July 25, 1944. D. B. THORNTON 2,354,559

BUTTONHOLE SEWING MACHINE

Filed Jan. 8, 1943 2 Sheets-Sheet 1

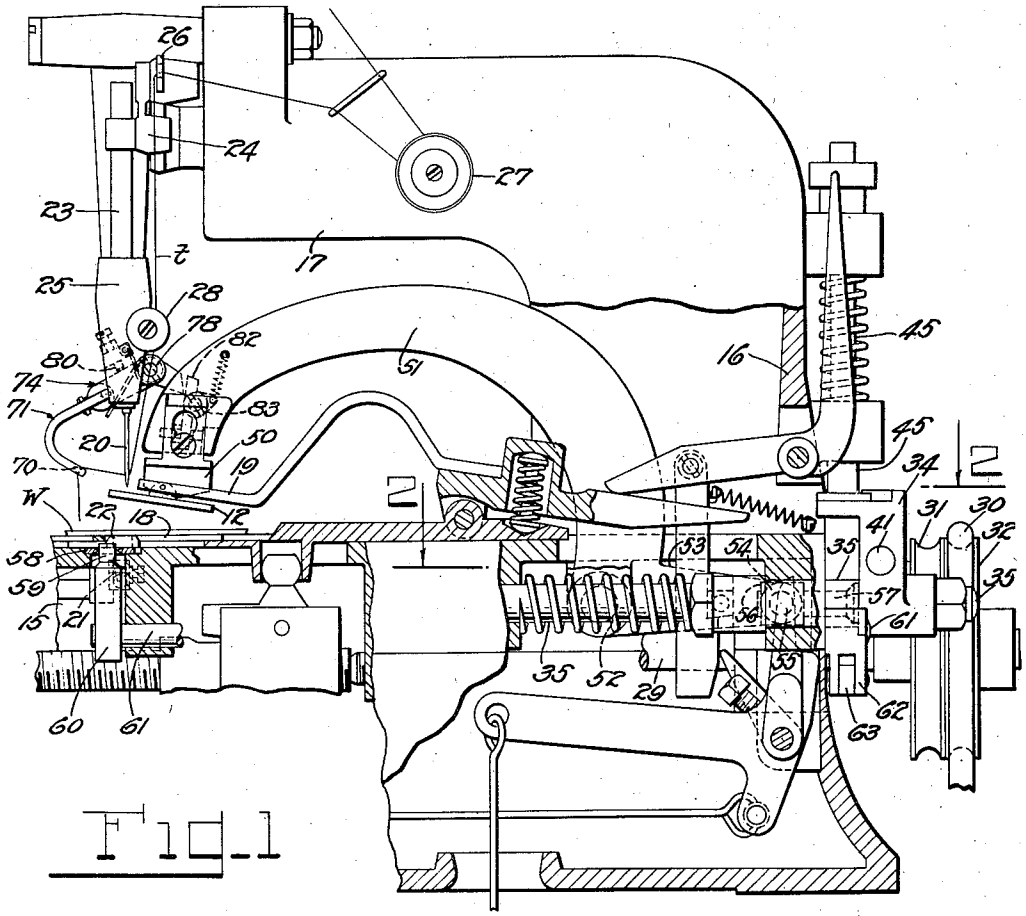


Fig. 1

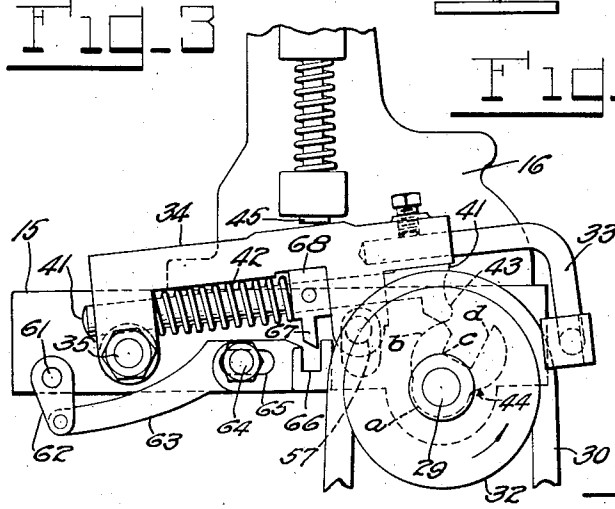


Fig. 3

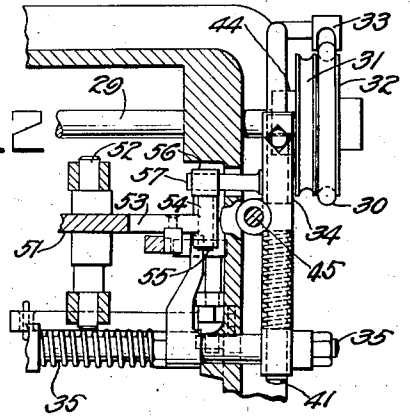


Fig. 2

INVENTOR:
David B. Thornton,
by Dike, Calvin & Potter
Attys

July 25, 1944. D. B. THORNTON 2,354,559

BUTTONHOLE SEWING MACHINE

Filed Jan. 8, 1943 2 Sheets-Sheet 2

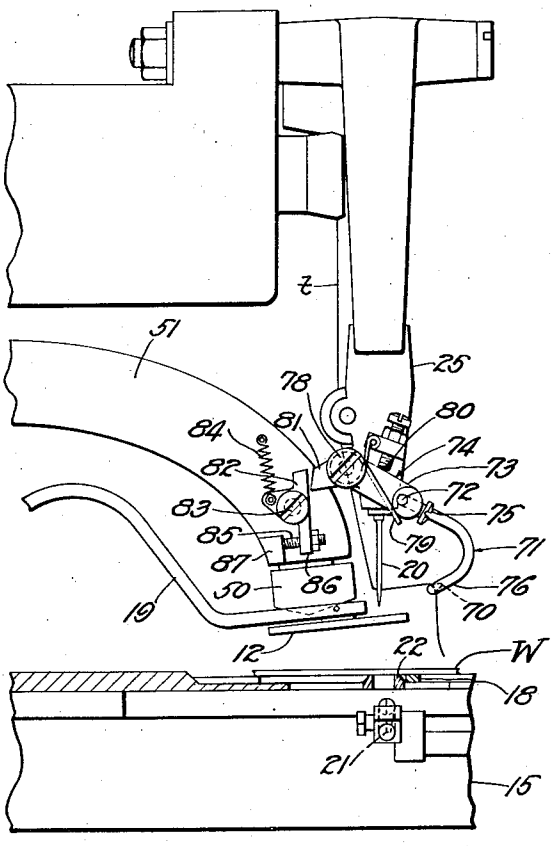


Fig. 4

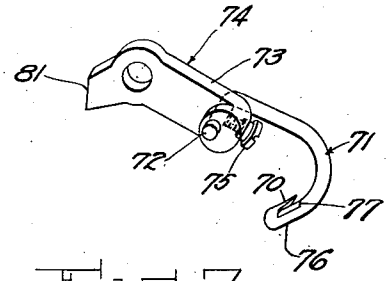


Fig. 7

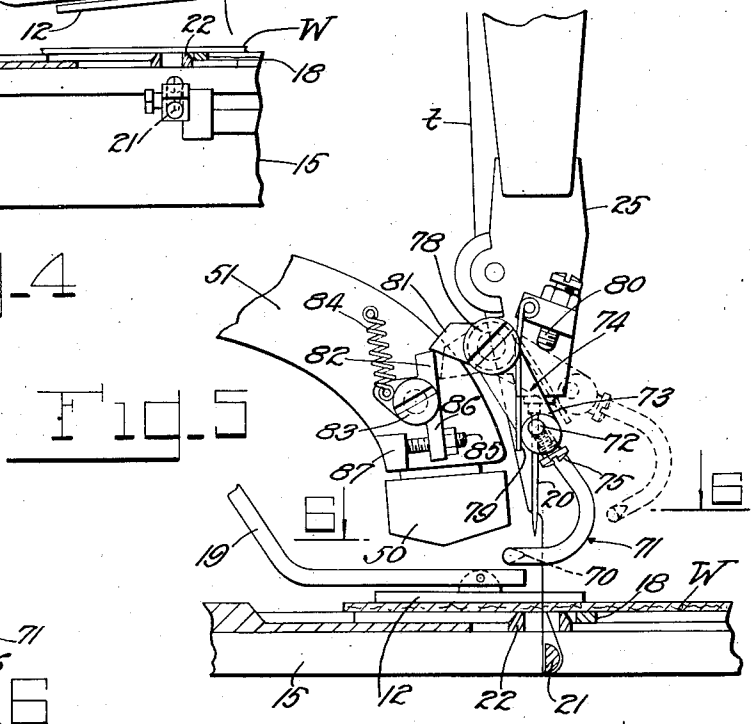


Fig. 5

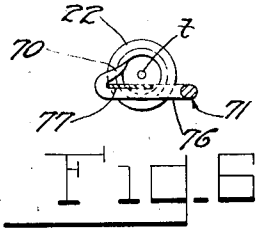


Fig. 6

INVENTOR:
David B. Thornton;
by Dike, Calver & Porter.
Attys.

Patented July 25, 1944

2,354,559

UNITED STATES PATENT OFFICE

2,354,559

BUTTONHOLE SEWING MACHINE

David B. Thornton, West Newton, Mass., assignor to The Reece Button Hole Machine Company, Boston, Mass., a corporation of Maine

Application January 8, 1943, Serial No. 471,641

11 Claims. (Cl. 112—252)

This invention relates to sewing machines and especially to buttonhole sewing machines of the type known as "straight hole" machines, described, for example, in U. S. Letters Patent No. 714,284, November 25, 1902; No. 749,776, January 19, 1904; No. 1,088,652, February 24, 1914; No. 1,402,073; January 3, 1922; and No. 1,483,307, February 12, 1924.

The invention relates particularly to a thread pick-up device which engages the thread between the work and the needle after the thread has been cut or trimmed and pulls the loose end of thread out of the work and holds it out of the path of the clamping mechanism and needle until the first stitch has been formed in the next sewing operation.

The object of the present invention is to remove and hold the trimmed thread as aforesaid very quickly during the brief interval after the trimming operation and before the machine comes to rest at the end of a sewing operation.

Buttonhole sewing machines of the "straight hole" type to which this invention relates include a cutter for cutting the buttonhole slit substantially upon the completion of the stitching operation, usually during the formation of the last stitch, and a thread trimmer timed to operate immediately thereafter upon the completion of the last stitch to sever or trim the thread below the work. Trimming is, therefore, the last operation performed before the machine comes to rest, and, as will later appear, takes place simultaneously with the operation of the stopping mechanism. In such machines, the thread pick-up mechanism must operate in the very short period of time after the rise of the needle during the completion of the last stitch, and after the thread trimming cutter has cut the thread, but before the machine comes fully to rest.

The invention will best be understood from the following description of an illustrative embodiment thereof shown in the accompanying drawings.

In the drawings:

Fig. 1 is a view in side elevation, partly broken away, of a machine embodying the present invention;

Fig. 2 is a view along line 2—2 of Fig. 1;

Fig. 3 is a view of a portion of the machine as seen from the right in Fig. 1;

Fig. 4 is a view of a portion of the left side of said machine, showing mechanism embodying the present invention in one operative position.

Fig. 5 is a similar view of the same mechanism in a different operative position;

Fig. 6 is a view along the line 6—6 of Fig. 5; and

Fig. 7 is a detail view of the pull-off device of the present invention.

The machine shown in the drawings may, as to its general organization, be similar to those described in the patents above referred to. It comprises a bed 15 from which rises a standard 16 carrying an overhanging arm 17 spaced above the bed. The work W is carried by a work clamp or holder comprising a clamp plate 18 and cooperating clamping arms 19 having clamp feet 12.

The stitch forming instrumentalities comprise an eye pointed needle 20 above the work and cooperating loopers or under thread handling devices 21 below the work. The needle 20 is carried by a needle bar 23 which is vertically reciprocated by means generally indicated at 24 in a needle bar guide 25. The thread *t* passes from a suitable source (not shown) through a take-up 26 and suitable tension devices 27 and 28 to the needle eye, whence it passes through the work W and a throat plate 22 to the loopers 21.

The stitch forming instrumentalities are driven by a main shaft 29 journalled in suitable bearings in the bed 15. Said shaft has power applied thereto by a belt 30 alternatively engageable with fast and loose pulleys 31 and 32 under control of a belt shifter 33. The belt shifter 33 constitutes an extension of a stop member or arm 34 carried by a rock shaft 35 mounted for oscillation and a limited longitudinal movement in the bed 15. Slidably mounted on the stop arm 34 is a stop element or bolt 41 normally urged toward the right in Fig. 3 by a spring 42. At its end the bolt 41 is formed with a nose 43 which, when the shaft 35 is in the longitudinal position to cause the belt shifter 33 to engage the belt 30 with the loose pulley 32, is in the path of movement of a cam 44 fast on the shaft 29. This cam has a concentric portion *a*, a rise *b*, a notch *c* and a stop shoulder *d* arranged to engage the nose 43 in the order named when the shaft 29 is rotated in the direction of the arrow in Fig. 3. A spring pressed plunger 45 carried by the upright 16 engages the stop arm 34 and tends to turn said arm and the rock shaft 35 in a clockwise direction, as shown in Fig. 3, to press the nose 43 against the periphery of the cam 44 when said nose is in the path of movement of said cam.

The buttonhole cutter 50 is carried by a lever 51 journalled on a short stud shaft 52 supported in the bed 15, said lever having an arm 53 car-

rying at its end a sleeve 54 in which is journalled a stud 55 having at one end a sleeve portion 56 which receives a stud 57 extended inwardly from the stop arm 34.

During the formation of the last stitch, the machine runs under its own momentum and the nose 43 follows the periphery of the cam 44. As said nose is engaged by the rise *b* of said cam, the stop arm 34 is lifted against the action of the spring-pressed plunger 45 into the position shown in Fig. 3. This lifting of the stop arm 34 operates, through the stud 57 and its connection with the arm 53 of the lever 51, to depress the buttonhole cutter 50 and cause the same to cut the buttonhole slit. Thereafter, the nose 43 drops off the rise *b* of the cam 44 and enters the notch *c*, under the influence of the spring-pressed plunger 45, this movement causing the buttonhole cutter 50 to be raised to its original position.

The construction, arrangement and mode of operation of the parts above referred to and certain associated parts are or may be substantially as more fully described in the above mentioned patents.

A stitch-setting and thread trimming element 58 is guided in ways in the bed 15 immediately below the throat plate 22. The element 58 receives a stud 59 carried by an arm 60 fast on one end of a rock shaft 61 journalled in suitable bearings in the bed 15 and having secured to its opposite end an arm 62 which is pivotally connected to a link 63 guided on the outer side of the bed on a screw 64 projecting from the bed and received in a slot 65 in said link. The opposite end of the link 63 is formed with a notch 66 adapted to be entered by a nose 67 on a collar 68 secured to the stop bolt 41.

At the completion of the last stitch-forming cycle, and substantially coincidentally with the stopping of the machine, the nose 43 of the stop bolt 41 enters the notch *c* in the cam 44 under the influence of the spring pressed plunger 45 and the nose 67 enters the notch 66. Thereafter, when the stop bolt 41 yields under the impact of the shoulder *d* on the nose 43, the link 63 is moved toward the left in Fig. 3, thereby turning the shaft 61 and operating the trimming element 58. The thread-trimming element and associated mechanism per se are not a part of the present invention. They are, or may be, substantially like the mechanism described and claimed in a copending application of Joseph H. Pikul, Serial No. 401,932, filed July 11, 1941.

Since the movement of the nose 67 into the notch 66 occurs when the stop member 34 is moved downwardly and the nose 43 enters the notch *c*, and since this movement coincides with the raising of the buttonhole cutter lever 51 through the mechanism described above, the trimming operation takes place practically simultaneously with the return of the button hole cutter to its raised, inoperative position.

In the present invention, a thread pick-up device is used to pull the thread out of the work and hold it in a position in which it will not be caught by the clamp feet when the clamp is closed at the beginning of the next sewing operation.

The pick-up device comprises a hook 70 formed at one end of a curved arm 71 having an inturned end 72 adjustable connected to the arm 73 of a lever 74 and held against movement therein except during adjustment by a screw 75. The arm 71 is curved in such manner as to extend outwardly and downwardly from the arm 73 (Fig. 7) to terminate in the straight shank 76 of the hook 70. The shank 76 is provided with a friction piece 77 of felt or similar material which extends into the angle of the hook 70. The lever 74 is pivoted at 78 to the needle bar guide 25 and normally urged outwardly and against an adjustable stop 80 by a spring 79. The other arm 81 of the lever 74 extends rearwardly into the path of movement of a pawl 82 pivoted at 83 on the button hole cutter lever 51 and normally urged in a clockwise direction as viewed in Fig. 4 by a spring 84 into a position determined by engagement of a stop screw 85 in an extension 86 of said pawl 82 with a shoulder 87 formed on said lever 51.

At the end of a sewing cycle, when the needle 20 rises in the formation of the last stitch, and the automatic stop mechanism of said machine comes into operation, the stop arm 34 is lifted as hereinbefore described into the position shown in Fig. 3, and operates, through the stud 57 and its connection with the arm 53 of the lever 51, to depress the button hole cutter 50 to cut the button hole slit. As the button hole lever 51 is depressed, the pawl 82 is brought into contact with the end of the arm 81 of the lever 74 and is rotated counter-clockwise in Fig. 4 against the impulse of the spring 84 until it passes beyond the arm 81, thereby permitting said pawl to pass the arm 81 idly during the downward movement of the cutter 50. After the pawl has passed by the arm 81, the spring 84 causes it to move clockwise to reassume its normal position.

After the cutter 50 has cut the buttonhole slit in the work W, the nose 43 drops into the notch *c* in the cam 44, allowing the stop arm 34 to be depressed by the spring pressed plunger 45, causing the lever 51 to be raised to its original position as shown in Fig. 1. At this time the stitch-setting and thread-trimming element 58 sets the last stitch and cuts the thread below the work. Then, as the lever 51 rises as aforesaid, the top surface of the pawl 82 engages the under surface of the arm 81 and raises it, thus swinging the lever 74 about the pivot 78 and lowering the curved arm 71 until the hook 70 passes between the needle and the work to lie in thread-receiving position slightly behind the thread extending between the needle and the work as shown in full lines in Fig. 5. The continued upward movement of the arm 51 thereafter carries the pawl 82 out of contact with the arm 81, whereupon the spring 79 causes the lever 74 to rotate in a counter-clockwise direction into the position shown in Fig. 4 and in broken lines in Fig. 5 to swing the curved arm 71 outwardly and upwardly. As the arm swings out, the thread is caught in the angle of the hook and held there by the friction piece 77. Continued outward movement of the arm 71 serves to pull the trimmed end of thread out of the work, the arm 71 finally coming to rest in thread-holding position as shown in Fig. 4, in which the thread is held away from the work clamp. At the beginning of the next sewing operation the work clamp is closed upon the work and then the needle descends to form a stitch, the descent of the needle pulling the thread out of the hook 70.

I claim:

1. In a buttonhole sewing machine, in combination, stitch-forming mechanism including a needle carrying a needle thread, a lever carrying a buttonhole cutter, means for moving said lever alternately in opposite directions to cause said cutter to cut a buttonhole slit and then retract

the same, a pick-up for the needle thread, and means carried by said lever for engaging and operating said pick-up, said operating means idly passing said pick-up during the cutting movement of said lever but acting during the retracting movement thereof to cause movement of said pick-up first into thread receiving position and then into thread pick-up position.

2. In a buttonhole sewing machine, in combination, stitch-forming mechanism including a needle carrying a needle thread, means for controlling said mechanism to cause the same to perform a predetermined series of stitch-forming operations and stop, a lever carrying a buttonhole cutter, means for moving said lever alternately in opposite directions to cause said cutter to cut a buttonhole slit during the latter part of the final stitch-forming operation and then retract the same, a pick-up for the needle thread, and means carried by said lever for engaging and operating said pick-up, said operating means idly passing said pick-up during the cutting movement of said lever but acting during the retracting movement thereof to cause movement of said pick-up first into thread receiving position and then into thread pick-up position.

3. In a buttonhole sewing machine, in combination, stitch-forming mechanism including a needle carrying a needle thread, a lever carrying a buttonhole cutter, means for moving said lever alternately in opposite directions to cause said cutter to cut a buttonhole slit and then retract the same, a pivoted pick-up for the needle thread, a spring for normally moving said pick-up into thread pick-up position, and a spring-pressed pawl carried by said lever in a position to engage said pick-up when said lever is moved as aforesaid, said pawl being so disposed on said lever as to pass said pick-up idly during the cutting movement of said lever but, during the retracting movement of said lever, to move said pick-up into thread receiving position and then release the same and permit said spring to restore it to thread pick-up position.

4. In a buttonhole sewing machine of the type having stitch-forming mechanism including a needle carrying a needle thread, and a stop mechanism that operates to stop the machine upon the completion of a predetermined series of stitch-forming operations by said stitch-forming mechanism, in combination, a buttonhole cutter, means to operate said cutter to cut a buttonhole slit during the latter part of the final stitch-forming operation and then retract the same, a pick-up for the needle thread, and means rendered operative by and during the retracting movement of said buttonhole cutter for moving said pick-up first into thread receiving position and then into thread pick-up position.

5. In a buttonhole sewing machine of the type having stitch-forming mechanism including a needle carrying a needle thread, and a stop mechanism that operates to stop the machine upon the completion of a predetermined series of stitch-forming operations by said stitch-forming mechanism, in combination, a thread trimmer, means for operating said trimmer to sever the needle thread substantially coincidentally with the stopping of the machine, a buttonhole cutter, means to operate said cutter to cut a buttonhole slit during the latter part of the final stitch-forming operation and then retract the same, a pick-up for the needle thread and means rendered operative by and during the retracting movement of said buttonhole cutter for moving said pick-up first into thread receiving position and then into thread pick-up position.

6. In a buttonhole sewing machine of the type having stitch-forming mechanism including a needle carrying a needle thread, and a stop mechanism that operates to stop the machine upon the completion of a predetermined series of stitch-forming operations by said stitch-forming mechanism, said needle having a work penetrating movement and a retracting movement during each stitch-forming operation, in combination, a buttonhole cutter, means to operate said cutter to cut a buttonhole slit during the needle retracting movement of the final stitch-forming operation and then retract the same, a pick-up for the needle thread, and means rendered operative by and during the retracting movement of said buttonhole cutter for moving said pick-up first into thread receiving position and then into thread pick-up position.

7. In a buttonhole sewing machine of the type having stitch-forming mechanism including a needle carrying a needle thread, and a stop mechanism that operates to stop the machine upon the completion of a predetermined series of stitch-forming operations by said stitch-forming mechanism, in combination, a thread trimmer, means for operating said trimmer to sever the needle thread substantially coincidentally with the stopping of the machine, a buttonhole cutter, means for advancing said cutter to cut a buttonhole slit during the latter part of the final stitch forming operation and for retracting said cutter after said slit has been cut, a thread pick-up member, and means rendered operative by and during the retracting movement of said buttonhole cutter for moving said pick-up member into thread receiving position and for moving said member into thread pick-up position when said trimmer has severed the thread.

8. In a buttonhole sewing machine of the type having stitch-forming mechanism including a needle carrying a needle thread, and a stop mechanism that operates to stop the machine upon the completion of a predetermined series of stitch-forming operations by said stitch-forming mechanism, in combination, a buttonhole cutter, means operated and controlled by the stop mechanism for operating said cutter to cut a buttonhole slit immediately prior to the stopping of the machine and during the latter part of the final stitch-forming operation and then retracting the same, a pick-up for the needle thread, and means rendered operative by and during the retracting movement of said buttonhole cutter for moving said pick-up first into thread receiving position and then into thread pick-up position.

9. In a buttonhole sewing machine of the type having stitch-forming mechanism including a needle carrying a needle thread, and a stop mechanism that operates to stop the machine upon the completion of a predetermined series of stitch-forming operations by said stitch-forming mechanisms, in combination, a thread trimmer, means operated by the stop mechanism for operating said trimmer to sever the needle thread substantially coincidentally with the stopping of the machine, a buttonhole cutter, means also operated by said stop mechanism for operating said cutter to cut a buttonhole slit immediately prior to the stopping of the machine and during the latter part of the final stitch forming operation and then retracting the same, a pick-up for the needle thread, and means rendered operative by and during the retracting movement of said button-

hole cutter for moving said pick-up first into thread receiving position and then into thread pick-up position.

10. In a buttonhole sewing machine of the type having stitch-forming mechanism including a needle carrying a needle thread, and a stop mechanism that operates to stop the machine upon the completion of a predetermined series of stitch-forming operations by said stitch-forming mechanism, said needle having a work penetrating movement and a retracting movement during each stitch-forming operation, in combination, a thread trimmer, means for operating said trimmer to sever the needle thread substantially coincidentally with the stopping of the machine, a pick-up for the needle thread, and means for moving said pick-up into thread receiving position during the needle retracting movement of the final stitch-forming operation and thereafter moving it into thread pick-up position when the thread has been severed.

11. In a buttonhole sewing machine of the type having stitch-forming mechanism including a needle carrying a needle thread, and a stop mechanism that operates to stop the machine upon the completion of a predetermined series of stitch-forming operations by said stitch-forming mechanism, said needle having a work penetrating movement and a retracting movement during each stitch-forming operation, in combination, a thread trimmer, means for operating said trimmer to sever the needle thread substantially coincidentally with the stopping of the machine, a pick-up for the needle thread movable into thread receiving and thread pick-up positions, means tending normally to move said pick-up into thread pick-up position, and means for moving said pick-up into thread receiving position during the needle retracting movement of the final stitch forming operation and for thereafter releasing the same to permit it to move into thread pick-up position when the thread has been severed.

DAVID B. THORNTON.