United States Patent [19]

Kuhn

[11] **3,808,994**

[45] **May 7, 1974**

[54] **ARRANGEMENT FOR MAKING KNOTTED CHAIN STITCH SEAM**

[76] Inventor: **Jean Kuhn,** Bundersrepublic, 6369 Schoneck II, Germany

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[21] Appl. No.: **276,413**

[52] **U.S. Cl.**..... **112/199,** 112/262, 112/438, 112/212, 112/235

[51] **Int. Cl.**... **D05b 1/06,** D05b 27/06, D05b 29/08

[58] **Field of Search** 112/116, 156, 165, 166, 112/197, 199, 221, 252, 262, 438, 212, 235

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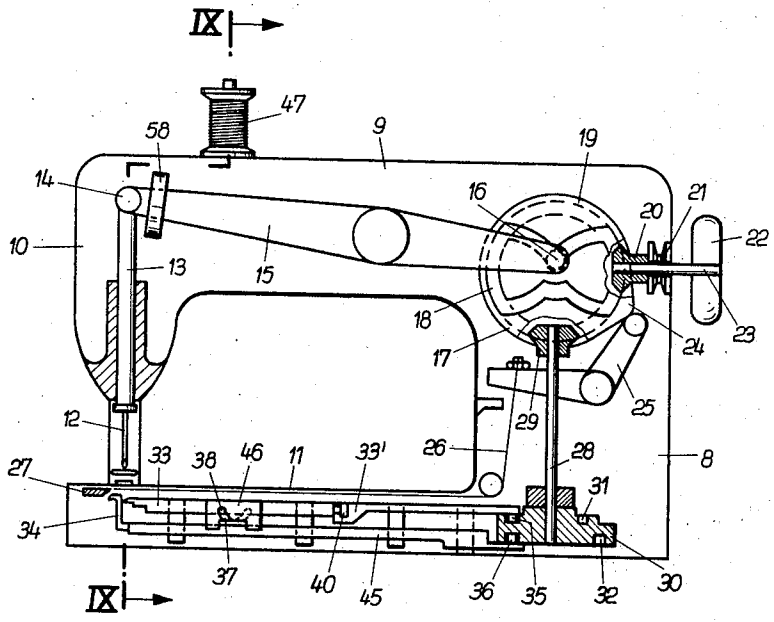
Primary Examiner—Werner H. Schroeder
Attorney, Agent, or Firm—Michael S. Striker

[57] **ABSTRACT**

A chain stitch seam with knotted needle loop is formed by twice inserting a needle at the same point of the fabric in such a manner that the loop developed during the first part of the movement forms a knot which connects the loop of the preceeding knot with the loop formed during the second part of the needle movement.

10 Claims, 38 Drawing Figures



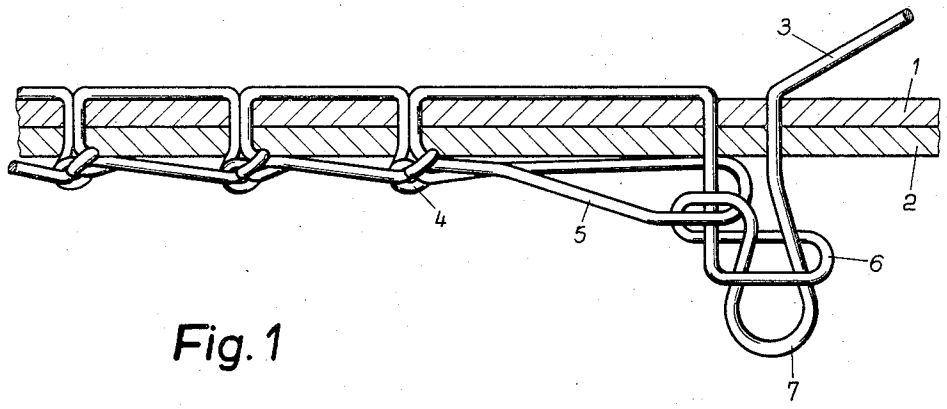

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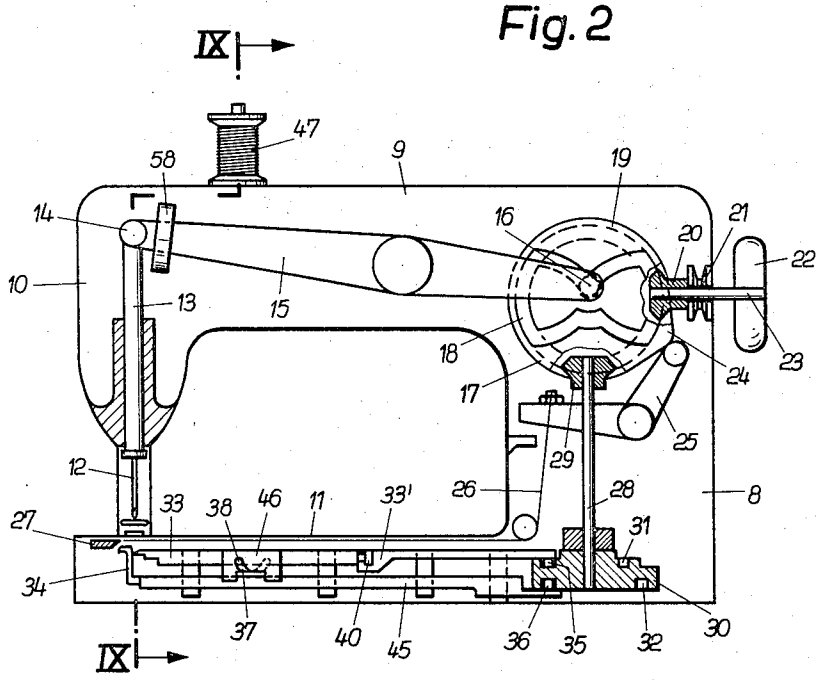
Fig. 1

Fig. 2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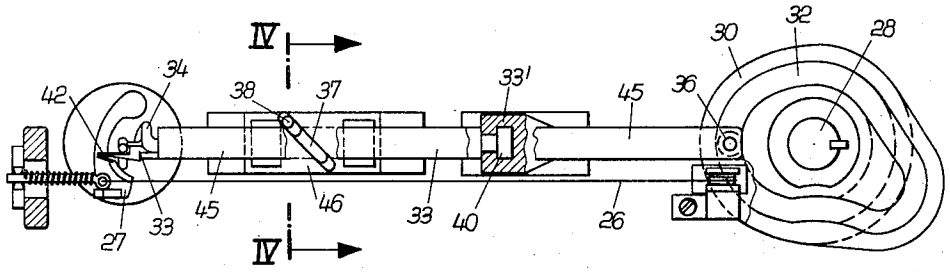

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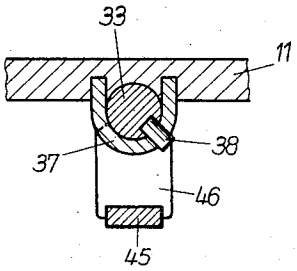
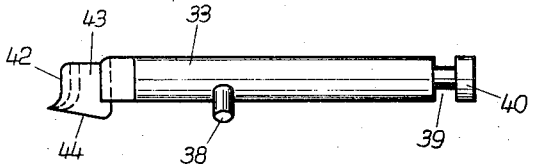


Fig. 4

Fig. 5



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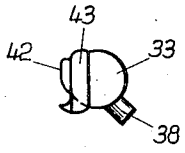

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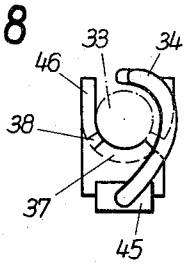

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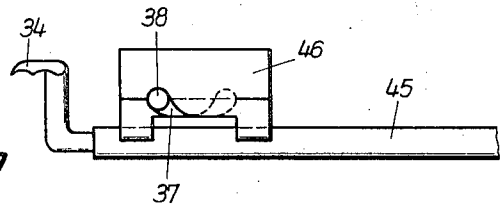

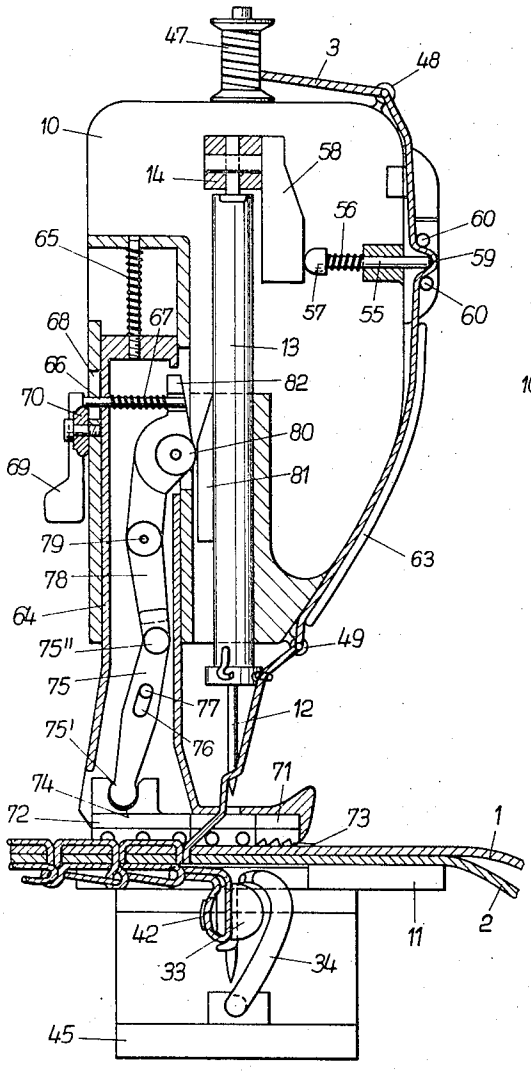
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Fig. 9

Fig. 10

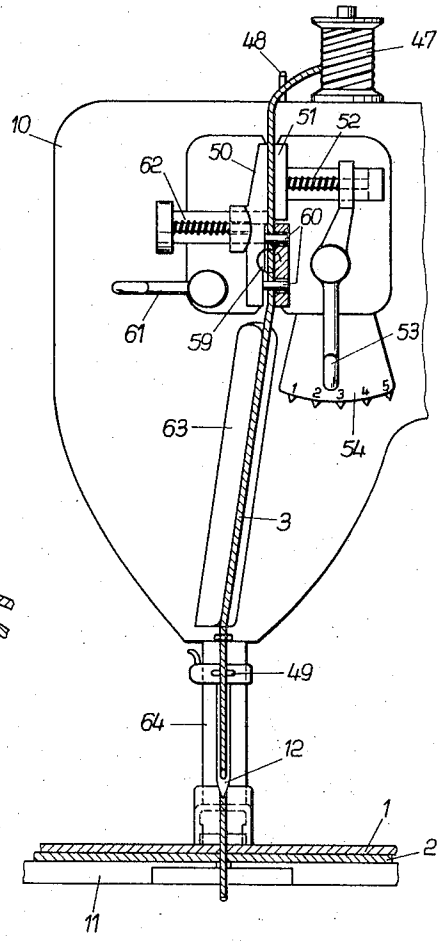
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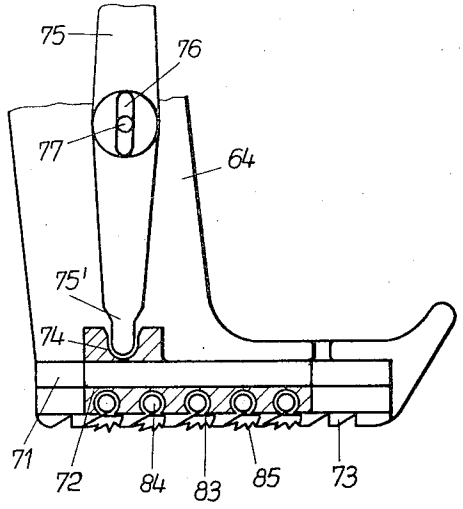
Fig. 11



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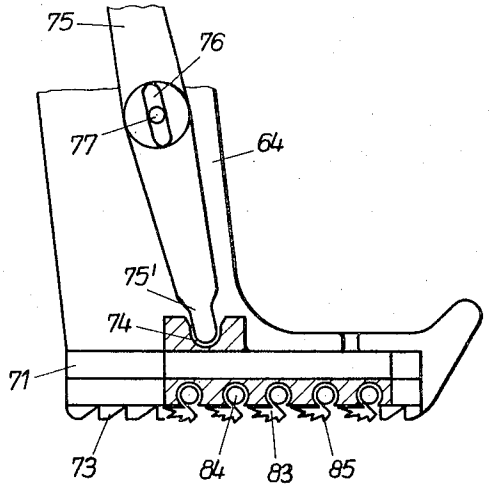

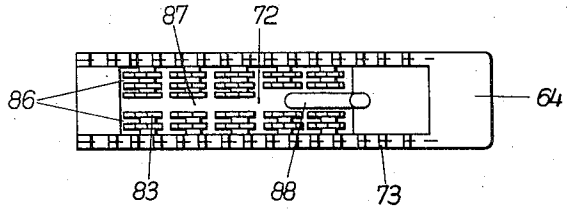

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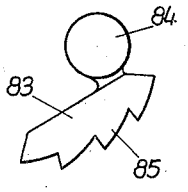
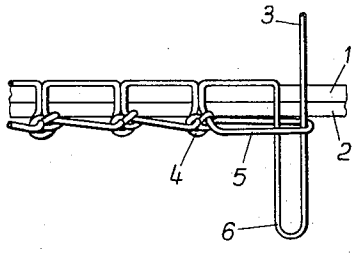


Fig. 13

Fig. 15



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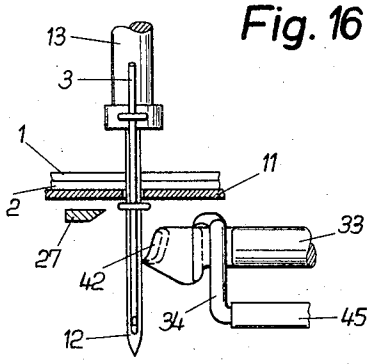

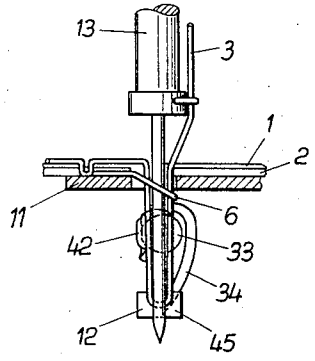

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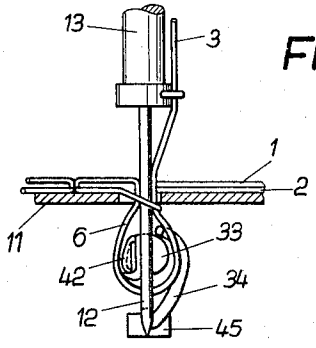

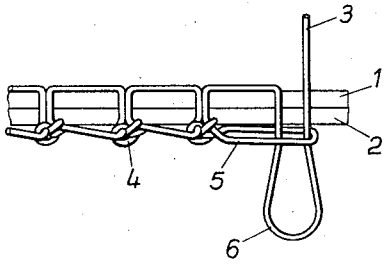

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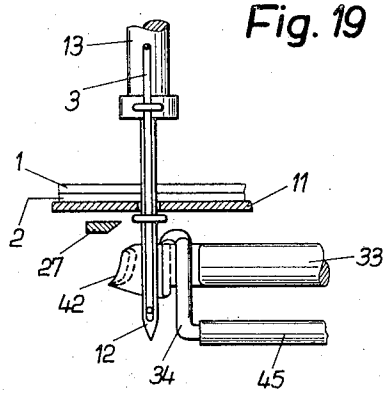

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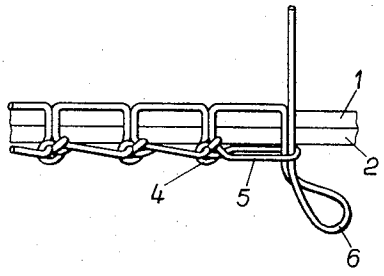

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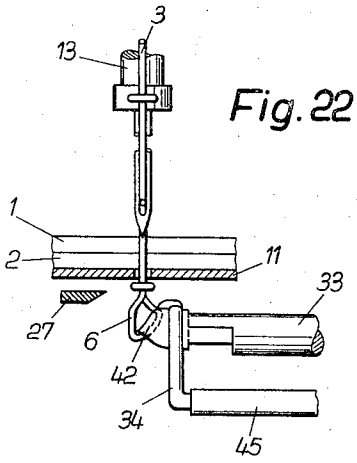

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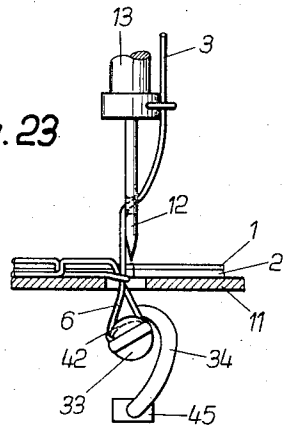

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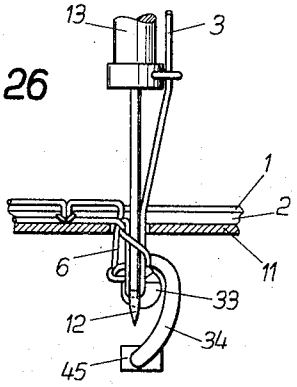

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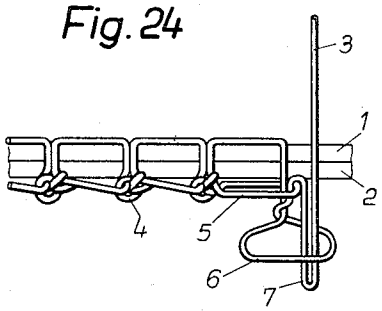

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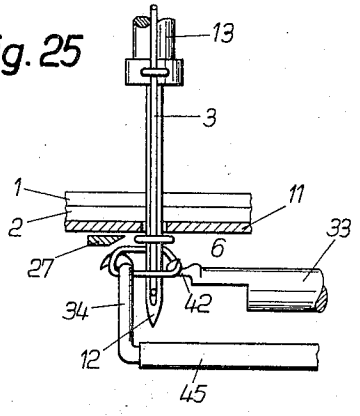

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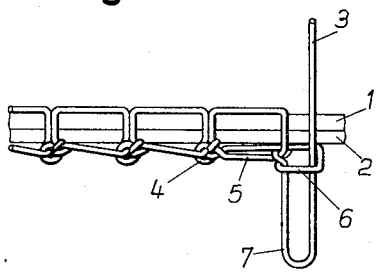

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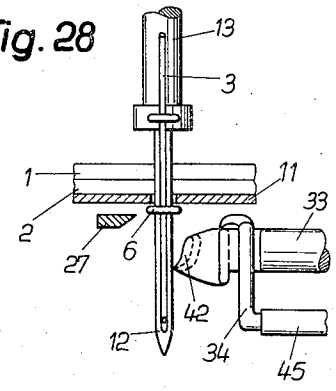

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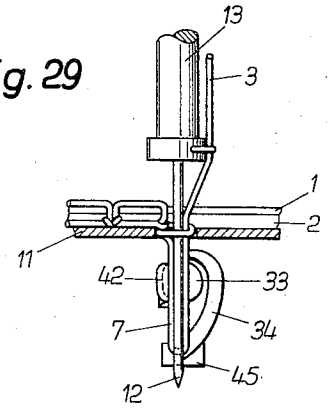

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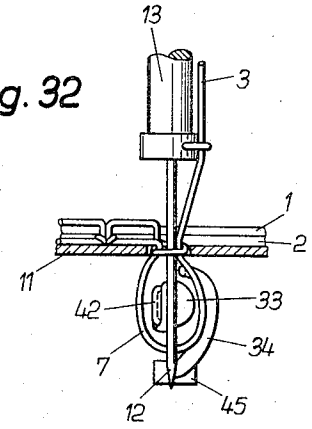

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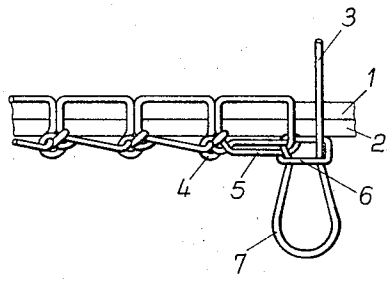

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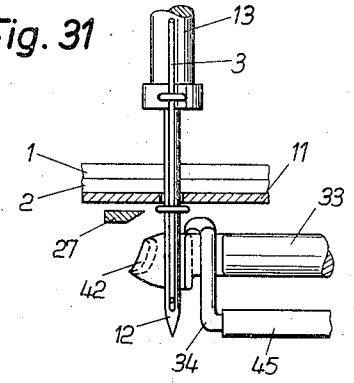

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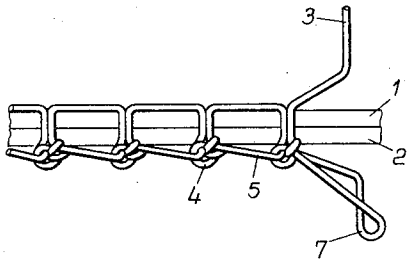

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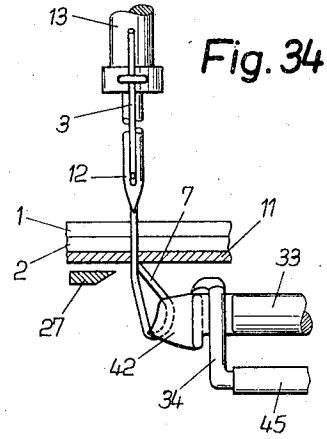

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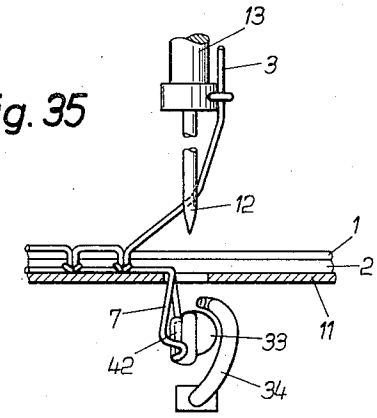

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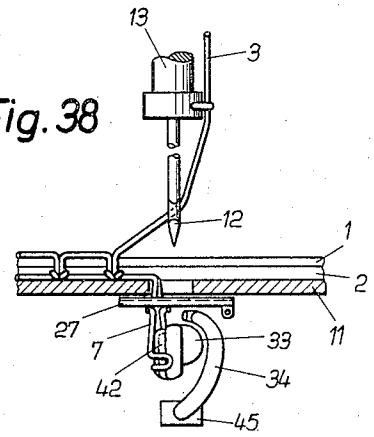

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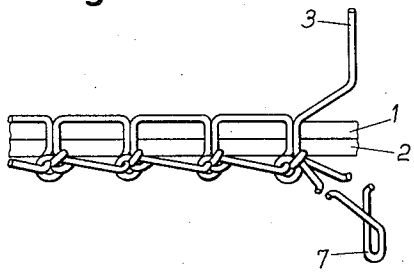

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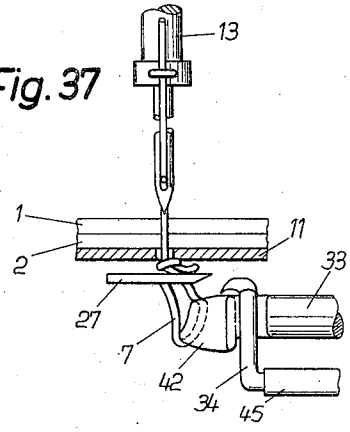

ARRANGEMENT FOR MAKING KNOTTED CHAIN STITCH SEAM

BACKGROUND OF THE INVENTION

The present invention relates to a chain stitch seam with knotted needle loops whose knots are formed by a needle twice entering the same point of a fabric. In seams of this type, the thread loops are knotted and secured so that they cannot be opened upon damage or destruction of thread portions.

The U.S. Pat. No. 2,906,224 discloses a manual operation for making a seam of this type. Since the thread cannot be tightened after the making of the knot, the thread of the seam only losely engages the connected parts so that such seams are not suitable for sewing expensive furs or leather goods.

It is the object of the invention to provide an arrangement of thread loops for a single thread chain stitch seam, which can be made on a machine, and in which the individual thread loops can be tightened during the making of a knot.

SUMMARY OF THE INVENTION

With this object in view, the thread loops made during the first part of the needle movement, form a knot which can be tightened, and connects the loop of the preceeding knot with the thread loop formed during the second part of the needle movement.

The making of such a seam is advantageously carried out by introducing the loop formed during the first part of the needle movement, into the loop of the preceding knot, so that the needle during further downward movement, tightens the knot, while during the following upward movement of the needle, the loop is held and turned an angle of 90°, whereupon the loop formed during the second part of the needle movement, is introduced into the ready loop at the entering point of the needle into the fabric, and is knotted with the loop of the preceding knot during further downward movement of the needle, whereupon the loop of the last formed knot is placed in a position of readiness for a new stitch at the stitching point, or is cut by a cutting device when the sewing operation has been completed.

For making a single thread chain stitch seam in accordance with the invention, a machine according to the invention is used, whose needle is secured to an up and down reciprocating needle bar which is driven from a rotary cam by means of a lever, while the feeding of the fabric is carried out by feed dog slide. The cam track of the rotary cam is preferably shaped in a butterfly pattern and provided with a gear crown with which a gear, secured to the drive shaft, meshes. The gear crown is connected by another gear with a cam disk which controls the loop catch and a loop opener. The cam having the gear crown, may be provided with a lug operating the cutting means for the yarn.

It is advantageous to arrange the loop catch and a loop opener slidable parallel to the axis, and to couple the loop catch and the loop opener in such a manner with a cam groove on the loop opener, which is engaged by a pin mounted on the shaft of the loop catcher, in such a manner that the loop catcher is tilted about its longitudinal axis when the relative movement caused by the two guide cams starts.

Another modification provides the needle bar and lever with means controlling the thread supply in such

a manner that upon pulling of the thread loop, and tightening of the knot, an increase of the thread tension is obtained.

In accordance with another feature of the invention, the fabric feeding dog is provided at the presser foot, and controlled by a cam mounted on the needle bar by means of a linkage. The fabric feeding dog is provided with eccentrically arranged coupling portions which are provided with saw teeth and grooves on an arcuate surface abutting the fabric. The stroke length of the feed dog can be adjusted by an adjustable shaft mounted in the presser foot on which a lever with an elongated slot is mounted. Furthermore, the feed dog can be lifted from the fabric by means of a cam acting on the presser foot, and arrested in the high position.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a sectional view illustrating a seam with knotted stitches;

FIG. **2** is a longitudinal section illustrating a sewing machine for making the seam shown in FIG. **1**;

FIG. **3** is a fragmentary plan view illustrating the loop catch and a loop opener arranged under the machine table;

FIG. **4** is a fragmentary sectional view along the line A–B in FIG. **3**;

FIG. **5** is a side view of the loop catch;

FIG. **6** is a front view of the loop catch;

FIG. **7** is a side view of the loop opener;

FIG. **8** is a front view of the loop opener;

FIG. **9** is a longitudinal section taken on line C–D in FIG. **2**;

FIG. **10** is a plan view of a thread tensioning and thread drawing devices provided in the head of the sewing machine;

FIG. **11** is a fragmentary side view of an enlarged scale, illustrating the lower portion of the presser foot during the transporting of the fabric;

FIG. **12** is a view corresponding to FIG. **11** and illustrating the lower part of the presser foot during the return to the initial position;

FIG. **13** is a fragmentary detail, illustrating on an enlarged scale, a coupling member arranged in the slide of the presser foot;

FIG. **14** is a bottom view illustrating a presser foot provided with a slide and coupling members; and

FIGS. **15–38** are fragmentary side views illustrating successive operational position of the needle and loop forming parts during the knot formation.

DESCRIPTION OF THE PREFERRED EMBODIMENTS:

In the thread loop pattern for a single thread chain stitch seam in accordance with the invention as shown in FIG. **1**, the needle, not shown in FIG. **1**, twice punctures the two superimposed fabrics **1** and **2** at the same point. The sewing thread **3**, is introduced during the forward needle movement into the prepared loop **5** of

the preceeding knot 4. The loop 6 formed in this manner, is held during the upward movement of the needle, and turned 90° so as to be ready at the entering point of the second part of the stitch. The needle introduces thread 3 into loop 6, and then tightens the knot formed in this manner, whose knot loop 7 is placed at the new puncturing point. By cutting the last knot loop 7 at the point indicated by broken line, opening of the seam is prevented.

FIG. 2 illustrates a sewing machine by which the chainstitch seam according to the invention can be made. The sewing machine has a post 8 connected with arm 9 which carries the machine head and mounted on a carrier plate 11 provided on a machine table, not shown. The carrier plate 11 serves as support for the two fabrics 1 and 2 during the sewing operation. Needle 12 is secured to a needle bar 13 which is reciprocable in the machine head 10, and is articulated at the upper end thereof by means of a guide fork 14 with a needle bar lever 15. Lever 15 is also mounted in arm 9 of post 8, and has at its free end, a roller 16 engaging a guide cam 18 which has a butterfly-like outline, and causes an up and down movement of the needle bar lever 15. The relation between the lengths of the arms of needle bar lever 15, determins the maximum stroke of the needle bar 13. The moment of advance, and the length of the stroke of the needle are determined by the guide cam 18 so that during one revolution of 360°, two stitches are effected. The cam 17 is provided on its other side with a gear crown or gear ring 19, and is driven by bevel gear 20 which is secured to a drive shaft 23 which is provided with a V-pulley and with a manual wheel 22.

At the outer periphery of cam shaft 17, a lug 24 is provided which operates by means of a pivotally mounted angular lever 25 and by a connecting wire 26, the thread cutter 27. Lug 24 is positioned on cam 17 so that the cutter 27 becomes operative only after a knotting operation has been completed. The parts required for forming the knots are shown in FIGS. 3 and 4 for parallel movement under the carrier plate 11, and are driven from a shaft 28, mounted in the post 8, by means of a bevel gear 29 meshing with the gear crown 19. At a lower end of shaft 28 a cam 30 is secured which is provided on both sides with guide cams 31 and 32. The cam 30 controls a double catch 33 and a loop opener 34 which respectively engage the guide cams 31 and 32 by rollers 35 and 36. In order to obtain the desired knotted stitch, it is necessary for the cam 30 to rotate at twice the speed as compared with the cam 17 which drives the needle bar lever 15. Since the two cams 31 and 32 do not register, a relative movement takes place between the loop catch 33 and a loop opener 34 which causes turning of the forward portion of the loop catch 33 about its longitudinal axis. This angular movement is effected by guide groove 37 provided on the loop opener 34, the guide groove 37 being engaged by the coupling pin 38 secured to the forward part of the loop catch 33.

The forward part of the loop catch 33 illustrated in FIGS. 5 and 6, is cylindrical and has at its rear end, an annular recess forming a collar 40 which fits into a recess 41 provided in the rear part 33'. The coupling pin 38 is fixedly secured with the loop catch 33. At the end of the loop catch 33 near the needle, loop catch 33 is twice recessed, and provided with a hook shaped thread tongue 42 which is pointed toward the needle eye in a shape similar to the forward end of a ski. The thread guiding surface 43 has a paraboloid rim 44.

FIGS. 7 and 8 illustrate the loop opener 34, whose offset end is secured to a prismatic rod 45 which is controlled by roller 36 from the guide cam 32. A supporting bracket 46 is secured to rod 45 and provided with a guide groove for the coupling pin 38. Bracket 46 supports the loop catch 33. Due to the great wear to which the loop catch 33 and the loop opener 34 are subjected, they are made of a wear resistant bendable and hardenable material.

The devices for tensioning the thread and for pulling off the thread, are shown in FIGS. 9 and 10. The thread 3 is pulled from a spool 47 and is threaded through the upper eye 48 of a combined thread tensioning and thread pulling off device, and from there guided through the eye 49 to the needle 12. The thread tensioning device is arranged in the head 10 of the sewing machine, and includes two clamping members 50 and 51 which engage the thread due to the pressure of spring 52 to produce the thread tension required for the formation of the knots. The pressure of spring 52 can be adjusted to five different yarn tensions by operation of a lever 53 cooperating with a scale 54 indicating five different thread tensions.

The pulling off device for the thread includes a yarn feeding pin 55 which abuts a cam plate 58 secured to the upper part of the needle bar lever 15, and being biassed by spring 56. The front end of thread feeding pin 55 has a slot 59 for guiding the thread 3 so that slipping off of the thread is prevented. The feeding pin 55 is operated by the cam plate 58 during the reciprocating up and down motion of needle bar 13 so that at the beginning of the entering of the needle into the fabric, so much thread 3 is pulled off the supply spool 47, as is required for making one knotted stitch. In order to assure equal length of the fed thread, the thread 3 is guided about two pins 60. When the needle 12 moves downward, the cam plate 58 holds the thread feeding pin for a certain period of time in the illustrated position, so that the pulling off of the thread is blocked. As a result, the needle 12 must draw the required length of thread out of the interconnected loops 5 and 6 so that the same are reduced in size and tightened. Only after the feeding pin 55 has been released by the cam plate 58, needle 12 can pull the additional required length of thread off the yarn spool 47, and this operation takes place during the first and second parts of the stitch.

In order to facilitate the placing of thread 3 into the thread tensioning and thread pulling off device, the clamping members 50, and the abutment pins 60 are pivotally mounted on the head 10 of the sewing machine. The two pins 60 are secured to the downward extended portion of clamping member 50, and can be turned therewith by means of an angular lever 61 to the left as viewed in the drawing. A pressure spring 62 acting on the angular lever 61 returns the seam automatically to the initial position when the handle portion is released.

In order to protect the thread 3 against interference from the outside, and also to permit observation of the thread 3, a transparent cover 63, which can be easily removed, is provided.

The fabric feeding means is combined with the presser foot 64 to form a unit. Presser foot 64 is secured to the head 10 of the machine, and is biassed by a spring 65 against the two superimposed fabrics 1 and

2 which are to be sewn together by a knotted seam. Fabrics 1 and 2 rest on the carrier plate 11 and are pressed against the same by the biassed presser foot. On the upper part of head 10, a guide pin 66 for the pressure spring 67 is mounted whose front end passes through a guide slot 68 provided in the head 10 of the machine, and abutting a lifting cam disk 70 provided on the presser foot lever 69 so that upon operation of the presser foot lever 69, presser foot 64 is lifted off the superimposed fabrics 1 and 2. The lower part of presser foot 64 is open, and provided at both sides with guide grooves 71 into which a slide 72 is inserted for serving as a feeding dog. The lower surface of presser foot 64 is provided with saw teeth 73 which are arranged in the direction of the movement of the fabric. The slide or feeding dog 72 has at its rear end, a bearing portion 74 which is engaged by the rounded end 75' of lever 75. Lever 75 has a slot 76 by which it is mounted on a pivot pin 77 in presser foot 64. At the other end of the double lever 78, a roller 80 is secured which engages a cam plate 81 secured to needle bar 13. Furthermore, a spring dish 82 is mounted at the outer end of the lever, on which a pressure spring 67 arranged on the guide pin 66, abuts. By the action of the up and down reciprocating cam plate 81, the slide 72 is reciprocated by the toggle levers 75 and 78. The under side of the slide 72 has part circular coupling members 83 which have journal pins 84 mounted in the side walls of feeding dog 72. The circular surfaces of the coupling members 83 are provided with saw teeth 85 which are arranged in a direction of the fabric movement. The pitch of teeth 85 is substantially smaller than the pitch of teeth 73 of presser foot 64. During the transporting movement of the feeding dog 72, the coupling members 83 rise due to the eccentric position thereof, and push, by means of teeth 85, the fabrics 1 and 2 a distance corresponding to the length of one stitch. During the rearward movement of the feeding dog 72, the teeth 85 of the coupling member 83 slide back to the initial position without resistance by the upper fabric 1.

Coupling members 83 have grooves 86 extending in the transporting direction, whose width corresponds to the fabric to be sewn. In order to permit the seam with its knots to slide past the teeth 85 of the coupling members 83, a groove 87 is provided at the center of the coupling member 83. Each coupling member 83 consists of two parts in the region 88 penetrated by needle 3.

The operation of the sewing machine when forming a seam in accordance with the invention will now be described with reference to FIGS. 15–38.

FIGS. 15, 16 and 17 illustrate the first operational phase of the downward needle movement. When needle bar 13 moves downward, needle 12 with thread 3 enters loop 5 of the last formed knot 4 which is held at the puncturing point of the needle. Since the thread feeding pin 55 still blocks the fabrics 1 and 2 and the addition of a new length of thread at the beginning of the downward movement, the needle 12 pulls the required length of thread out of the loops of the still loose knot 4 so that loop 4 is tightened. The loop catch 33 and the loop opener 34 have already released the loop 5 at the piercing point of the needle, and have returned to the initial position. During further downward movement of needle 12, loop catcher 33 and loop opener 34 simultaneously move toward the needle 12.

As shown in FIGS. 18, 19 and 20, the loop catcher 33 enters with its point between the needle and the thread in the thread loop 6. Due to the different guide cams 31 and 32, loop catcher 33 and loop opener 34 move now toward each other so that the loop catcher 33, which engages with pin 38 the guide groove 37 of the loop opener 34, is turned due to the action of the guide groove 37. During the following return movement, the needle catcher 33 turns to the position illustrated in FIGS. 21, 22 and 23. The thread tongue 42 of the loop catcher 33 hooks into the loop 6 and holds this loop turned 90° in a position of readiness for the entry of the loop opener 34. In the meantime, needle 12 has moved so far upward that its point is located in the upper fabric 1.

In the sequence of operational position shown in FIGS. 24, 25 and 26, the loop catcher 33 and the loop opener 34 hold the opened loop 6 ready for the following stitch of needle 12, which has already been carried out. The formed knot loop 7 pulls, as shown in FIGS. 27, 28 and 29, the threaded loop 6 to a closed position during further downward movement. Loop catcher 33 and loop opener 34 return at the same time to the initial position. Before needle 12 is again moved upward, the loop catcher 33 engages the knot loop 7 and holds the same by means of thread tongue 42, as shown in FIGS. 30, 31 and 32. When needle 12 has moved out of the superimposed fabrics 1 and 2, the fabrics are advanced, and during this movement the knot loop 7 is held at the piercing point of the needle, by the loop catcher 33, as shown in FIGS. 33, 34 and 35. The operations are repeated until the seam has been completed. In order to protect the seam from accidental pulling out of the thread, the last knot loop 7 is cut by a cutter 27 as illustrated in FIGS. 36, 37 and 38.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of arrangements for making a knotted chain stitch seam, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

While the invention has been illustrated and described as embodied in a method and apparatus for making a single thread knotted chain stitch seam on a sewing machine, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. A sewing machine for making a single yarn stitch seam comprising a needle bar carrying a needle; a guide cam including a butterfly-shaped cam track; a lever having a follower engaged in said cam track and connected spaced from said follower to said needle bar for reciprocating said needle bar and needle upon rota-

tion of said guide cam; a gear crown on said guide cam; drive means for said guide cam; a control cam having two guide cam portions; transmission means between said gear crown and said control cam to drive the latter upon rotation of said guide cam; and a loop catcher and a loop opener respectively operatively connected to said two guide cam portions of said control cam.

2. Sewing machine as claimed in claim 1 wherein the cam having said gear crown has a lug; and a thread cutter operated by said lug.

3. Sewing machine as claimed in claim 2, wherein said loop catcher and said loop opener are mounted for parallel sliding movement in a predetermined direction and operated by said cam portions to move relative to each other, wherein said loop opener has a guide groove extending inclined to said direction and engaging a coupling pin of said loop catcher so that said loop catcher and said loop opener are coupled with each other in such a manner that the loop catcher is turned about its longitudinal axis upon start of the relative movement caused by the cam portions.

4. Sewing machine as claimed in claim 3 including a needle bar lever connected with said needle bar and having a cam plate; and a yarn feeding member operated by said cam plate during reciprocation of said needle bar so that the thread loop is held for a short time during pulling of the thread loop, and during tightening of the knot, so that the threads tension is increased.

5. Sewing machine as claimed in claim 4 including a feeding dog for advancing the fabric; a presser foot supporting said feeding dog, and a cam plate secured to said needle bar and connected with said feeding dog for operating the same.

6. Sewing machine as claimed in claim 5, wherein said feeding dog has coupling members having arcuate surfaces abutting said fabric and being formed with a sawtooth surface and with grooves.

7. Sewing machine as claimed in claim 6 including an adjusting shaft for adjusting the length of the movement of the feeding dog, and being mounted on said presser foot.

8. Sewing machine as claimed in claim 7 comprising a lifting cam for lifting said feeding dog off the fabric, and for holding said feeding dog in said lifted off position.

9. A single thread stitch seam with knotted loops in which a first thread loop formed during a first advance of a needle is introduced into the loop of a preceding knot and in which the thread loop formed during a second advance of the needle is introduced into the first thread loop after the same has been turned through 90° so that the first thread loop forms a tightenable knot which connects the loop of the preceding knot with the loop formed during the second advance of the needle.

10. A method for making a single thread chain stitch seam comprising inserting a thread loop formed by a first stitching movement of a needle in downward direction into a loop of a preceding knot; further moving the needle downward while clamping a thread portion downstream of the needle so that the knot is tightened; moving the needle upward while holding the thread loop and turning the same through 90°; forming a further thread loop by a second stitching movement of the needle and introducing the same at the piercing point of the prepared thread loop; knotting said further loop during downward movement of the needle; and holding the loop of the last formed knot in a 90° turned position ready for a new stitch at the piercing point of the fabric.

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