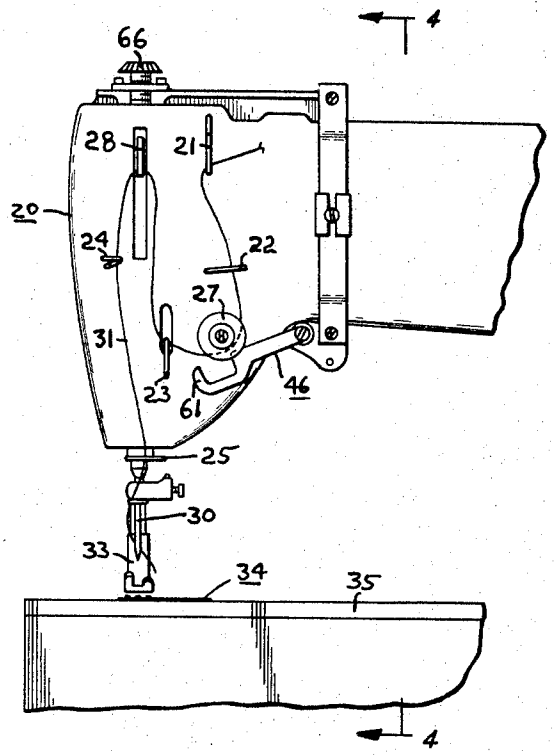
Dec. 3, 1968 M. SPINRAD ET AL 3,413,944

THREAD SEVERING ATTACHMENT FOR SEWING MACHINE

Filed Oct. 1, 1965 5 Sheets-Sheet 1

FIG. 1



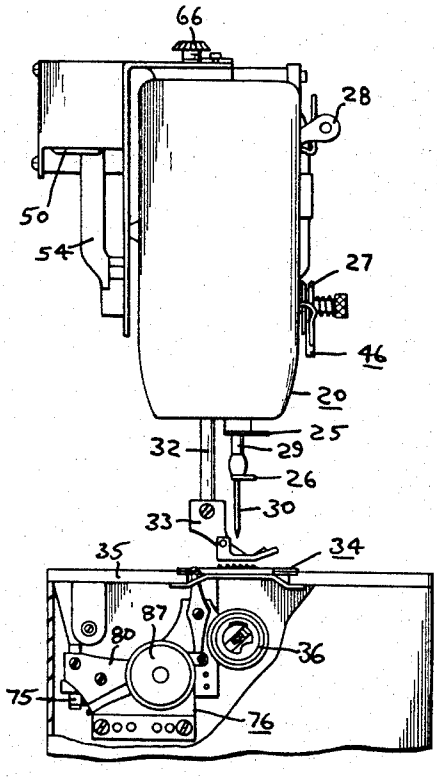


FIG. 2

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THREAD SEVERING ATTACHMENT FOR SEWING MACHINE

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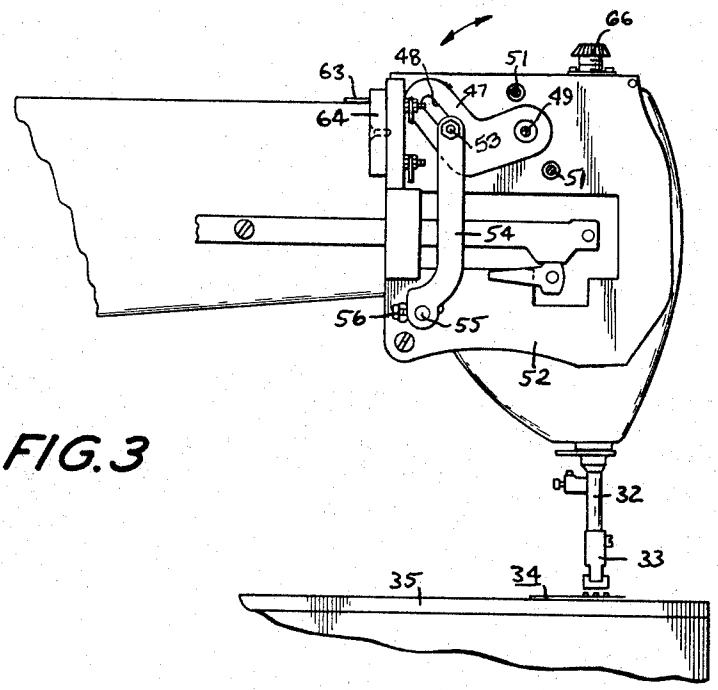


FIG. 3

FIG. 4

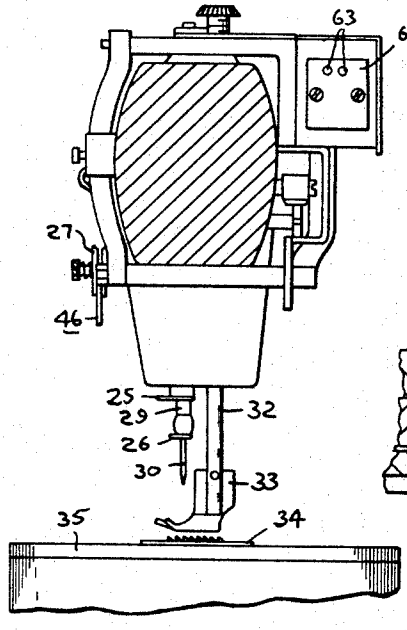
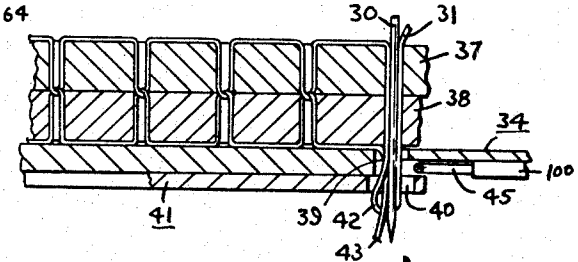


FIG. 13



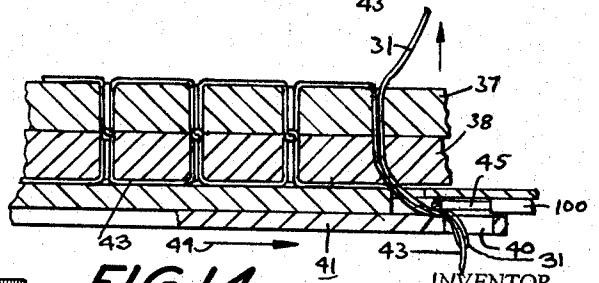


FIG. 14

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THREAD SEVERING ATTACHMENT FOR SEWING MACHINE

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FIG. 5

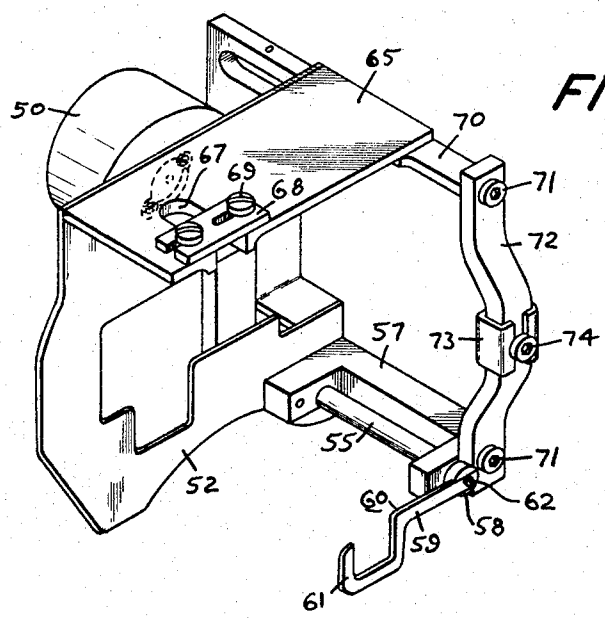
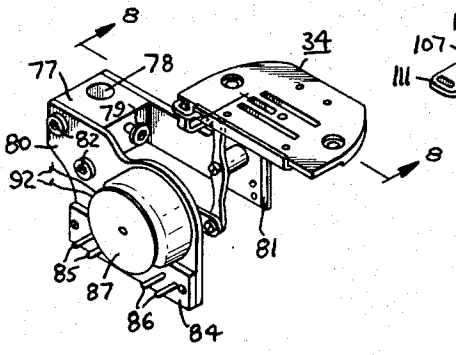


FIG. 6



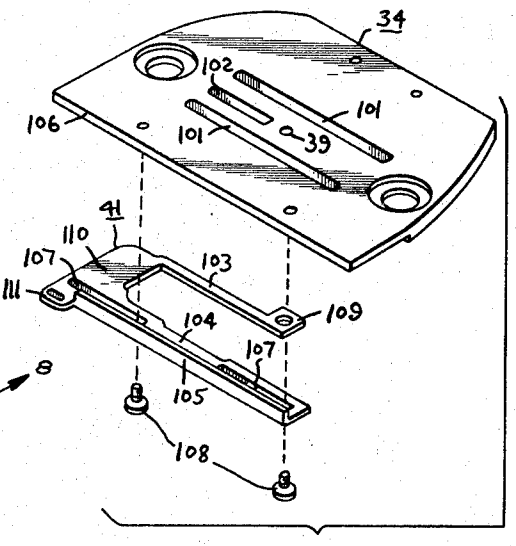


FIG. 7

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THREAD SEVERING ATTACHMENT FOR SEWING MACHINE

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FIG.8

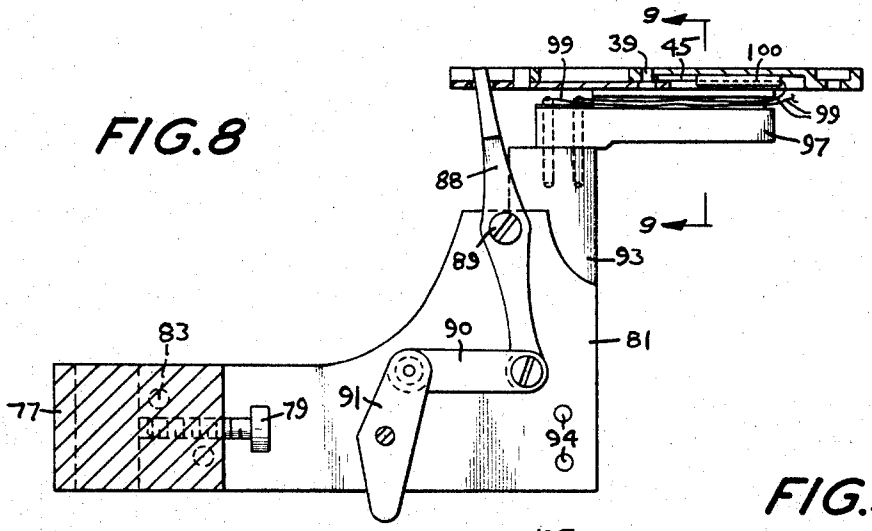


FIG.9

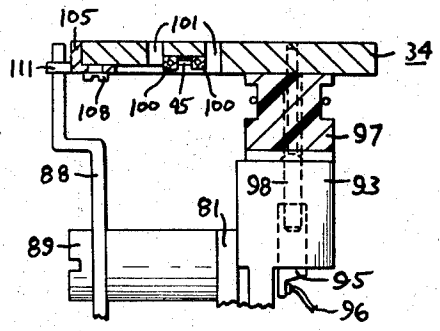
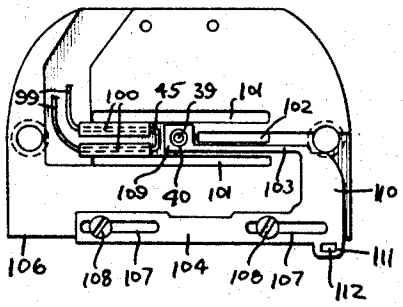


FIG.10



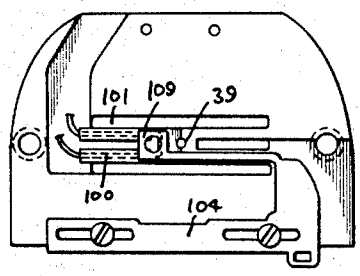


FIG.11

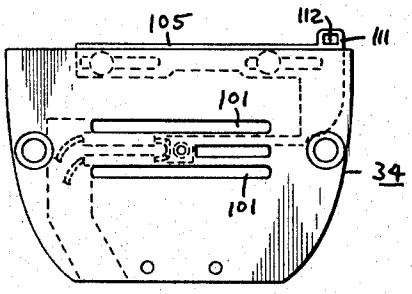


FIG.12

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THREAD SEVERING ATTACHMENT FOR SEWING MACHINE

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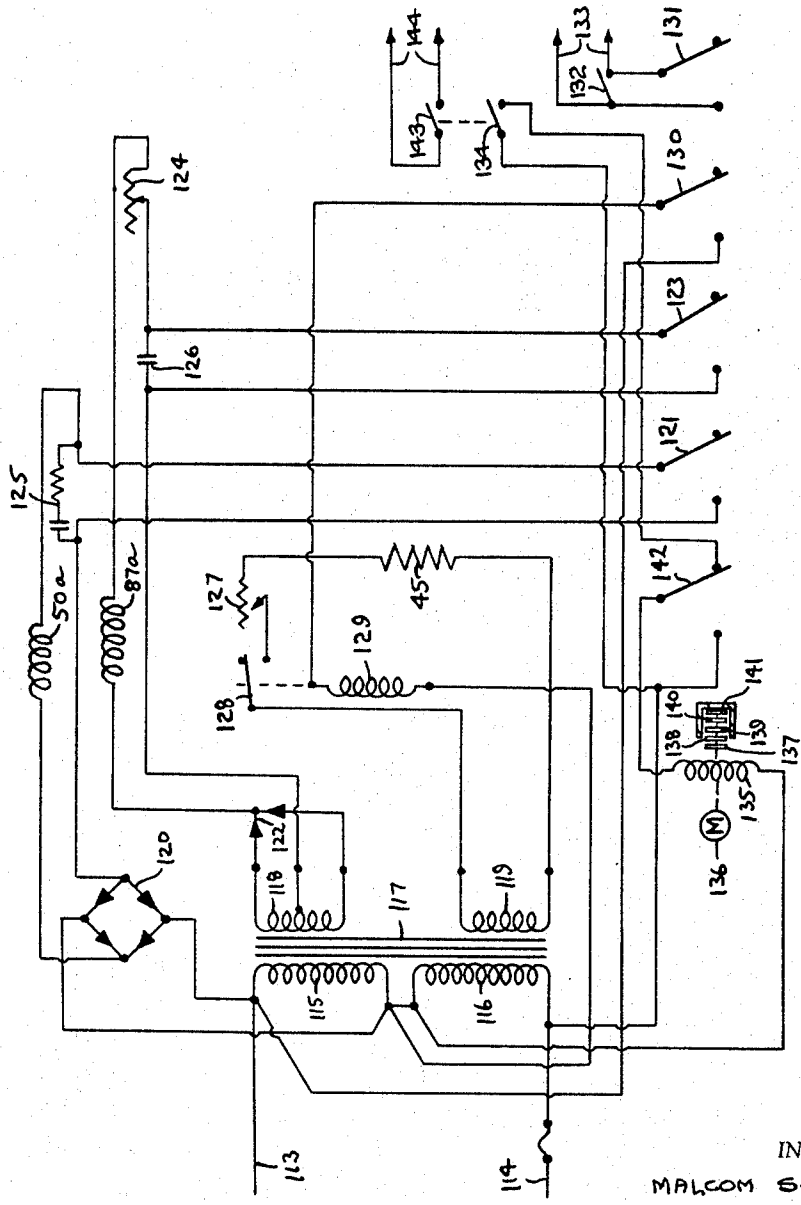


FIG. 15

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United States Patent Office

3,413,944

Patented Dec. 3, 1968

3,413,944

THREAD SEVERING ATTACHMENT FOR SEWING MACHINE

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Filed Oct. 1, 1965, Ser. No. 492,200
14 Claims. (Cl. 112—252)

ABSTRACT OF THE DISCLOSURE

Special throat plate apparatus for a sewing machine to provide simultaneous severance of both needle thread and bobbin thread close to the undersurface of the work by first snubbing both threads with a slider against an unheated heatable wire carried by the throat plate at a time when the needle thread take-up lever has risen to a particular position lower than its topmost position, then severing both threads by heating the heatable wire after the needle thread take-up lever has completed its rise to draw thread for the next stitch, and then retracting the snubbing slider. The apparatus can be operated manually or in conjunction with an automatic needle positioning mechanism, which latter is described with the illustration of an operating circuit.

This invention relates to thread severing mechanisms for sewing machines, and more particularly relates to a mechanism for simultaneously cutting both the needle thread and the bobbin thread at a point very close to the outer surface of the material being stitched so that subsequent trimming of such threads is not required.

In commercial operations utilizing sewing machines for the mass production of stitched articles, such as in the garment trade, the sale price of the stitched article produced is necessarily related to the labor cost involved in producing the same. Accordingly, reductions in the fabrication time of a stitched article result in the ability to sell such articles at a lower price, and labor saving devices are therefore of great interest to the trade. During the stitching process, it is frequently necessary to sever the needle and bobbin threads while the fabric being stitched is centrally located relative to the needle, that is, when the line of stitching does not terminate at or near the edge of the fabric.

Generally, in such a case, the work must be displaced from its position at the end of the line of stitching so that sufficient of the needle and bobbin threads become available for hand cutting, the work being then repositioned in the proper place of starting the next line of stitching. After the stitching operations have all been completed it is then necessary to trim off all the projecting thread ends so that the stitched article may present a neat and finished appearance. Such a thread cutting operation is time consuming and can contribute materially to labor costs associated with the production of a particular stitched article.

In order to alleviate this thread trimming problem, attempts have been made in the past to provide automatic thread cutting means designed to leave a minimum of thread to be trimmed and which in some cases could be ignored. One such thread cutting means has been mounted to the rear of the presser foot to cut the thread by a vertical down stroke of a cutting edge. This type of apparatus, of course, could only be used at the edge of a fabric where the fabric is shifted out from under the needle and behind the vertical cutting device, in order that the cutting stroke should cut only the thread and not the underlying fabric as well. The vertical cutting devices are therefore

of limited use, being helpful only in those cases where the line of stitching terminates at the edge of the stitched article.

Other mechanical cutting arrangements have been devised which cut the thread by a cutting stroke in a plane parallel to the surface of the fabric being stitched. Such devices can of course be utilized when the fabric is centrally located under the needle without requiring that the fabric be removed from the sewing machine. However, even cutters of this type generally leave thread ends of undesirable length and the need for subsequent trimming of the short ends remains. This invention on the other hand provides for cutting of the needle and bobbin threads simultaneously and very close to the fabric surface, and consequently eliminates the need for subsequent trimming.

Previously known hot wire thread cutting devices, as for example that shown in U.S. Patent No. 3,191,562 assigned to the assignee of this invention, have utilized separate hot wire devices to independently sever the needle thread and bobbin thread with the needle thread being severed by a hot wire carried by a specially constructed presser foot. The present invention eliminates the need for such a special presser foot and thereby permits sewing machine operation with the standard types of presser feet normally employed. Moreover, other thread trimming devices have required the use of auxiliary needle thread clamping devices to prevent dethreading of the needle after severing has been effected and stitching has been recommenced. Such clamping devices are not required with the present invention when utilized in a novel way with an automatic needle positioning device.

Briefly, our invention accomplishes thread cutting by apparatus including a single hot wire associated with the throat plate of the sewing machine which rapidly burns through both the needle and bobbin threads to be severed. This single hot wire is only energized when so desired by the sewing machine operator, so that during a normal stitching operation there is no tendency whatever for needle thread and bobbin thread to be prematurely severed. Additionally, means are also provided for insuring that the sewing machine may be again immediately utilized after a thread cutting operation without having to re-thread the needle. Accordingly, it is a primary object of this invention to prvoide a novel thread cutting apparatus effective when actuated to sever the needle thread and bobbin thread of a sewing machine very close to an outer surface of an article being stitched to thereby eliminate the need for subsequent hand trimming of short thread ends.

Another object of this invention is to provide a novel thread cutting apparatus for severing the needle thread and bobbin thread of a sewing machine close to the surfaces of a stitched article by means of an operator controlled and selectively energizable hot wire.

Yet another object of this invention is to provide novel thread cutting apparatus which permits the needle thread and bobbin thread associated with the sewing machine to be cut simultaneously without displacing the article being stitched from the position it occupies at the end of the stitching operation.

A further object of this invention is to provide novel thread cutting apparatus including means for insuring that the thread cutting operation does not unthread the needle of the sewing machine.

The foregoing and other objects of the invention will become clear from a reading of the following specification in conjunction with an examination of the appended drawings, wherein:

FIGURE 1 is a fragmentary elevational view showing the working end of a sewing machine head as seen look-

ing into the front of the presser foot, illustrating one view of the means employed to provide needle thread tension release in order to avoid rethreading of the needle after the thread cutting operation;

FIGURE 2 is an end elevational view of the sewing machine head illustrated in FIGURE 1 illustrating certain organizational details of the thread severing mechanism not visible in FIGURE 1;

FIGURE 3 is a rear elevational view of that part of the sewing machine head which is seen in FIGURE 1 illustrating certain details of the mechanical arrangement utilized to provide needle thread tension release;

FIGURE 4 is a view of the apparatus according to the invention as would be seen when viewed along the line **4**—**4** of FIGURE 1;

FIGURE 5 is a perspective view of the apparatus for effecting needle thread tension release illustrated as removed from its mounted position on the sewing machine head;

FIGURE 6 is a perspective view of the thread severing mechanism demounted from the sewing machine structure;

FIGURE 7 is an enlarged exploded top perspective view of the throat plate and underlying thread shifting slide device;

FIGURE 8 is a vertical sectional view through the throat plate of the sewing machine as would be seen when viewed along the line **8**—**8** of FIGURE 6 showing certain details of the thread severing mechanism;

FIGURE 9 is an enlarged vertical sectional view taken through the throat plate and slider structure as would be seen when viewed along the line **9**—**9** of FIGURE 8;

FIGURE 10 is a bottom plan view of the heatable wire carrying throat plate and slider illustrating the aligned positions thereof as during a normal stitching operation;

FIGURE 11 is similar to the showing of FIGURE 10 excepting that the thread shifting slider is illustrated in shifted position corresponding to that for thread severing by thread displacement against the heatable wire;

FIGURE 12 is a top plan view of the throat plate and slider assembly aligned as shown in the bottom plan view of FIGURE 10;

FIGURES 13 and 14 are enlarged vertical sectional views taken through the throat plate in the same manner as seen in FIGURE 8 with two plies of fabric being stitched, FIGURE 13 illustrating the relative positions of needle and slider device during stitching, while FIGURE 14 shows the relative positions during thread severing; and

FIGURE 15 illustrates in schematic form the electrical circuitry associated with the thread trimming device for actuating the same under control of the sewing machine operator.

In the several figures, like elements are denoted by like reference characters.

Turning to an examination of the figures, there is seen in FIGURES 1 to 4 a sewing machine head designated generally as **20** provided with a plurality of thread guides **21** through **26**, thread tensioner **27**, thread take-up lever **28**, needle bar **29** carrying needle **30** through which is threaded in usual fashion a thread **31**. Disposed behind the needle bar **29** is the presser foot bar **32** carrying presser foot **33** shown in operative position seated downward upon the feed dogs projecting upward through the throat plate **34** of the sewing machine. The throat plate **34** is clip engaged to the sewing machine bed plate **35** below which is operatively mounted in the usual manner the bobbin **36**. The presence of all of the foregoing described elements in a sewing machine is conventional, but the specific structure of the throat plate **34** is not conventional and incorporates therein the electrically energizable hot wire thread cutting means for severing the needle thread and the bobbin thread. Before describing the additional mechanism associated with the throat plate for energizing and actuating the thread cutting device per se, it will be conducive to a more complete understanding of the invention to first examine the mode of operation of the entire apparatus.

Operation of the apparatus is best understood by referring to FIGURES 1, 2, 13 and 14 of the drawings and involves the inter-relationships of the thread take-up **28**, needle **30** and bobbin **36**. FIGURE 13 illustrates the needle **30** in its down position where it has passed through upper and lower plies of cloth **37** and **38**, through the needle hole **39** in the throat plate **34** and through an underlying aligned hole **40** in a thread shifting means slider device **41** to be described hereinafter, and has thrown out a needle thread loop **42** about to be caught by the hook point of the bobbin **36** for the purpose of stitch forming with the bobbin thread **43**.

It should be noted that the sewing machine is not motionless but is in the process of stitch formation and the sequence of events now being described involves proper timing of the sewing machine stitch forming cycle with actuation of the thread severing mechanism in the manner being now set forth. At this point of the operation the needle **30** has just started to rise but the needle thread **31** does not rise with it since the loop **42** has been engaged by the bobbin hook and is being carried down and around the bobbin, the needle thread being loose at this point so as to be pulled by the bobbin hook due to the fact that the thread take-up **28** is moving downward. The needle **30** continues to rise upward and out of the throat plate and fabric toward its upper position, the bobbin has interlooped the needle thread **31** with the bobbin thread **43**, and the thread take-up **28** has reached the bottom of its travel and is about to start upward.

As the thread tage-up **28** starts upward it immediately begins to shorten the needle thread loop **42** which has been substantially enlarged by the casting operation of the bobbin so that this enlarged loop **42** begins to decrease in size and effectively move upward toward the throat plate **34**. The needle **30** is still moving upward and the sewing machine feed dogs are starting to advance the plies being stitched for the next stitch length. At this part of the cycle the needle **30** is substantially at the top of its stroke and the thread take-up **28** has brought the needle thread loop **42** upward so that it is approximately of the size shown in FIGURE 13 although it will be understood that the showing of FIGURE 13 should be viewed as though the needle **30** were absent therefrom.

The timing of the apparatus is such that the throat plate slider **41** is now quickly shifted, as shown by the arrow **44** in FIGURE 14, to carry the needle thread loop **42** and bobbin thread **43** against the heatable wire **45** which is at that time deenergized so that the threads are held by the slider **41** and heatable wire **45**. Simultaneous with this movement of the slider **41**, the needle thread tensioner **27** is disengaged from the needle thread **31** by operation of the tension release device **46** so that the upwardly moving needle thread take-up **28** pulls thread through the opened tensioner **27** from the needle thread supply. Needle thread tension release and holding of the threads in the throat plate by the slider **41** is maintained until the thread take-up **28** reaches the top of its stroke to thereby draw all of the thread that is required for formation of the next stitch.

At this point in the cycle, the sewing machine needle has just started to descend and the sewing machine apparatus is brought to a stop. The tension release device **46** is now deactuated to reapply the thread tensioner **27** to the needle thread **31**, and the heatable wire **45** in the throat plate **34** is energized to sever the needle thread and bobbin thread held thereagainst by the slider **41**. The wire **45** is now deenergized and the throat plate slider **41** is shifted back to the position shown in FIGURE 13 with its aperture **40** in vertical alignment with the throat plate needle hole **39**.

From the foregoing description and an examination of FIGURE 14 it is observed that the thread severing opera-

tion has been completed in such manner as to leave a very short thread tail extending downward from the lower ply **38**, on the order of half a stitch length, and at the same time all of the thread necessary to form the next stitch has been drawn from the needle thread supply so that initiation of the next sewing operation does not unthread the needle **30**. Moreover, the needle **30** is substantially at its upper position so that the stitched work may be easily removed and new work placed in stitching position.

Understanding now the operation of the apparatus according to the invention, consider now FIGURES 1 to 5 which illustrate the portion of the apparatus operative to release the tension on the needle thread **31** as previously described, after which the throat plate thread severing portion of the apparatus and the electrical circuitry for providing the necessary timed operation will be described.

As best seen in FIGURES 3 and 5, a cam **47** provided with a slot **48** is mounted upon for rotation with the drive shaft **49** of a rotary solenoid **50** which is itself fixedly mounted by studs **51** to the backplate **52** of the tension release device support frame. Projecting into cam slot **48** is a cam follower stud **53** fixedly secured to the upper end of a crank arm **54** which has its lower end fixedly secured to a transversely extending crank shaft **55** by means of a lock screw **56**, the crank shaft **55** extending forward to the front of the sewing machine head through the arms of a U-shaped bearing block **57** as best seen in the showing of FIGURE 5. The forward end of crank shaft **55** is provided with a slotted front face keyway **58** within which is disposed the arm **59** of the needle thread tension release member **60** which terminates at its forward end in an upturned hook **61**, the tension release member **60** being locked to the crank shaft **55** by means of the end screw **62**. As best seen in FIGURE 1, the upturned hook **61** of the tension release member **60** is so positioned as to normally not interfere with the operation of the thread tensioner **27**, but it will be appreciated that when the hook **61** swings upward between the plates of the thread tensioner it causes the latter to move away from one another and to thereby release the tension upon the needle thread **31**.

The motion of the tension release hook **61** is effected by actuation of rotary solenoid **50** to rotate its shaft **49** and the aforedescribed cam **47** mounted thereon. The slot **48** of the cam **47** causes the cam follower stud **53** to rotate the crank arm **54** and crank shaft **55** to cause the tension release hook **61** to release tension of the needle thread **31**. Deactuation of solenoid **50** allows the tension release hook **61** to rotate downward to its normal disengaged position from the thread tensioner **27** to thereby reestablish normal engagement of the tensioner with the needle thread. Actuation and deactuation of the rotary solenoid **50** is effected by electrical energization and deenergization of the solenoid via suitable electrical conductors connected to the plug **63** carried by insulating block **64**.

The frame to which all of the previously described operative parts of the needle thread cutting mechanism are secured is disposed upon the sewing machine head **20** as best seen in the showings of FIGURES 1 to 5 so that the frame top plate **65** overlies the sewing machine head with the stud **66** disposed within the slot **67** to thereby lock the frame with the plate **68** and machine screws **69**. Projecting transversely from rear to fore end of the frame immediately beneath the top plate **65** and above the U-shaped bearing block **57** is the bar **70**. Secured to the front end of the bar **70** and bearing block **57** by means of the socket head bolts **71** is a curved clamp bar **72** about the center of which is disposed a pressure pad **73** adjustably shiftable toward or away from the head carrying arm of the sewing machine by means of the adjusting bolt **74**.

Understanding now the portion of the apparatus for releasing tension on the needle thread of the sewing machine, now consider that part of the apparatus which is operative to sever the needle and bobbin threads of the sewing machine. This portion of the apparatus is illustrated in combination with the sewing machine in FIGURE 2 and is separately illustrated in the showings of FIGURES 6 to 14. As best seen in the showing of FIGURE 2 the sewing machine is provided with a cylindrical stud **75** secured to and extending downward from the bed plate **35** upon which is mounted the unit **76** which conjointly with the structure of the throat plate **34** comprises the thread cutting mechanism. As best seen in FIGURES 6 and 8, the unit **76** includes a mounting block **77** vertically bored as at **78** so that the unit may be slipped onto the stud **75** and fixedly secured in position thereon by means of the locking screw **79**. Disposed upon opposite sides of the mounting block **106** and extending toward the bobbin **36** are a pair of side plates designated respectively as **80** and **81**, the side plate **80** being secured to the mounting block **77** as by means of the screws **82** and the side plate **81** being similarly secured to the mounting block **77** by means of screws **83**.

Fixedly secured to the lower edge of side plate **80** is an insulating terminal board **84** which carries two sets of electrical contact plug prongs designated respectively as **85** and **86**. Also mounted to the side plate **80** is the rotary solenoid **87** effective to clockwise rotate the upper end of lever **88** about pivot **89** through the intervening links **90** and **91**. Such rotation of lever **88** occurs when the rotary solenoid **87** is actuated by energization via its conductor leads **92** which are electrically connected to plug prongs **85**. As best seen in FIGURES 8 and 9 an insulator block **93** is secured to side plate **81** as by means of the machine screws **94**, the insulator block carrying a pair of contact sleeves **95** electrically energizable via electrical conductors **96** the opposite ends of which connect to plug prongs **86** mounted upon terminal board **84**.

Secured to the underside of the throat plate **34** is an insulator terminal block **97** carrying a pair of plug prongs **98** seatable downward into the contact sleeves **95** carried by the side plate **81**. The prongs **98** have extending therefrom electrical conductors **99** which feed respectively into a pair of ceramic insulating sleeves **100** and close through a resistance wire element **45** which has been previously mentioned in connection with the showings of FIGURES 13 and 14. The ceramic sleeves **100** are cemented into a recess cut upward from the underside of the throat plate **34** so as to position the resistance wire element **45** immediately adjacent to the throat plate needle hole **39** with the sleeves **100** lying between the normally existing feed dog slots as for example illustrated at **101** and **102**.

Underlying the throat plate **34** is a generally U-shaped slider element **41** having a thin arm **103** extending parallel to and between the half feed dog slot **102** and one of the full slots **101**, and a wide arm **104** having a turned up outer side edge **105** which abuts the straight side **106** of the throat plate **34**. The slider arm **104** is slotted as at **107**, the screws **108** projected therethrough into the throat plate holding the slider captive and in proper position. The end of thin arm **103** terminates in thread shifter **109** centrally apertured at **40** as previously described, the aperture **40** being colinear with the throat plate needle hole **39** during stitching. Slider arm **104** is provided at its end connected to the slider arms bridging part **110** with an ear **111** having an aperture **112** therethrough within which the upper end of lever **88** is adapted for disposition to shift the slider **41** and cause the thread shifter **109** to shift the bobbin thread **43** and needle thread loop **42** over against the resistance wire element **45** carried by the insulating sleeves **100** and to thereby sever the threads when the resistance wire element is in a heated state.

Operation of the thread cutting system according to the invention is carried out automatically in combination with operation of an automatic needle positioning mech-

anism which causes the sewing machine needle to rise to its upper position. A suitable automatic needle positioning mechanism for this purpose is described in U.S. Patent No. 2,961,591 entitled "Automatic Needle Positioning Mechanism." Operation of the thread severing mechanism as has hereinbefore been described may be effected by electrical circuitry as illustrated in the showing of FIGURE 15 of the drawings to which reference should now be made.

Power for operation of the thread severing apparatus is supplied by a source of alternating current through conductors **113** and **114** which connect to the primary windings **115** and **116** of a transformer **117** having secondary windings **118** and **119**. Connected across primary winding **115** is a bridge rectifier circuit **120** which supplies energizing current to coil **50***a* of rotary solenoid **50** through switch **121** when the latter is closed. Secondary winding **118** supplies energizing current through a fullwave rectifier **122** to coil **87***a* of rotary solenoid **87** through switch **123** when the latter is closed, the energizing current magnitude being controlled by the setting of series connected rheostat **124**. The contact switches **121** and **123** are protected by arc suppression circuits **125** and **126** connected respectively thereacross.

Secondary winding **119** provides alternating current to the thread severing heatable wire **45** through a series connected control rheostat **127** and relay contacts **128** which latter is controlled by energization and deenergization of relay coil **129**. The energization of relay coil **129** is effected by alternating current picked off from transformer primary winding **115** and applied through switch **130** when the latter is closed. Energization of the needle positioning mechanism used in combination with the thread trimming apparatus is controlled by switch **132** which completes the needle positioning energization circuit via conductors **133**. Initiation of the entire thread trimming operation is controlled by the closure of momentary make switch **134** which energizes the winding **135** of motor **136** which is connected across primary winding **116**. Motor **136** is a timer motor having an output shaft upon which are mounted for rotation therewith a series of five cams designated **137** through **141**, these cams being mounted to respectively operate in the desired time sequence the switches **142**, **121**, **123**, **130** and **131**.

Switch **132** is a part of the treadle switch structure described in the previously referred to U.S. Patent 2,961,-591, this switch being closed only when the sewing machine treadle has been released to terminate a stitching operation with the sewing machine needle in its down position under control of the needle positioning mechanism.

Switch **134** closes the circuit through motor winding **135** to initiate rotation of the motor **136**. Cam **137** transfers the pole of switch **142** to bypass switch **134** and provide a holding circuit which maintains the motor winding **135** energized so that the cams continue to rotate. Switch **143** closes simultaneously with switch **134** and completes a circuit through conductors **144** to initiate the upward movement of the sewing machine needle. Cam **141** next closes switch **131** so that the needle positioner is energized through conductors **133** to provide an interlock between the needle positioner and the thread trimmer during the trimming cycle. At the proper time during operation of the needle positioner, as has previously been explained, cams **138** and **139** close switches **121** and **123** to energize the solenoids **50** and **87** to thereby release the needle thread tensioner from the needle thread and actuate throat plate slider **41**. Cam **138** opens switch **121** to deenergize rotary solenoid **50** and reapply the thread tensioning device to the needle thread. Cam **140** now closes switch **130** to deenergize solenoid coil **129** and close switch **128** which energizes heatable wire **45** to thereby sever the needle and bobbin threads. Cam **140** then opens switch **130** to deenergize severing wire **45**, after which cam **139** opens switch **123** to deenergize rotary solenoid **87** and retract throat plate slider **41**. Cam **137** now opens switch **142** which breaks the holding current circuit for the motor **136** and causes the motor to stop so that the circuit conditions are again as illustrated with the exception that the treadle interlock switch **132** remains closed until a new stitching operation is commenced.

Having now described our invention in connection with a particularly illustrated embodiment thereof, it will be appreciated that modifications and variations of this invention may now occur from time to time to those persons normally skilled in the art without departing from the essential scope or spirit of the invention, and accordingly it is intended to claim the same broadly as well as specifically as indicated by the appended claims.

What is claimed as new and useful is:

1. In combination with a sewing machine having, a throat plate provided with a needle hole therethrough, a reciprocating needle cyclically carrying a needle thread upward above the throat plate and downward therebelow through the needle hole in the throat plate, a needle thread tensioner, a rotating looper below the throat plate carrying a bobbin thread operative to pick up the needle thread and interloop the same with the bobbin thread to form lock stitches drawable upward into work disposed on the throat plate, an oscillating needle thread take-up arm moving in synchronism with the movements of said needle and looper to draw the formed stitches up into the work as aforesaid and to thereafter draw thread through said tensioner from a needle thread supply to form the next stitch, the combination comprising,

(a) an electrically energizable heat generating element disposed beneath the throat plate immediately adjacent to the throat plate needle hole and effective when energized to burn through threads contacting the same, and

(b) thread shifting means disposed beneath the throat plate in such positional relationship to said electrically energizable heat generating element that said thread shifting means is operative when actuated to frictionally snub both the interlooped needle thread and bobbin thread around and between said thread shifting means and said electrically energizable heat generating element.

2. In combination with a sewing machine having, a throat plate provided with a needle hole therethrough, a reciprocating needle cyclically carrying a needle thread upward above the throat plate and downward therebelow through the needle hole in the throat plate, a needle thread tensioner, a rotating looper below the throat plate carrying a bobbin thread operative to pick up the needle thread and interloop the same with the bobbin thread to form lock stitches drawable upward into work disposed on the throat plate, an oscillating needle thread take-up arm moving in synchronism with the movements of said needle and looper to draw the formed stitches up into the work as aforesaid and to thereafter draw thread through said tensioner from a needle thread supply to form the next stitch, the combination comprising,

(a) an electrically energizable heat generating element carried by the throat plate on the underside thereof immediately adjacent to the throat plate needle hole and effective when energized to burn through threads contacting the same, and

(b) thread shifting means carried by the throat plate on the underside thereof in such positional relationship to said electrically energizable heat generating element that said thread shifting means is operative when actuated to frictionally snub both the interlooped needle thread and bobbin thread around and between said thread shifting means and said electrically energizable heat generating element.

3. The apparatus as set forth in claim **2** wherein the throat plate includes a plurality of parallel feed dog slots and said thread shifting means comprises, a generally U-

shaped slider device disposed against the underside of the throat plate and shiftable laterally with respect thereto in opposite directions parallel to the longitudinal extent of the throat plate feed dog slots, one arm of said U-shaped slider being relatively thin and extending longitudinally between an adjacent pair of throat plate feed dog slots and terminating at its free end in a thread shifter end formation disposed immediately adjacent to the throat plate needle hole, the other arm of said slider including slider guide means disposed in abutment against a straight side edge of the throat plate, and means holding said slider captive to said throat plate.

4. In combination with a sewing machine having, a throat plate provided with a needle hole therethrough, a reciprocating needle cyclically carrying a needle thread upward above the throat plate and downward therebelow through the needle hole in the throat plate, a needle thread tensioner, a rotating looper below the throat plate carrying a bobbin thread operative to pick up the needle thread and interloop the same with the bobbin thread to form lock stitches drawable upward into work disposed on the throat plate, an oscillating needle thread take-up arm moving in synchronism with the movements of said needle and looper to draw the formed stitches up into the work as aforesaid and to thereafter draw thread through said tensioner from a needle thread supply to form the next stitch, the combination comprising,

(a) an electrically energizable heat generating element disposed beneath the throat plate immediately adjacent to the throat plate needle hole and effective when energized to burn through threads contacting the same,

(b) thread shifting means disposed beneath the throat plate in such positional relationship to said electrically energizable heat generating element that said thread shifting means is operative when actuated to frictionally snub both the interlooped needle thread and bobbin thread around and between said thread shifting means and said electrically energizable heat generating element,

(c) needle thread tension release means operative when actuated to disable the said needle thread tensioner to remove tension on the needle thread, and operative when deactuated to restore needle thread tension,

(d) first selectively operable control means for moving the take-up arm upward and the needle upward out of the throat plate to draw the interlooped needle thread and bobbin thread upward toward the work being stitched and for drawing thread from the needle thread supply, and

(e) second selectively operable control means effective when operated to actuate and deactuate said thread shifting means and tension release means and energize and deenergize said heat generating element in timed relation to one another and to the positions of the thread take-up arm and needle as determined by said first control means so that said interlooped needle thread and bobbin thread are held below the throat plate by said thread shifting means while the take-up arm draws thread for the next stitch from the needle thread supply through the thread tensioner disabled by said tension release means, and thereafter the held threads are severed by energization of said heat generating element.

5. In combination with a sewing machine having, a throat plate provided with a needle hole therethrough, a reciprocating needle cyclically carrying a needle thread upward above the throat plate and downward therebelow through the needle hole in the throat plate, a needle thread tensioner, a rotating looper below the throat plate carrying a bobbin thread operative to pick up the needle thread and interloop the same with the bobbin thread to form lock stitches drawable upward into work disposed on the throat plate, an oscillating needle thread take-up arm moving in synchronism with the movements of said needle and looper to draw the formed stitches up into the work as aforesaid and to thereafter draw thread through said tensioner from a needle thread supply to form the next stitch, the combination comprising,

(a) an electrically energizable heat generating element carried by the throat plate on the underside thereof immediately adjacent to the throat plate needle hole and effective when energized to burn through threads contacting the same,

(b) thread shifting means carried by the throat plate on the underside thereof in such positional relationship to said electrically energizable heat generating element that said thread shifting means is operative when actuated to frictionally snub both the interlooped needle thread and bobbin thread around and between said thread shifting means and said electrically energizable heat generating element,

(c) needle thread tension release means operative when actuated to disable the said needle thread tensioner to remove tension on the needle thread, and operative when deactuated to restore needle thread tension,

(d) first selectively operable control means for moving the take-up arm upward and the needle upward out of the throat plate to draw the interlooped needle thread and bobbin thread upward toward the work being stitched and for drawing thread from the needle thread supply, and

(e) second selectively operable control means effective when operated to actuate and deactuate said thread shifting means and tension release means and energize and deenergize said heat generating element in timed relation to one another and to the positions of the thread take-up arm and needle as determined by said first control means so that said interlooped needle thread and bobbin thread are held below the throat plate by said thread shifting means while the take-up arm draws thread for the next stitch from the needle thread supply through the thread tensioner disabled by said tension release means and thereafter the held threads are severed by energization of said heat generating element.

6. In combination with a sewing machine having, a throat plate provided with a needle hole therethrough, a reciprocating needle cyclically carrying a needle thread upward above the throat plate and downward therebelow through the needle hole in the throat plate, a needle thread tensioner, a rotating looper below the throat plate carrying a bobbin thread operative to pick up the needle thread and interloop the same with the bobbin thread to form lock stitches drawable upward into work disposed on the throat plate, an oscillating needle thread take-up arm moving in synchronism with the movements of said needle and looper to draw the formed stitches up into the work as aforesaid and to thereafter draw thread through said tensioner from a needle thread supply to form the next stitch, the combination comprising,

(a) an electrically energizable heat generating element carried by the throat plate on the underside thereof immediately adjacent to the throat plate needle hole and effective when energized to burn through threads contacting the same,

(b) thread shifting means carried by the throat plate on the underside thereof in such positional relationship to said electrically energizable heat generating element that said thread shifting means is operative when actuated to frictionally snub both the interlooped needle thread and bobbin thread around and between said thread shifting means and said electrically energizable heat generating element,

(c) electrically energizable actuating means coupled to said thread shifting means operative when energized to actuate said thread shifting means and operative when deenergized to deactuate said thread shifting means,

(d) needle thread tension release means carried by the sewing machine and operative when actuated to disable the said needle thread tensioner to remove tension on the needle thread, and operative when deactuated to restore needle thread tension,

(e) first selectively operable control means for moving the take-up arm upward and the needle upward out of the throat plate to draw the interlooped needle thread and bobbin thread upward toward the work being stitched and for drawing thread from the needle thread supply, and

(f) second selectively operable control means effective when operated to actuate and deactuate said thread shifting means and tension release means and energize and deenergize said heat generating element in timed relation to one another and to the positions of the thread take-up arm and needle as determined by said first control means so that said interlooped needle thread and bobbin thread are held below the throat plate by said thread shifting means while the take-up arm draws thread for the next stitch from the needle thread supply through the thread tensioner disabled by said tension release means, and thereafter the held threads ar severed by energization of said heat generating element.

7. In combination with a sewing machine having a throat plate provided with a needle hole therethrough, a reciprocating needle cyclically carrying a needle thread upward above the throat plate and downward therebelow through the needle hole in the throat plate, a needle thread tensioner, a rotating looper below the throat plate carrying a bobbin thread operative to pick up the needle thread and interloop the same with the bobbin thread to form lock stitches drawable upward into work disposed on the throat plate, an oscillating needle thread take-up arm moving in synchronism with the movements of said needle and looper to draw the formed stitches up into the work as aforesaid and to thereafter draw thread through said tensioner from a needle thread supply to form the next stitch, and an automatic needle positioning device automatically operative to position the needle in its down position at the end of a stitching operation and including selectively actuatable position control means operative when actuated to raise the sewing machine take-up arm to its maximum upward position, the combination comprising,

(a) an electrically energizable heat generating element disposed beneath the throat plate immediately adjacent to the throat plate needle hole and effective when energized to burn through threads contacting the same,

(b) thread shifting means disposed beneath the throat plate in such positional relationship to said electrically energizable heat generating element that said thread shifting means is operative when actuated to frictionally snub both the interlooped needle thread and bobbin thread around and between said thread shifting means and said electrically energizable heat generating element,

(c) needle thread tension release means operative when actuated to disable the said needle thread tensioner to remove tension on the needle thread, and operative when deactuated to restore needle thread tension, and

(d) selectively operable control means effective when operated to actuate and deactuate said needle positioning device position control means and said shifting means and tension release means and energize and deenergize said heat generating element in automatically timed relation to one another so that said interlooped needle thread and bobbin thread are held below the throat plate by said thread shifting means while the take-up arm draws thread for the next stitch from the needle thread supply through the thread tensioner disabled by said tension release means and thereafter the held threads are severed by energization of said heat generating element.

8. In combination with a sewing machine having a throat plate provided with a needle hole therethrough, a reciprocating needle cyclically carrying a needle thread upward above the throat plate and downward therebelow through the needle hole in the throat plate, a needle thread tensioner, a rotating looper below the throat plate carrying a bobbin thread operative to pick up the needle thread and interloop the same with the bobbin thread to form lock stitches drawable upward into work disposed on the throat plate, an oscillating needle thread take-up arm moving in synchronism with the movement of said needle and looper to draw the formed stitches up into the work as aforesaid and to thereafter draw thread through said tensioner from a needle thread supply to form the next stitch, and an automatic needle positioning device automatically operative to position the needle in its down position at the end of a stitching operation and including selectively actuatable position control means operative when actuated to raise the sewing machine take-up arm to its maximum upward position, the combination comprising,

(a) an electrically energizable heat generating element disposed beneath the throat plate immediately adjacent to the throat plate needle hole and effective when energized to burn through threads contacting the same,

(b) thread shifting means disposed beneath the throat plate in such positional relationship to said electrically energizable heat generating element that said thread shifting means is operative when actuated to frictionally snub both the interlooped needle thread and bobbin thread around and between said thread shifting means and said electrically energizable heat generating element,

(c) needle thread tension release means operative when actuated to disable the said needle thread tensioner to remove tension on the needle thread, and operative when deactuated to restore needle thread tension, and

(d) selectively operable control means effective when operated to render operative said needle positioning device position control means, said thread shifting means and tension release means, and said thread severing heat generating element in automatically timed relation to one another, whereby,

(1) said needle positioning device is activated to move the needle thread take-up arm upward toward its topmost position,

(2) said tension release means and thread shifting means are actuated while the take-up is moving upward at a time before the interlooped needle thread and bobbin thread are drawn up above the underside of the throat plate so that the threads are snubbed as aforesaid and the needle thread tensioner is disabled,

(3) the take-up arm continues to move to its topmost position and draws thread from the needle thread supply through the disabled tensioner, the needle positioner being then deactivated,

(4) said tension release means is deactuated and said heat generating element is energized to burn through both the needle thread and bobbin thread,

(5) said heat generating element is deenergized and said thread shifting means is deactuated.

9. In combination with a sewing machine having, a throat plate provided with a needle hole therethrough, a reciprocating needle cyclically carrying a needle thread upward above the throat plate and downward therebelow through the needle hole in the throat plate, a needle thread tensioner, a rotating looper below the throat plate carrying a bobbin thread operative to pick up the needle thread and interloop the same with the bobbin thread to

form lock stitches drawable upward into work disposed on the throat plate, an oscillating needle thread take-up arm moving in synchronism with the movements of said needle and looper to draw the formed stitches up into the work as aforesaid and to thereafter draw thread through said tensioner from a needle thread supply to form the next stitch, and an automatic needle positioning device automatically operative to position the needle in its down position at the end of a stitching operation and including selectively actuatable position control means operative when actuated to raise the sewing machine take-up arm to its maximum upward position, the combination comprising,

(a) an electrically energizable heat generating element carried by the throat plate on the underside thereof immediately adjacent to the throat plate needle hole and effective when energized to burn through threads contacting the same,

(b) thread shifting means carried by the throat plate on the underside thereof in such positional relationship to said electrically energizable heat generating element that said thread shifting means is operative when actuated to frictionally snub both the interlooped needle thread and bobbin thread around and between said thread shifting means and said electrically energizable heat generating element,

(c) electrically energizable actuating means coupled to said thread shifting means operative when energized to actuate said thread shifting means and operative when deenergized to deactuate said thread shifting means,

(d) needle thread tension release means carried by the sewing machine and operative when actuated to disable the said needle thread tensioner to remove tension on the needle thread, and operative when deactuated to restore needle thread tension, and

(e) selectively operable control means effective when operated to actuate and deactuate said needle positioning device position control means and said thread shifting means and tension release means and energize and deenergize said heat generating element in automatically timed relation to one another so that said interlooped needle thread and bobbin thread are held below the throat plate by said thread shifting means while the take-up arm draws thread for the next stitch from the needle thread supply through the thread tensioner disabled by said tension release means and thereafter the held threads are severed by energization of said heat generating element.

10. In combination with a sewing machine having, a throat plate provided with a needle hole therethrough, a reciprocating needle cyclically carrying a needle thread upward above the throat plate and downward therebelow through the needle hole in the throat plate, a needle thread tensioner, a rotating looper below the throat plate carrying a bobbin thread operative to pick up the needle thread and interloop the same with the bobbin thread to form lock stitches drawable upward into work disposed on the throat plate, an oscillating needle thread take-up arm moving in synchronism with the movements of said needle and looper to draw the formed stitches up into the work as aforesaid and to thereafter draw thread through said tensioner from a needle thread supply to form the next stitch, and an automatic needle positioning device automatically operative to position the needle in its down position at the end of a stitching operation and including selectively actuatable position control means operative when actuated to raise the sewing machine take-up arm to its maximum upward position, the combination comprising,

(a) an electrically energizable heat generating element carried by the throat plate on the underside thereof immediately adjacent to the throat plate needle hole and effective when energized to burn through threads contacting the same,

(b) thread shifting means carried by the throat plate on the underside thereof in such positional relationship to said electrically energizable heat generating element that said thread shifting means is operative when actuated to frictionally snub both the interlooped needle thread and bobbin thread around and between said thread shifting means and said electrically energizable heat generating element,

(c) electrically energizable actuating means coupled to said thread shifting means operative when energized to actuate said thread shifting means and operative when deenergized to deactuate said thread shifting means,

(d) needle thread tension release means carried by the sewing machine and operative when actuated to disable the said needle thread tensioner to remove tension on the needle thread, and operative when deactuated to restore needle thread tension, and

(e) selectively operable control means effective when operated to render operative said needle positioning device position control means, said thread shifting means and tension release means, and said thread severing heat generating element in automatically timed relation to one another, whereby,

(1) said needle positioner is activated to move the needle thread take-up arm upward toward its topmost position,

(2) said tension release means and thread shifting means are actuated while the take-up is moving upward at a time before the interlooped needle thread and bobbin thread are drawn up above the underside of the throat plate so that the threads are snubbed as aforesaid and the needle thread tensioner is disabled,

(3) the take-up arm continues to move to its topmost position and draws thread from the needle thread supply through the disabled tensioner, the needle positioner being then deactivated,

(4) said tension release means is deactuated and said heat generating element is energized to burn through both the needle thread and bobbin thread,

(5) said heat generating element is deenergized and said thread shifting means is deactuated.

11. The apparatus as set forth in claim **10** wherein the throat plate includes a plurality of parallel feed dog slots and said thread shifting means comprises, a generally U-shaped slider device disposed against the underside of the throat plate and shiftable laterally with respect thereto in opposite directions parallel to the longitudinal extent of the throat plate feed dog slots, one arm of said U-shaped slider being relatively thin and extending longitudinally between an adjacent pair of throat plate feed dog slots and terminating at its free end in a thread shifter end formation disposed immediately adjacent to the throat plate needle hole, the other arm of said slider including slider guide means disposed in abutment against a straight side edge of the throat plate, and means holding said slider captive to said throat plate.

12. In combination with a sewing machine having, a throat plate provided with a needle hole therethrough, a reciprocating needle cyclically carrying a needle thread upward above the throat plate and downward therebelow through the needle hole in the throat plate, a needle thread tensioner, a rotating looper below the throat plate carrying a bobbin thread operative to pick up the needle thread and interloop the same with the bobbin thread to form lock stitches drawable upward into work disposed on the throat plate, an oscillating needle thread take-up arm moving in synchronism with the movements of said needle and looper to draw the formed stitches up into the work as aforesaid and to thereafter draw thread through said tensioner from a needle thread supply to form the next stitch, the combination comprising,

(a) an electrically energizable heat generating element carried by the throat plate on the underside thereof

immediately adjacent to the throat plate needle hole and effective when energized to burn through threads contacting the same,

(b) thread shifting means carried by the throat plate on the underside thereof in such positional relationship to said electrically energizable heat generating element that said thread shifting means is operative when actuated to frictionally snub both the interlooped needle thread and bobbin thread around and between said thread shifting means and said electrically energizable heat generating element, and

(c) needle thread tension release means carried by the the sewing machine and operative when actuated to disable the said needle thread tensioner to remove tension on the needle thread, and operative when deactuated to restore needle thread tension.

13. In combination with a sewing machine having a throat plate provided with a needle hole therethrough, a reciprocating needle cyclically carrying a needle thread upward above the throat plate and downward therebelow through the needle hole in the throat plate, a needle thread tensioner, a rotating looper below the throat plate carrying a bobbin thread operative to pick up the needle thread and interloop the same with the bobbin thread to form lock stitches drawable upward into work disposed on the throat plate, an oscillating needle thread take-up arm moving in synchronism with the movements of said needle and looper to draw the formed stitches up into the work as aforesaid and to thereafter draw thread through said tensioner from a needle thread supply to form the next stitch, and an automatic needle positioning device automatically operative to position the needle in its down position at the end of a stitching operation and including selectively actuatable position control means operative when actuated to raise the sewing machine take-up arm to its maximum upward position, the combination comprising,

(a) an electrically energizable heat generating element disposed beneath the throat plate immediately adjacent to the throat plate needle hole and effective when energized to burn through threads contacting the same,

(b) thread shifting means disposed beneath the throat plate in such positional relationship to said electrically energizable heat generating element that said thread shifting means is operative when actuated to frictionally snub both the interlooped needle thread and bobbin thread around and between said thread shifting means and said electrically energizable heat generating element, and

(c) needle thread tension release means operative when actuated to disable the said needle thread tensioner to remove tension on the needle thread, and operative when deactuated to restore needle thread tension.

14. In combination with a sewing machine having, a throat plate provided with a needle hole therethrough, a reciprocating needle cyclically carrying a needle thread upward above the throat plate and downward therebelow through the needle hole in the throat plate, a needle thread tensioner, a rotating looper below the throat plate carrying a bobbin thread operative to pick up the needle thread and interloop the same with the bobbin thread to form lock stiches drawable upward into work disposed on the throat plate, an oscillating needle thread take-up arm moving in synchronism with the movements of said needle and looper to draw the formed stitches up into the work as aforesaid and to thereafter draw thread through said tensioner from a needle thread supply to form the next stitch, and an automatic needle positioning device automatically operative to position the needle in its down position at the end of a stitching operation and including selectively actuatable position control means operative when actuated to raise the sewing machine take-up arm to its maximum upward position, the combination comprising,

(a) an electrically energizable heat generating element carried by the throat plate on the underside thereof immediately adjacent to the throat plate needle hole and effective when energized to burn through threads contacting the same,

(b) thread shifting means carried by the throat plate on the underside thereof in such positional relationship to said electrically energizable heat generating element that said thread shifting means is operative when actuated to frictionally snub both the interlooped needle thread and bobbin thread around and between said thread shifting means and said electrically energizable heat generating element,

(c) electrically energizable actuating means coupled to said thread shifting means operative when energized to actuate said thread shifting means and operative when deenergized to deactuate said thread shifting means, and

(d) needle thread tension release means carried by the sewing machine and operative when actuated to disable the said needle thread tensioner to remove tension on the needle thread, and operative when deactuated to restore needle thread tension.

References Cited

UNITED STATES PATENTS

3,118,405	1/1964	Schenkengel	112—252
3,194,118	7/1965	Chudner	112—252

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