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[54] **COVER THREAD PULLING AND TAKE-UP DEVICE FOR MULTINEEDLE SEWING MACHINES**

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[52] **U.S. Cl.** **112/243**

[51] **Int. Cl.** **D05b 49/00**

[58] **Field of Search** 112/241, 242, 243, 163, 112/165

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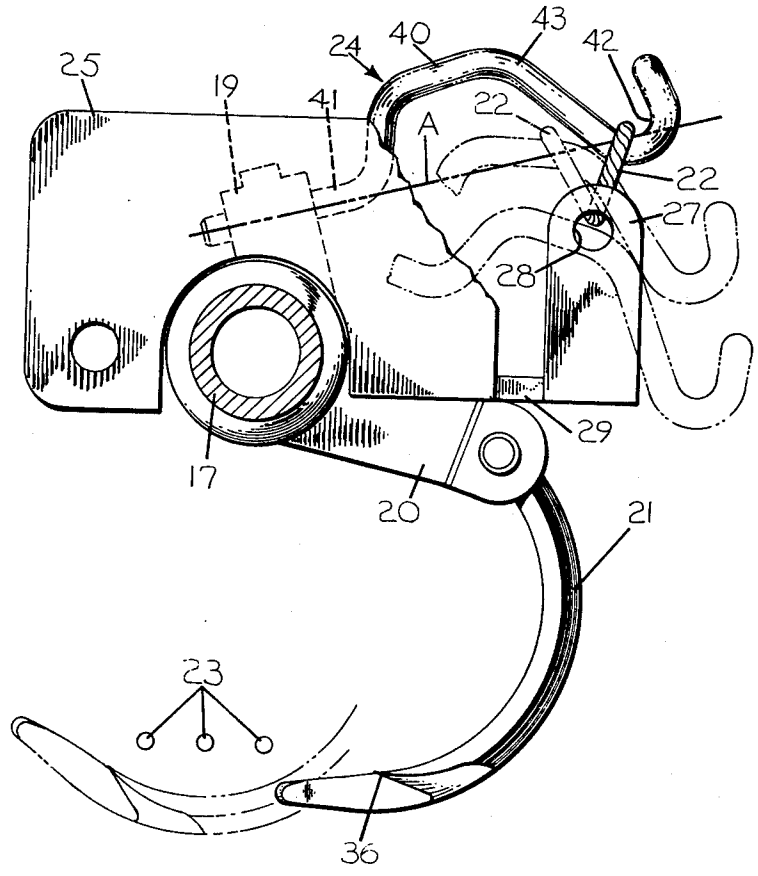
[57] **ABSTRACT**

A multineedle sewing machine having a cover thread pulling device which is linked to a cover stitch device comprising an upper looper. The cover thread pulling device is fixed near the upper looper and moves integrally therewith to exercise a pull of the cover thread without being influenced by the stretching of the thread due to the latter's elasticity which is now negligible due to a shortening of the length of the thread exposed to the action of the thread pulling device.

4 Claims, 5 Drawing Figures



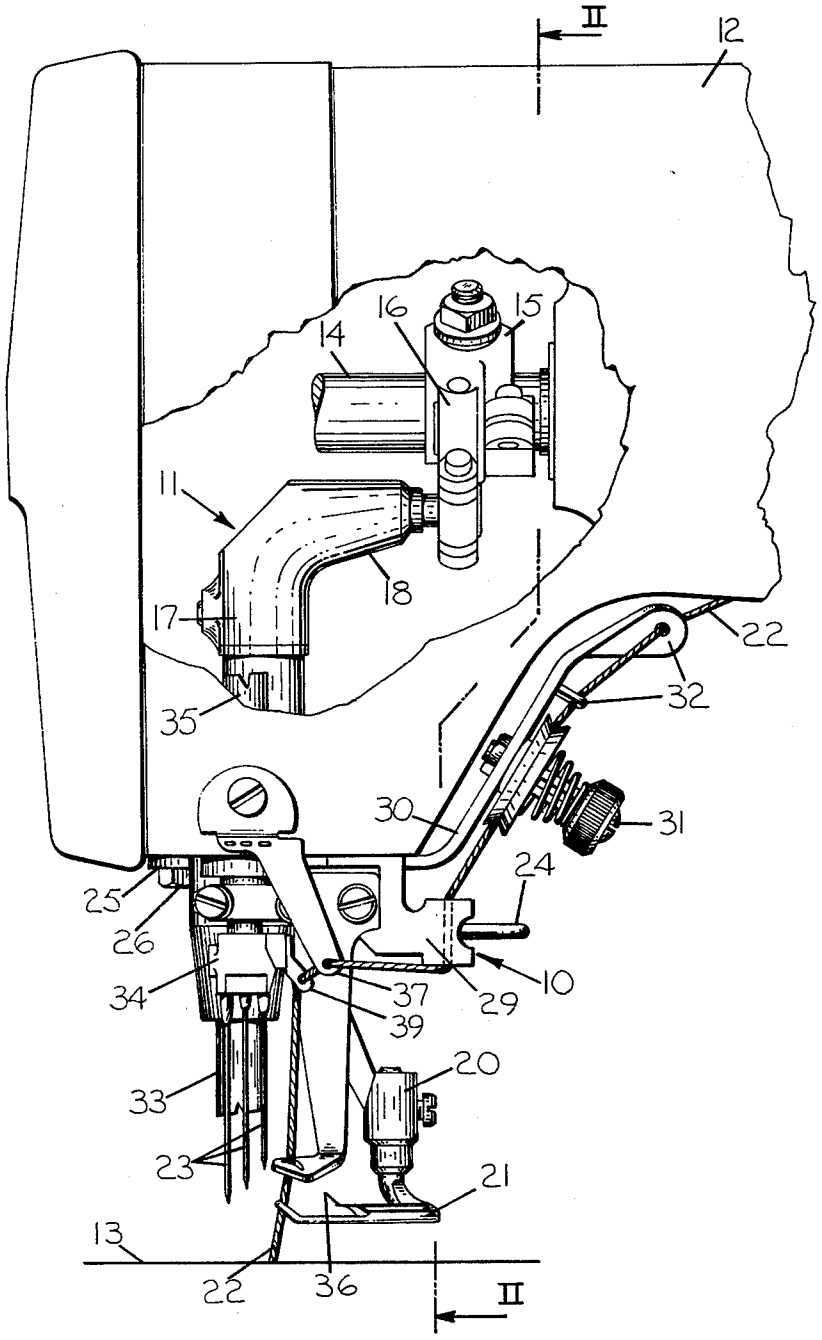

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Fig.1

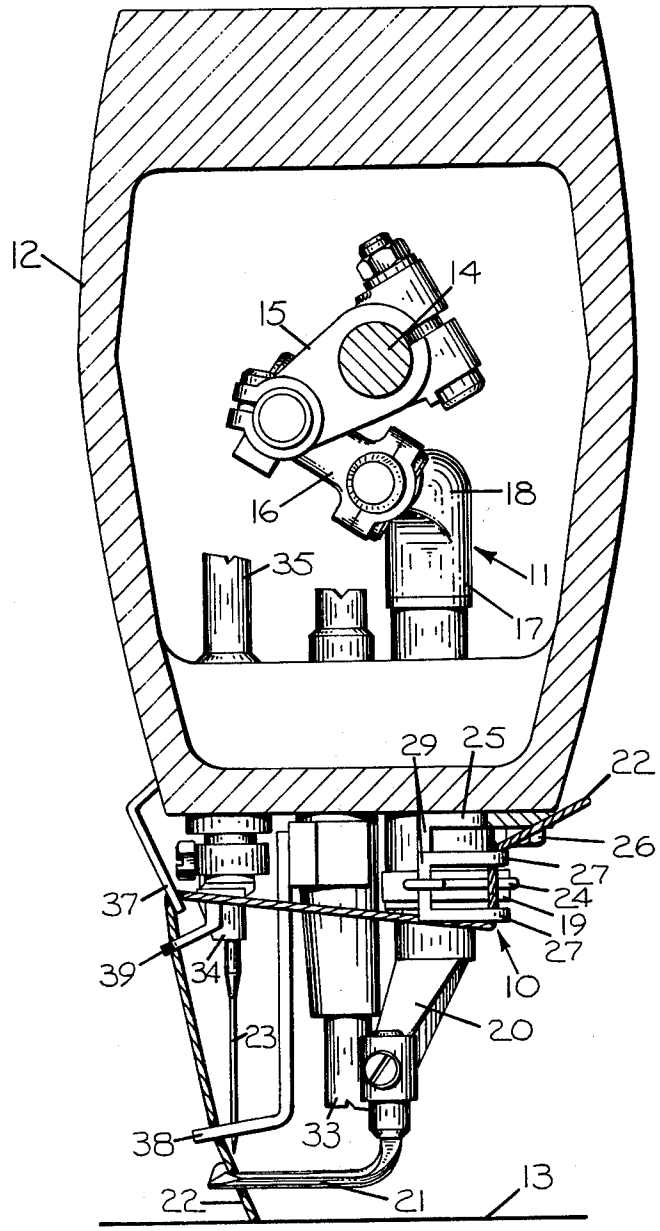
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Fig. 2

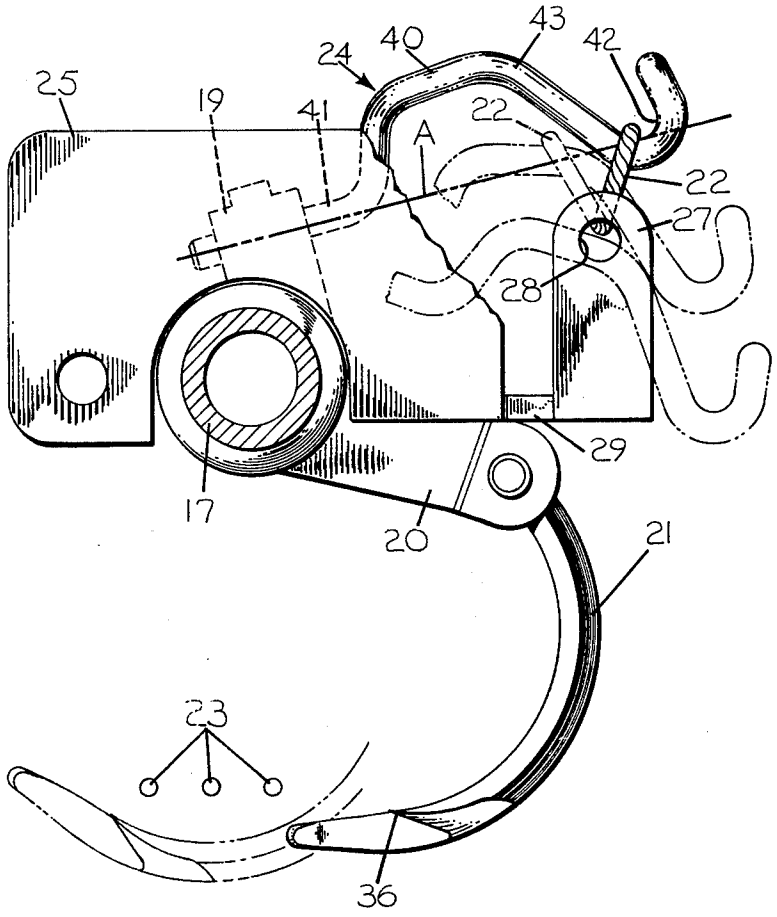

Fig. 3

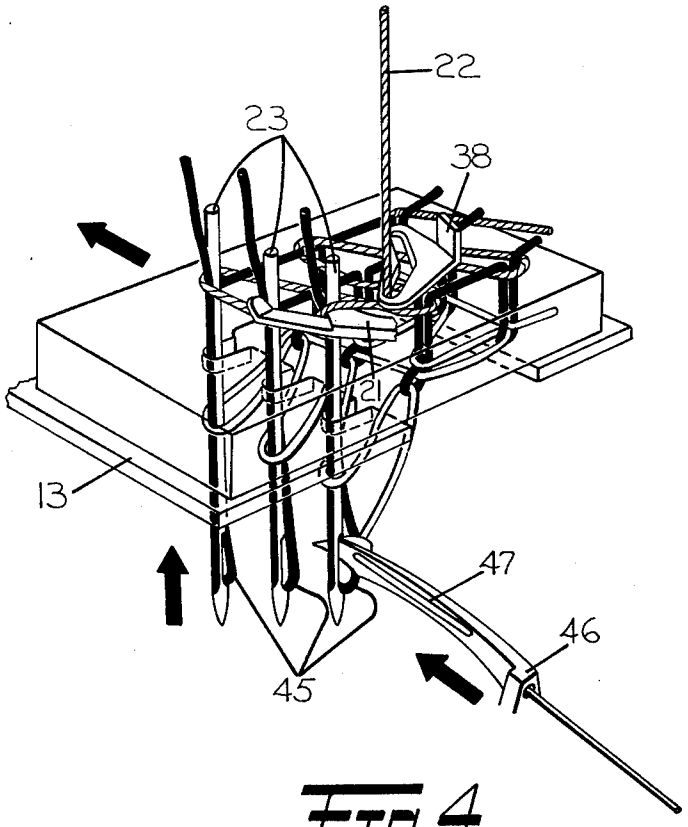

Fig. 4

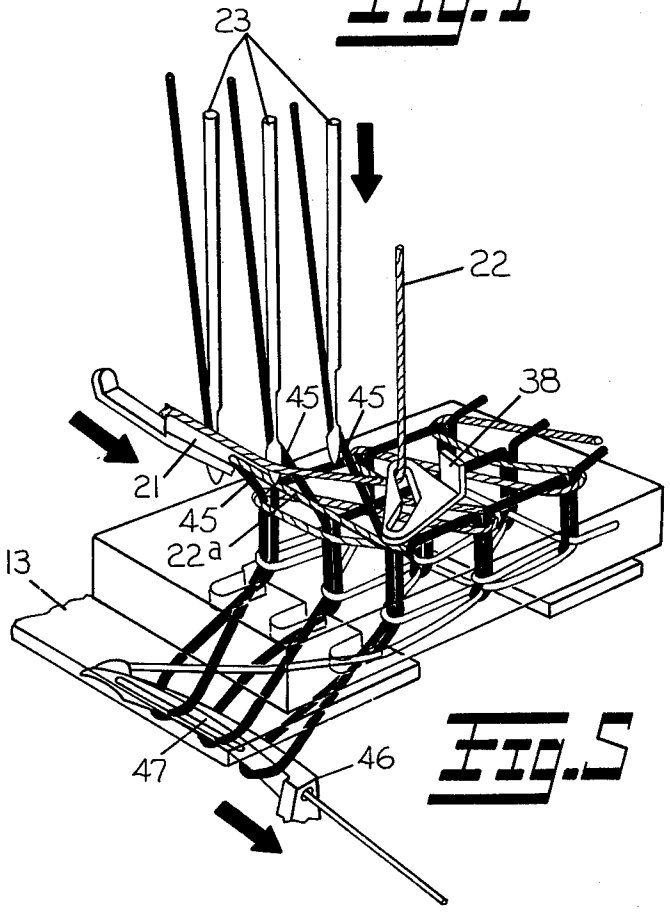

Fig. 5

COVER THREAD PULLING AND TAKE-UP DEVICE FOR MULTINEEDLE SEWING MACHINES

The present invention relates to a thread pulling device for a multineedle sewing machine cover thread, the said device being linked to a cover stitch device complete with upper looper, and fitted with a movable thread take-up element functionally connected to the said cover stitch device, the whole so designed as to act directly on the cover thread.

Thread pulling devices of this kind are already well known in the art, but the thread take-up element acting directly on the cover thread so as to allow it to run freely to the workpiece during the stitching operation and to pick it up at the end of thereof, has drawbacks exercising a negative influence on the sewing operation.

These drawbacks are mainly caused by the said thread pulling device being normally fixed to the sewing machines at a point away from the relative cover stitch device.

For this reason, there is a considerable length of thread stretched out between the said devices, this length being subjected to continuous alternating stress oscillations, being lengthened and again shortened for each stitch to be made.

The thread used for cover stitching is very elastic and the excessive length of thread between the two devices is impairing its soundness.

The great distance separating the two devices exercises a till further negative effect in that the thread, to follow the profile of the machine, has to pass through a great number of thread guides with the therefrom excessive wear caused by the metal parts of these guides. A still further negative effect is that the kinematic chain for their operation requires a great number of mechanical parts which, obviously, will have a negative influence on the timing values interlinking the two devices, and which are caused by the small mechanical errors inevitably appearing in a mechanical transmission chain.

Finally, the action of the thread pulling devices too results to be somewhat imperfect and not very efficient as regards the perfect and uniform formation of the cover stitches, resulting very often in the wrinkling of the workpiece and stressing at the point of sewing. In fact, the thread pulling device of the known kind is subjected to an oscillating motion which, for each stitch, rhythmatically first tightens and then releases the thread, lengthening thus each time the real path to be covered, this to pick up part of the excess of thread inserted into the stitches to be formed, and to recall at the same time from the spool the length of thread which, at the end of the cycle, is absorbed by the stitch.

Obviously, the thread, to be able to respond in the best way to the action of the pulling and pick-up device, must first be drawn out so as to take up all of its elasticity, and then moved. Thus the thread's natural internal tension is increased until reaching its maximum drawn-out length when the said device will impress on it the required forward motion. For this reason the thread must be sufficiently prestretched to maintain it at the required length for being able to respond as soon as possible to the action of the pulling device. It is obvious that the pretensioning of the thread required to keep the latter stretched out to the limit of its resistence and capable of eliminate its natural elasticity, must have a very high value.

It follows therefrom that the thread will be negatively influenced because of the straining action generated by the tension discs the thread is passing through.

It is the object of the present invention to eliminate the above-mentioned drawbacks so as to obtain seams in which all the threads are well interlinked and laid and in which the elasticity of the threads does not leave any traces.

To reach this object, the technical problem to be resolved mainly consists in reducing the distance between the thread pulling device and the cover stitch device, as well as in changing the laws of motion of the thread pulling device so as to ensure a more suitable and efficient action of the cover thread when forming the single points.

The said problem is resolved by providing a thread pulling device of the above type, in which a movable thread pulling element is fixed to the drive shaft of the cover stitch device, the latter carrying the upper looper, and in which the said thread pulling element is fixed to and integrally moving with the said upper looper. This new arrangement results in a sensible shortening of the length of thread periodically exposed to the action of the thread pulling device, which, therefore operates without being influenced by the stretching of the thread due to the latter's elasticity which is now negligible.

This results in the formation of aesthetically perfect and uniform seams with the cover stitch thread well tensioned between the corresponding sewing stitches.

It is obvious that also the structure of the thread pulling device acting on the cover thread, has an influence of the quality of the seams. In fact, it is not sufficient that the thread pulling device periodically increases the length of the thread to form a loop permitting at the same time the lengthening of that part of the thread available for the cover stitch device for forming good stitches, but it is also necessary that the thread be handled according to a particular law ensuring that the taking up of the excess thread tightens the stitches without causing wrinkling or an excessive tightening of the finished seam.

It is hence necessary to exert a short initial jerk causing the thread to be stretched, keeping it stretched until the wire from the stitches has been fully taken up and exert then a rather violent final pull to definitely tighten the stitch and recover the length of thread successively used up by the stitches from the spool. For this reason the above-mentioned technical problem is also resolved by providing the thread-pulling element with an attachment for connecting it to the cover stitch device drive shaft and a centre part connected at one side to the said attachment shaped as offset at the other side with the free end opportunely bent back to prevent the thread from sliding off; the said centre section being displaced with respect to the line joining the said attachement to the free end; the displacement being such as to determine the said offset provided as a temporary obstacle against the cover thread prematurely leaving the said centre section which exercises a constant and uniform pull on the said thread; the said free end being designed so as to exercise a final pull on the cover thread to tighten the stitch being formed and recall at the same time from the spool a length of thread which is sufficient to form a new stitch. It is evident that this

new characteristic has the advantage of permitting the formation of a perfect and safe tightening of the stitch, which cannot be obtained without the final pull.

Other characteristics and further advantages will be evidenced by the following description and the accompanying drawings given by way of example without limiting the range of the present invention, and in which:

FIG. 1 is a sectional view of the object of the present invention applied to a sewing machine of the above-mentioned type;

FIG. 2 is a section along linr II-II of FIG. 1;

FIG. 3 is an enlarged plan of the thread-pulling device here referred to;

FIGS. 4 and 5 schematically show two different phases of stitching complete with cover stitch.

Referring now to FIG. 1, the thread pulling device **10**, object of the present invention, is fixed to a multi-needle sewing machine and linked to a cover stitch device **11**.

The said sewing machine comprises a frame provided with an arm **12** over a base (not shown) fitted with the table **13** which receives the workpiece during the sewing operation.

A drive shaft **14** is fixed in the manner of a rock shaft inside of the arm **12** and is fitted with a lever arm **15** hinged to a link **16** for transmitting the rocking movements of the said drive shaft to the cover stitch device **11**.

The said device consists of an oscillatably driven drive shaft **17** provided at the top with an arm **18** connected in turn to the link **16**. The other end of the drive shaft **17** projecting from the bottom of the frame, carries a clamp **19** of the thread pulling device **10** (FIG. 2) and a support **20** for the upper looper **21** of the cover stitch device.

The said upper looper is positioned near the table **13** and is provided for gripping the thread **22** so as to tenter it as required among the threads (not shown) carried by the needles **23** of the sewing machine. The thread pulling device **10** comprises in addition to the said clamp **19** also an opportunely shaped rod which defines a thread-pulling element **24** adjustably fixed to the said clamp **19** and which moves integrally with the upper looper **21**. A plate **25** is fixed with screws **26** to lower part of arm **12** of the machine near the cover stitch device and also very near to the support **20** of the upper looper **21**. The plate **25** (see also FIG. **3**) is provided with two parallel lugs **27** each of which neing provided with a hole **28** through which passes the cover thread **22** leading to the upper looper **21**.

The thread guide lugs **27** are linked together by a crossbar **29** which acts as spacer and connects them at the same time to plate **25**. In the space formed by the two lugs operates a thread-pulling element **24** cyclically oscillating in and out of the said space. The movement of the said thread-pulling element **24** between the said thread guide lugs **27** is provided for generating a loop in the thread and lengthen it for having sufficient thread available at the stitches for ensuring the perfect tightening of the latter and, at the same time, allowing sufficient thread to be taking up at the spool for replacing that used up for making the stitch. The plate **25** is also fitted with a shaped tailpiece **30** carrying a disk tensioning element **31** for passing the cover thread **22** and a pair of thread guides **32** positioned between the said tensioning element and a standard thread spool (not shown).

Finally the sewing machine comprises the known presser device of which only the presser bar **33** is shown; a needle clamp **34** is fixed to the lower part of the needle bar **35** which slides vertically in the said arm **12**.

As well known, the upper looper **12** is provided to grip by means of the gripping point **36** the cover thread which normally runs at the right of the needles **23** and shift it to the left thereof and link it to the thread carried by each of them.

Along the path between the thread-pulling device **10** and the upper looper **21**, the thread is guided by the thread guides **37,38,39**. The first one is at the top to lead the thread coming from the thread pulling device to the second one at the bottom near the gripping zone. The third one is fixed to the needle clamp **34** and follows the movements of the latter during its vertical displacement during the making of a stitch.

With reference to FIG. **3**, the thread-pulling device **24** is so shaped as to possess a centre section **40** linked at one side to an attachment **41** designed to be inserted into the clamp **19**, and having at the other side a free end **42** opportunely curved to prevent temporarly the thread to slide off. The centre section **40** is rather displaced relative to the position of the link A joining the attachment **41** to the curved up end **42** to ensure that the said centre section **40** contact the thread **22** stretched out between the two holes **28** before the said end. The above displacement, defines a bend **43** in the thread pulling element **24**, which, because of the motion the latter carries out together with the clamp **19** around the axis of the drive shaft **17** of the cover stitch device **11**, serves as temporary obstacle against the rapid sliding off of the thread **22** from the centre section **40** toward the curved up end **42**.

With particular reference to FIGS. **3, 4** and **5**, the object of the present invention has been linked by way of example without being limited thereto, to a multi-needle interlock, double-locked chain stitch sewing machine which, as known, has only one main looper.

The cover stitch and the sewing stitch are made simultaneously, because the thread **22** is locked to the needle threads **45** opportunely held back by the main crochet **46** operating beneath the table **13** of the machine.

At the beginning of the cycle, the main looper **46** moves forward to grip in turn all the needle threads **45** carried by the needles **23** all lowered; the upper looper **21** moves from the right to the left relative to the said needles **23** to grip the cover thread **22** having been fed forward by the lower thread guide **38**, whilst the intermediate thread guide **39** is near the lower one, perfectly in line with the latter and the upper one **37**. The thread-pulling element **24**, following the movement of the upper looper **21**, approaches the holes **28** of the thread guide lugs **27** to reduce speedily its own action on the thread **22**. The needles in this phase moving upwards, also the intermediate thread guide **39** moves away from the lower one **38** to approach the upper one **37** until being side by side with the latter and lengthening thus the path of the thread **22**.

For this reason the thread **22** will always be well stretched because during the downstroke of the needles the thread is exposed to the action of the pulling element **24** and during the upstroke of the needles is simultaneously stretched by the intermediate guide **39** and the moving workpiece.

This ensures the safe take-up of the thread by the upper looper. At the end of this phase the main looper **46** has fully moved forward and, with the needle threads held back on its blade **47**, the upper looper **21** is shifted to the left of the needles **23** with the cover thread so arranged as to be easily retained by the needles which have reached in the meantime the upper stop, while the thread-pulling element has reached its innermost position between the guide lugs **27**.

At this point the above-mentioned movements are reversed to start the return stroke and finish the cycle.

The main looper **46** moves back to permit the forming of of a new series of stitches; the needles **23** move downwards carrying with them also the length **22***a* of the cover thread **22** in the meantime left free by the upper looper **21**. The thread-pulling device **10** recovers thread by the action of the thread-pulling element **24**, the centre section **40** of which is now almost in contact with the cover thread stretched out between the holes **28**, while the curved end **42** is held back near the cross-bar **29** in the space formed by the thread guide lugs **27**. As soon as the upper looper **21** begins its return stroke, the centre portion **40** exercises a thrust onto the said thread and, being nearer the drive shaft **17**, moves together with the latter but slower than the curved end **42**, and exercising a uniform and constant thrust thereon. The thread is forced to follow this movement for a certain time, at the end of which it will overcome the obstacle created by the bend **43** and slide onto the bend end **42** which, being now farther away from the said shaft **17**, moves in a faster manner.

This difference in speed causes a sharp pull on the cover thread **22**, resulting, as already outlined, in the perfect tightening of the formed stitch and the feed in, from the spool over the tensioning disc **31**, of a certain length of thread sufficient to compensate that taken up by the stitch.

Given the fact that the length of thread stretched out between the tensioning element **31** and the thread guide **37** is substantially rather short when compared to the elasticity of the thread and hence rather insensible to lengthening, the forces used to tensioning the cover thread are relatively small and do not compromise the integrity of the thread, ensuring at the same time a perfect stitch.

Finally, the thread pulling element **24** being adjustably fixed to the clamp **19**, its travel for each cycle can be varied; positioning it nearer or farther away from the drive shaft **17**, it is possible to obtain a smaller or greater feed in of thread and a smaller or greater tightening pull at the end.

What is claimed is:

1. A cover stitch device for sewing machines of the multi-needle type comprising:

a. an oscillatable drive shaft having an upper looper carried on one end of and moveable with said drive shaft;

b. a thread pulling element operatively connected to said drive shaft and movable with said upper looper in a first direction to draw and hold under tension a predetermined amount of cover thread from its source and in a second direction to release the cover thread to the upper looper for its presentation to the stitches being formed by the needles of the sewing machine.

2. The device according to claim **1** wherein said thread pulling element defines a rod member having one end adjustably clamped to said drive shaft, an off-set center section for exercising a constant and uniform pull on the cover thread while moving in the first direction with said drive shaft and a curved free end for exerting a sharp final pull on the cover thread for tightening the previously formed stitch and withdrawing a sufficient amount of cover thread for the subsequent stitch.

3. The device according to claim **2** wherein said cover stitch device includes a pair of spaced parallel lugs (**27**) having aligned holes (**28**) through which the cover thread extends and between which said off-set center section of said thread pulling element is movable to draw and tension the thread as it moves in its first direction of travel.

4. The device according to claim **2** wherein said curved free end of said thread pulling element is located a greater distance from said drive shaft than said off-set center section so as to move at a faster rate than the latter to increase the linear speed of the thread during the final pull of said thread pulling element in its first direction of travel.

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