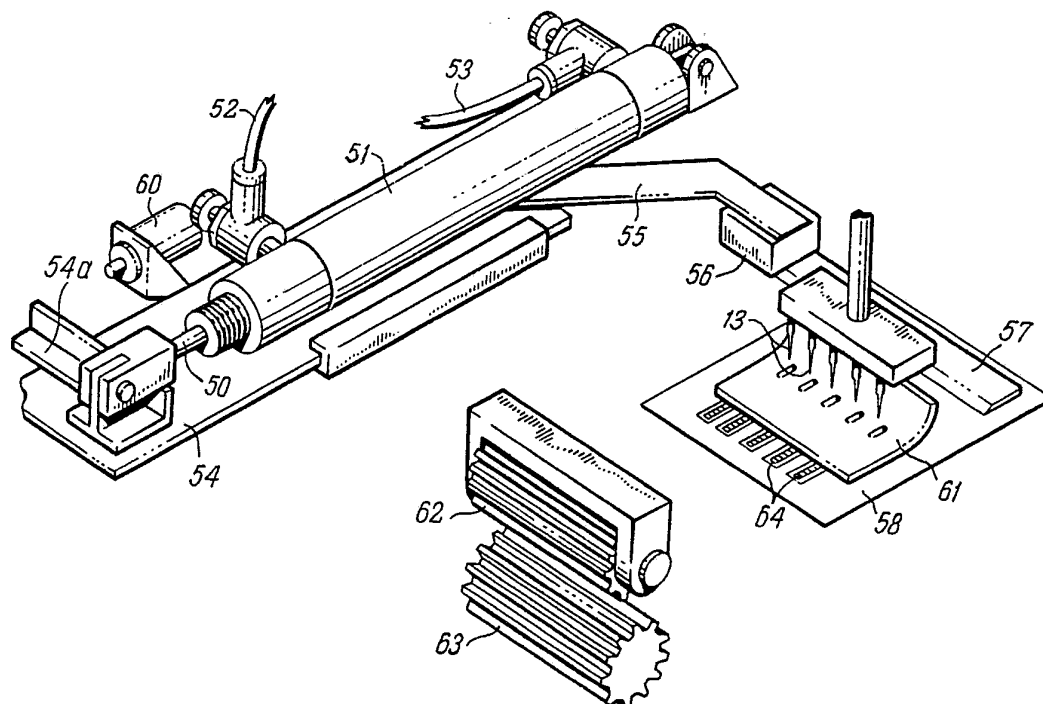




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: THREAD UNDERCUT ATTACHMENT FOR A MULTI-NEEDLE SEWING MACHINE



(57) Abstract

A thread undercut attachment for use on multi-needle sewing machines uses a single piston (51) to actuate a cutting blade (57) which passes through the sewing area beneath the workpiece and above the loopers. To prevent the needles and loopers from becoming unthreaded or to prevent undue lengths of thread extending from either the work product or the needles after cutting, thread pullers (76 and 91) are provided for creating a measured amount of slack in the threads leading to the needles and loopers, and thread brakes (66, 71 and 81, 86) hold the threads firmly to prevent further payout of thread when the workpiece is pulled toward the operator and as the threads are cut.

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-1-

5

10 THREAD UNDERCUT ATTACHMENT FOR A
 MULTI-NEEDLE SEWING MACHINE

BACKGROUND OF THE INVENTION

 This invention relates to method and apparatus for
15 cutting multiple threads in a single, controlled step on
 a work product being sewn by a multi-needle sewing
 machine.

 The use of multi-needle sewing machines for
 simultaneously forming a plurality of rows of stitches in
20 a work piece materially reduces the amount of time
 involved in completing various work products. Such
 multi-needle operation does create problems, however.
 For example, when the work piece having several rows of
 stitches is completed, the operator is required to delay
25 commencing a new sewing operation while the multiple
 threads extending from both the needles and the loopers
 of the machines are cut, usually by hand. It is also
 difficult for the operator to cut the threads
 expeditiously by hand, since it is generally necessary to
30 pull the work product out of the machine and to cut the
 threads with scissors. Such manual operation wastes time
 and thread, since the operator usually must pull the work
 product too far out of the machine in order to see and
 reach the threads, resulting in either the lengths of
35 thread at the needles and loopers being too long, or the

-2-

lengths of thread hanging from the finished work product being too long.

Heretofore, various types of automated thread cutters for mechanically cutting the threads extending from the needles and loopers have been developed. Prior art multiple thread cutters often require individual cutting members for each thread, as shown in U.S. patent 3,139,849 of Cohen et al, which are integral with the sewing machine itself, thus requiring machines especially built for specific applications. Still others, as exemplified in U.S. patent 3,532,065 of Marforio, act to pull the threads to be cut out of the sewing area, thus creating, at least in some cases, unnecessarily long lengths of thread.

Many prior art arrangements are limited with respect to the number of threads that can be cut; some require that the needles be staggered so that separate cutting elements can be applied to individual threads, and, as in the case of the Cohen et al arrangement, many are not adapted for use on a variety of machine configurations. Another characteristic of many prior art devices is the use of two cutters, one for cutting the needle threads, the other for cutting the looper threads, which at least in some arrangements, can only be done at the end of the work piece, and not at some intermediate point.

SUMMARY OF THE INVENTION

The present invention is an improved method and apparatus for cutting multiple threads extending from the work piece to both the needle and the loopers and employs a single cutting member for cutting both sets of threads. When the machine operator finishes sewing a work piece, or when for any reason it is desired to cut the threads, the foot operated control pedal, which in addition to its normal operating positions has a cut position, is moved to

-3-

the cut position by the operator. As a result, a motion control stops the needles in their raised position and the presser foot of the machine is raised.

At the same time, thread slack units are activated
5 to create slack in the threads extending to the needles and to the loopers, and then to hold the threads from the spools firmly. The operator pulls the work piece backwards away from the stitching area until the slack in the threads is removed and the threads are taut. When
10 the threads are taut, a cutting member located beneath the work piece and above the loopers is driven forward, cutting the threads from both the needles and the loopers.

It is, therefore, an object of the present invention
15 to provide an improved method and apparatus for cutting multiple threads extending from a work piece to the needles and loopers of a multi-needle sewing machine with a cutting blade by moving the cutting blade forward beneath the work piece to cut all of the threads at the
20 same time.

It is another object of this invention to provide an improved method and apparatus for controlling the length of the threads being cut in a multiple needle sewing machine by activating thread puller feet to create slack
25 in the threads extending to the needles and the loopers and then engaging and holding the threads with thread brakes to hold the threads taut when the operator pulls back on the work product, enabling a cutter to cut all of the threads in a single stroke.

Still another object of the invention is to provide
30 an improved method and apparatus for cutting with a thread cutter multiple threads from a work piece being sewn by a multi-needle sewing machine leaving enough thread extending from the needles and loopers of the

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-4-

sewing machine so that the needles and loopers remain threaded for the next sewing operation.

It is still another object of the present invention to provide an attachment for a multi-needle sewing machine, with the attachment enabling the operator to cut the threads extending from the needles and loopers to the work piece by pulling the work piece rearwardly while actuating a cutting means which simultaneously cuts all the threads in one cutting operation.

Other objects, features, and advantages of the present invention will become apparent from the following detailed description read in conjunction with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

Fig. 1 is a front perspective view of a multi-needle sewing machine equipped with a thread cutter attachment;

Fig. 2 is a side elevation view showing the action of the cutter blade in the needle area; and

Fig. 3 is a perspective view of the cutting blade and the actuating mechanism therefor.

DETAILED DESCRIPTION

Turning to Fig. 1, there is shown a sewing machine 11 having a head portion 12 from which extends a plurality of aligned sewing needles 13 mounted to needle drive plate 14 and shaft 16 (Fig. 2). A plurality of spools 17 of thread 18 are located adjacent the machine 11 and supply threads 18 to a plurality of creels or tensioning devices 19. From the creels 19 the threads pass through a first thread guide 21, a second thread guide 22, through a thread braking and pulling assembly 23, which will be discussed more fully hereinafter, a third guide 24, a tensioning guide 26, and through fourth and fifth thread guides 27 and 28 to needles 13.

-5-

The looper thread supply is basically similar to the needle thread supply, and comprises a plurality of spools 29 of thread 31 located adjacent the machine. From the spools the threads 31 pass through creels 32, and first and second thread guides 33. From guide 34 the threads 31 pass through a thread braking and pulling assembly 36, thread guide 37, thread tensioning member 38, and thread guide 39 to loopers 41 (Fig. 2). As thus far described, the arrangement of Fig. 1 is a standard multi-needle type sewing machine except for thread braking and pulling assemblies 23 and 36, and guides 22, 24 and 34, 37, which will be explained more fully hereinafter.

Control of the machine 11 is through an operator actuated control pedal 42 which is connected by a crank assembly 43 to a control box 44. Control box 44 controls drive motor 46 and also the various elements of the thread cutting components of the present invention. The entire mechanism is turned on and off by a suitable switch 47.

Mounted on the bed 48 of the machine 11 is the cutting mechanism 49 of the present invention.

As illustrated in Fig. 3, cutting mechanism 49 comprises a cylinder and piston assembly 51 which can be either hydraulically or pneumatically operated through fluid or air supply conduits 52, 53. Piston rod 50 reciprocates slide plate 54 which carries laterally extending blade support arm 55, blade support block 56 and thread cutting blade 57. Pilot valve 60 is actuated by the extension 54a of slide plate 54 during the reciprocation of the cutting blade 57. It can be seen in Fig. 2 that blade 57 is located above bed 48 and throat plate 58 but below the work piece 59 and presser foot 61. Also shown in Fig. 2 are feed rollers 62 and 63 which function to pull the work piece 59 through the sewing area and keep it aligned properly. Feed dogs 64 (Fig.

3), also function to feed the work piece 59 through the sewing area. Feed dogs are standard equipment on most sewing machines.

5 In Fig. 2, thread cutting blade 57 is shown in dashed outline in its normal position in front of the needles where it stays during the sewing operation and is also shown in solid line in its cutting position. In Fig. 3, the blade 57 is shown in its normal position.

Returning to Fig. 1, upper thread braking and
10 pulling assembly 23 comprises a first brake or nipper cylinder and piston 66 which may be either pneumatically or hydraulically actuated. A piston rod extension 67 has a foot 68 mounted on its free end adapted to fit within a U-shaped plate 69. As can be seen in Fig. 1, threads 18
15 pass over the upturned ends of plate 69 and beneath shoe 68. When the piston and cylinder unit 66 is actuated, shoe 68 is driven down against threads 18, pressing them firmly against plate 69, thereby effectively braking the threads. Assembly 23 also includes a second brake or
20 nipper cylinder and piston 71, extended piston rod 72, foot 73, and plate 74, which function in the same manner as the elements of the first brake. Situated between brake element 65 and 71 is a thread puller cylinder and piston 76, having an extended piston rod 77 with a foot
25 78 mounted on the free end thereof. When cylinder and piston unit 76 is actuated, foot 78 presses down against thread 18 to create slack in the threads extending between brake foot 73 and creels 19.

Lower thread braking and pulling assembly 36 is
30 virtually identical to upper assembly 23, operating on the looper threads 31 in the same manner as assembly 23 operates on needle threads 18. Assembly 36 comprises a first brake unit having a cylinder and piston unit 81, extended piston rod 82, foot 83, and plate 84. A second
35 brake unit comprises cylinder and piston unit 86,

-7-

extended piston rod 87, foot 88, and plate 89. Between units 81 and 86 is located puller cylinder and piston unit 91 having extended rod 92 and foot 93. Fluid conduits 94, 96, and 97 supply actuating fluid to units 5 81, 86, and 91, respectively. While both assemblies 23 and 36 have been shown and discussed as either pneumatically or hydraulically actuated, it is also possible that they be solenoid operated. In addition, no fluid supply, either hydraulic or air, has been shown, 10 inasmuch as such elements are of standard design and their operation is well known.

It can readily be seen that the thread cutting unit 49 and brake and pulling units 23 and 36 are not integral parts of the sewing machine 11 but are readily attachable 15 thereto. Together these elements constitute a thread cutting assembly readily attachable to a variety of sewing machines.

OPERATION

20 During normal sewing operation, none of the piston units of assemblies 23, 36 and 49 is actuated, the cutting blade 57 is in its normal position as shown in Fig. 3, and feet 68, 73, 78, 83, 88, and 93 are in the raised position, out of contact with threads 18 and 31. 25 When the sewing operation is completed, or when, for any reason the operator wishes to cut the threads, the operator moves the foot pedal 42 (Fig. 1) to the cutting position. A motion control means in the control box 44 connected to the control pedal 42 by a control rod 43 and 30 linkage, engages upon movement of the control pedal and elevates the needles 13, 15 and the presser foot 61 away from the workpiece 59. Such a control means is standard equipment on most machines and examples are described in U.S. Patents 3,590,969 and 3,804,043. Immediately 35 thereafter piston units 71 and 86 are actuated, braking

-8-

the thread to the needles and loopers. While the threads are thus braked, thread puller units 76 and 91 are actuated, pushing down on the threads and creating slack in the threads between the actuated brakes 71 and 86 and the creels. As soon as the threads are depressed to form slack in the threads, as shown in Fig. 1, brake units 66 and 81 are actuated, braking the threads, and brake units 71 and 86 are released, leaving a loop of slack in the thread extending from the actuated brake to the needles and to the loopers.

When the slack has been formed in both needle and looper threads, the operator pulls back on the workpiece, pulling the slack from the threads to both the needles and loopers, and the cutter piston unit is actuated, causing the cutter blade 57 to pass through the sewing area and cut the threads coming from both the needles and the loopers, leaving both needles and loopers still threaded. One of the purposes for creating slack in the threads just prior to cutting is to insure that there will be sufficient thread to avoid unthreading either the needles of the loopers and to insure that a sufficient length of threads remains on the work product.

The timing of the various steps is controlled by the control box 44, and can be varied to suit the operator. However, the sequence remains the same.

Although a single, straight edge cutting blade 57 has been illustrated and described for the purpose of cutting the threads extending from the work product, other thread cutters can be substituted for the blade, if desired. For example, a serrated blade or a pair of reciprocable serrated blades can be used, or other cutters of relatively flat configuration can be used which can pass beneath the work product.

The foregoing has been a description of the invention in a preferred embodiment thereof. Numerous

-9-

modifications, additions, or deletions may readily occur to workers in the art without departure from the spirit and scope of the invention.

CLAIMS

1. An attachment for a multi-needle sewing machine of the type including a thread supply, a plurality of reciprocable needles and loopers receiving threads from said thread supply, a presser foot, means for advancing a work product beneath the needles, and a motion control means for stopping needle movement with the needles and presser foot in a raised position, said attachment characterized by a cutting member normally positioned in front of the needles, cutting member moving means for moving said cutting member in the direction of movement of the work product from a position in front of the needles through the area beneath the needles and presser foot, beneath a workpiece and above the loopers into cutting contact with threads extending from the workpiece to the loopers.

2. The attachment as claimed in claim 1 and further characterized by a first thread braking and pulling means for creating slack in the threads extending from the thread supply to the needles and including means for holding the threads taut when the workpiece is pulled from the sewing area.

3. The attachment as claimed in claim 2 and further characterized by a second thread braking and pulling means for creating slack in the threads extending from the thread supply to the loopers and including means for holding the threads taut when the workpiece is pulled from the sewing area.

4. The attachment as claimed in claim 1 and further characterized by the cutting member comprising a horizontal cutting blade and said means for moving said cutting member comprising a fluid actuated cylinder including a piston connected to said cutting blade.

-11-

5. A multiple needle sewing machine having a plurality of needles and loopers and thread supplies for supplying threads to the needles and loopers, characterized by first and second thread control means, each of said thread control means comprising a first thread braking member and a thread pulling member positioned between the needles and loopers and their thread supplies, each of said first thread braking members including a braking foot and a braking plate and each of said thread pulling members including a thread pulling foot.

6. The thread control means as claimed in claim 5 further characterized by each of said thread control means further including a second braking member located on the other side of said thread pulling members from said first thread braking member, each of said second thread braking members including a braking foot and a braking plate.

7. The thread control means as claimed in claim 5 further characterized by each of said thread braking members and each of said thread pulling members comprising a fluid actuated cylinder and piston and includes an extended piston rod to which said foot is attached.

8. In a multiple needle sewing machine of the type including a plurality of reciprocated needles and loopers, a presser foot, feed means for moving a work product along a path beneath the needles, thread supplies for supplying threads to the needles and the loopers, and a motion control means for stopping the motion of the needles with the needles and the presser foot in a raised position, the improvement therein comprising;

cutting means positioned in front of the needles,

means for moving said cutting means beneath the needles and the presser foot and in the direction of the path of the work product when the needles and the presser foot are in the

-12-

raised position into cutting contact with threads extending from the workpiece to the loopers.

9. In a multiple needle sewing machine, the improvement as claimed in claim 8 and further characterized by first and second thread control means, each of said thread control means comprising first and second thread pulling means for pulling a measured amount of slack in the threads from the thread supplies to the needles and to the loopers, and brake means for preventing additional thread being drawn to the needles and loopers.

10. In a multiple needle sewing machine, the improvement as claimed in claim 9 and further characterized by said means for moving said cutting means and each of said thread pulling means and said brake means comprises a fluid actuated cylinder and piston.

11. A method of cutting threads extending from the needles and loopers of a multiple needle sewing machine to the workpiece sewn by the machine comprising the steps of

terminating the sewing operation of the machines with the needles and presser foot raised from the workpiece,

pulling additional lengths of needle and looper threads from the source of supply of the threads,

pulling the workpiece away from the needles,

moving a cutting member beneath the workpiece in a direction opposed to the direction that the workpiece is pulled and

engaging and cutting with the cutting member the threads extending from the workpiece toward the loopers of the sewing machine.

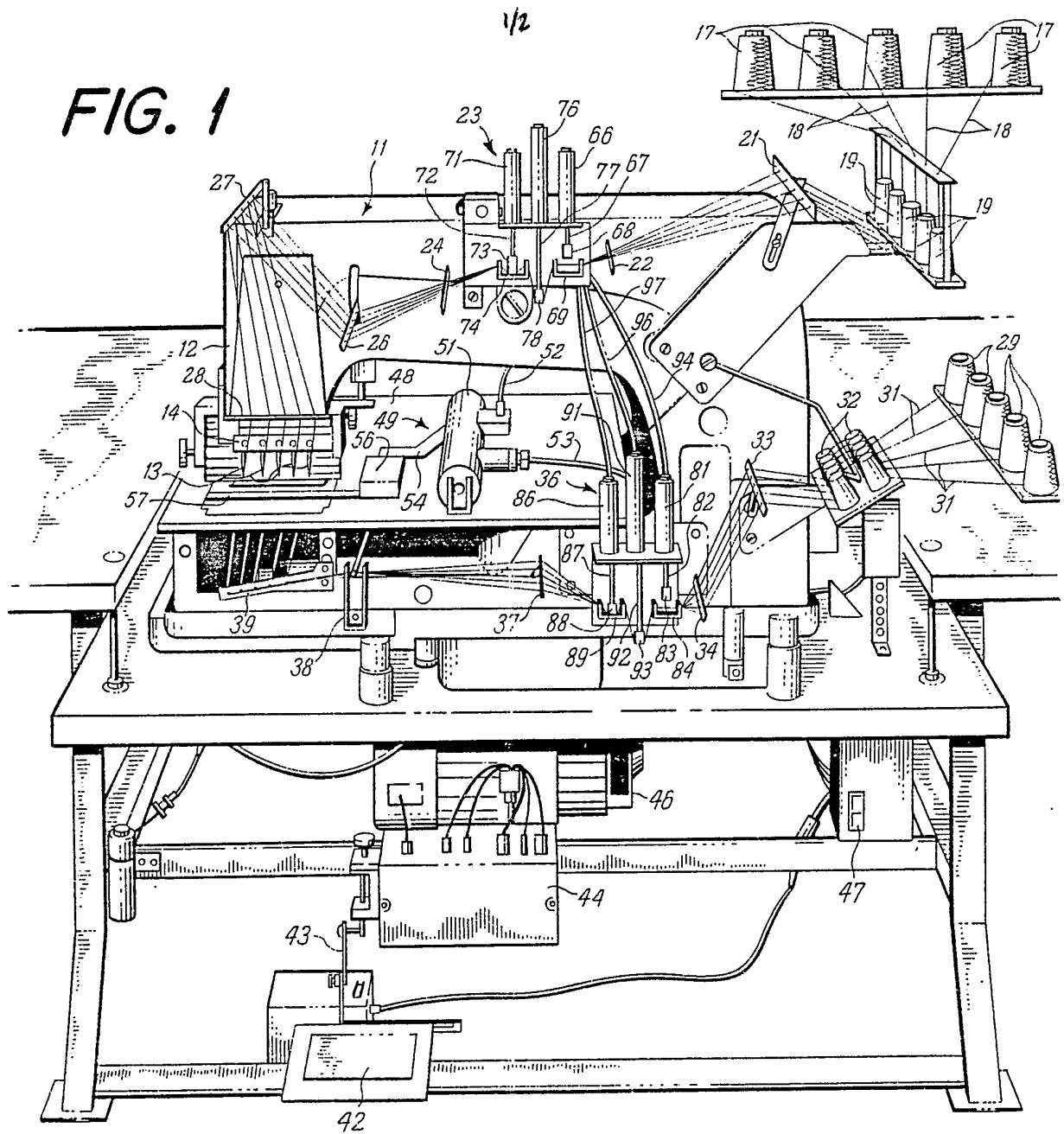
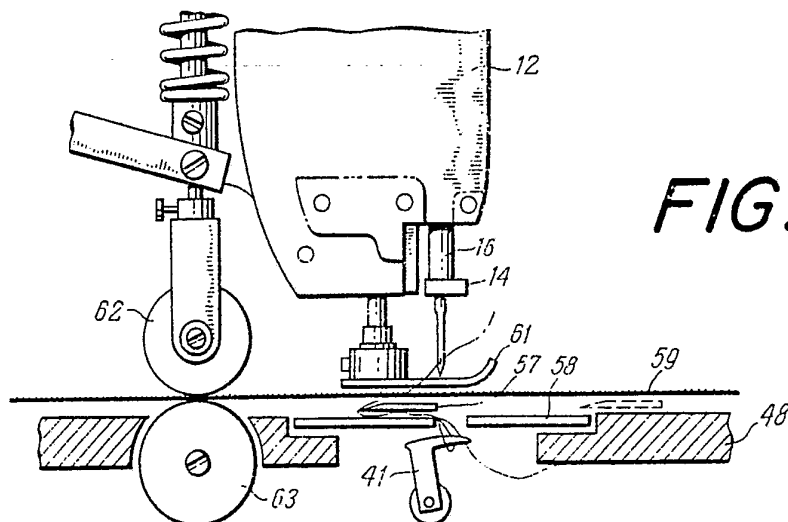
-13-

12. A method of cutting threads as claimed in claim 11 and further characterized by the step of preventing additional lengths of needle thread from being pulled from the source of supply of the needle threads while the workpiece is being pulled away from the needles.

13. A method of cutting threads as claimed in claim 12 and further characterized by the step of preventing additional lengths of looper thread from being pulled from the source of supply of the looper threads while the workpiece is being pulled away from the loopers.

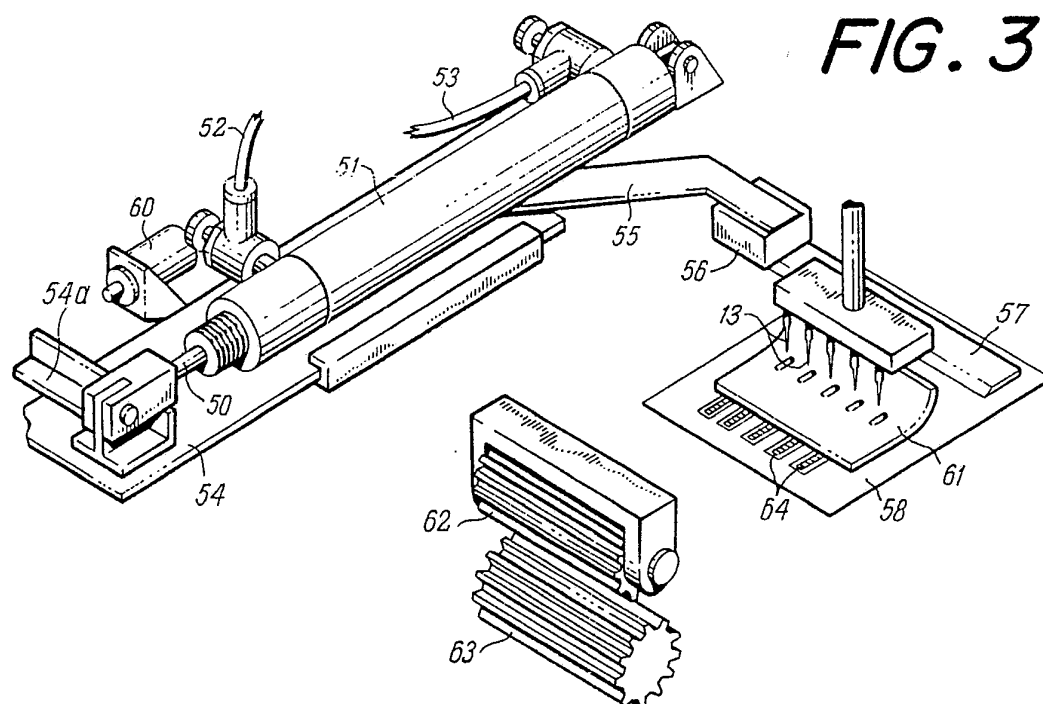
14. A method of cutting threads as claimed in claim 13 and further characterized by the step of preventing thread from being pulled from the needles while additional lengths of thread are being pulled from the source of supply of the needle threads.

15. A method of cutting threads as claimed in claim 14 and further characterized by the step of preventing thread from being pulled from the loopers while additional lengths of thread are being pulled from the source of supply of the looper threads.

FIG. 1**FIG. 2**

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FIG. 3



INTERNATIONAL SEARCH REPORT

International Application No. **PCT/US88/04332**

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC INT CL (4): D05B 57/02; D05B 65/02 US CL: 112/292; 112/255; 112/166; 112/301; 112/262.1		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
US	242/147.R; 112/291, 292, 301, 295, 255, 239, 197, 166, 262.1, 163, 295 298, 294, 296, 297	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X	IT,A, 716,849 (GIUSEPPE) 15 Oct. 1966 Note the braking means 25 and 26 and pulling foot 15, 16.	5
X	US,A, 3,648,634 (VAN HAZENDONK) 27 April 1970. Note the loop taking hook on line 4 in column 3.	1, 4
A	US,A, 4,461,229 (ANGELE ET AL) 7 July 1984	
A	US,A, 3,532,065 (MARFORIO) 6 October 1970	
X	JP,A 6152894 (SEISAKUSHO) 15 March 1986 Note the plural loopers 13 in Fig. 1.	1, 4, 8
Y	US,A, 3,804,043 (BENSON ET AL) 20 Jan., 1970 Note the needle positioner in Fig. 3.	1, 4, 8
X	US,A, 3,139,849 (COHEN ET AL) 7 July, 1964 Note the blade portion 120 in the front of the needle aperture 96.	1, 8
* Special categories of cited documents: ¹⁰ "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
25 January 1989	18 APR 1989	
International Searching Authority	Signature of Authorized Officer	
ISA/US	Andrew Falik	

X	US,A, 4,459,925 (MIYACHI ET AL) 9 September 1982. Note the blade 225 in Fig. 14.	1, 4, 8
A	US,A, 1,013,252 (WOOD) 2 January 1912	
A	US,A, 2,968,269 (SMITH ET AL) 17 January 1961	
A	US,A, 3,359,933 (BONO) 26 December 1967	
A	US,A, 4,303,030 (PALACINO ET AL) 1 December 1981	
A	US,A, 4,421,045 (PORTILLA) 20 December 1983	

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

- VI.
- ☐
- OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING²**

This International Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.
2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:
3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:
4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

- ☐ The additional search fees were accompanied by applicant's protest.
☐ No protest accompanied the payment of additional search fees.

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	US,A, 4,558,654 (SCHILLING ET AL) 17 December 1985	
A	DE,A, 2,165,186 (MAIER ET AL) 16 August 1973	