direction to a first position during rotation of said member and to be operated in the opposite direction to a second position by the elastic energy stored in said belt upon stoppage of said drive shaft, to prevent axial movement of said second rockshaft during rotation of said drive shaft and to allow of axial movement of said second rockshaft upon stoppage of said shaft, respectively, and second resilient means and operating means therefor to temporarily bias said second rockshaft in a direction opposite to the bias by said first resilient means, whereby to operate said coupling means to engaged position by operation of said stop means to said second position upon stoppage of said drive shaft in the biased position of said second resilient means.

2. In thread-trimming mechanism for sewing machines as claimed in claim 1, said first and second rockshafts being coupled by a straight radial extension of one shaft engaging a forked extension of the other shaft.

3. In thread-trimming mechanism for sewing machines as claimed in claim 1, said releasable coupling means consisting of a cam connected to said driven member, and

a cam follower secured to said second rockshaft adapted to engage and disengage said cam by axial shifting of said second rockshaft.

4. In thread-trimming mechanism for sewing machines as claimed in claim 3, said cam having an operating contour, to effect a single oscillating movement of said rockshafts during a needle operating cycle.

5. In thread-trimming mechanism for sewing machines as claimed in claim 1, said stop means being comprised of an abutment member upon said second rockshaft, a lever having one end rotatably frictionally engaging said driven member, to impart thereto a torque urging the opposite end of said lever against said second rockshaft and to lock the same against axial movement.

6. In thread-trimming mechanism for sewing machines as claimed in claim 1, said machine including a thread tension device, and means responsive to the axial movement of said second rockshaft, to release the thread tension during a thread-trimming operation.

7. In combination with a sewing machine having a reciprocating needle, a drive shaft operably connected thereto, a rotary looper having a looper shaft, transmission means including an elastic belt to drive said looper shaft by said first shaft, and an oscillating cutting device mounted adjacent to said looper for trimming the needle and looper threads during a predetermined fractional period of a needle operating cycle, operating mechanism for said device comprising a first rockshaft, linkage means operably connecting the same with said device, a second rockshaft coupled with said first rockshaft in axially slidable relation thereto, releasable coupling means operable by axial shifting of said second rockshaft, to connect the same with and to disconnect it from said looper shaft, said coupling means adapted to convert rotary motion of said looper shaft into oscillating motion of said rockshafts with the oscillating phase predeterminately related to the rotation of said looper shaft, first resilient biasing means to normally urge said second rockshaft to a position of disengagement from said looper shaft, stop means for said second rockshaft controlled by said looper shaft to be operated in one direction to a first position during rotation of said looper shaft and to be operated in the opposite direction to a second position by the elastic energy stored in said belt upon stoppage of said drive shaft, to prevent axial movement of said second rockshaft during rotation of said looper shaft and to allow of axial displacement of said second rockshaft upon stoppage of said looper shaft, respectively, and second resilient means and operating means therefor, to temporarily bias said second rockshaft in a direction opposite to the bias by said first resilient means, whereby to operate said coupling means to engaged position by said stop means in the biased position of said second resilient means.

8. In thread-trimming mechanism for sewing machines as claimed in claim 7, said releasable coupling means consisting of a cam mounted upon said looper shaft, and a cam follower secured to said second rockshaft and adapted to engage and disengage said cam by axial shifting of said second rockshaft.

9. In thread-trimming mechanism for sewing machines as claimed in claim 7, said stop means being comprised of an abutment element upon said second rockshaft, a lever having one end frictionally rotatably engaging said looper shaft, to impart thereto a torque urging the opposite end of said lever against said second rockshaft, to lock the same against axial displacement by said element.

10. In thread-trimming mechanism for sewing machines as claimed in claim 7, said machine including a thread tension device, and means responsive to the displacement of said second rockshaft, to release the thread tension during a thread-trimming operation.

11. In a sewing machine having a reciprocating needle, a drive shaft operably connected thereto, and an oscillating cutting device to trim the thread at the end of a sewing operation, of operating mechanism for said device comprising drive means comprised of an elastic belt, a driving member therefor connected to said shaft and a driven member, releasable coupling means connecting said device with said shaft and adapted to convert rotary motion of said shaft into reciprocating motion of said device for trimming the thread during a predetermined fractional period of a needle operating cycle, first resilient biasing means to normally urge said coupling means to disengaged position, stop means in operative connection with said coupling and controlled by said driven member to be operated in one direction and to a first position during rotation of said member and to be operated in the opposite direction to a second position by the elastic energy stored in said belt upon stoppage of said shaft, to prevent engagement of said coupling means during rotation of said shaft and to enable coupling between said driven member and said device upon stoppage of said shaft, respectively, and second resilient means and operating means therefor, to temporarily bias said coupling means in a direction opposite to the bias by said first resilient means, whereby to operate said coupling means to engaged position by operation of said stop means to said second position upon stoppage of said drive shaft in the biased position of said second resilient means.

12. In a sewing machine having a reciprocating needle, a drive shaft operably connected thereto, and a cutting device to trim the thread at the end of a sewing operation, of operating mechanism for said device comprising drive means comprised of an elastic belt, a driving member therefor connected to said shaft and a driven member, releasable coupling means connecting said device with said driven member for trimming the thread during a fractional period of a needle operating cycle, first resilient biasing means to normally urge said coupling means to disengaged position, stop means controlled by said driven member to be operated in one direction and to a first position during rotation of said driven member and to be operated in the opposite direction to a second position by the elastic energy stored by said belt upon stoppage of said drive shaft, whereby to prevent engagement of said coupling means by said stop means during rotation of said shaft and to enable coupling between said driven member and said device upon stoppage of said shaft, respectively, and second resilient means and operating means therefor, to temporarily bias said coupling means in a direction opposite to said first resilient means, whereby to operate said coupling means to engaged position by operation of said stop means to said second position upon stoppage of said drive shaft in the biased position of said second resilient means.

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