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MECHANISM FOR DRAWING AN ELONGATED
SEWN PRODUCT FROM A SEWING MACHINE

The present invention relates to an apparatus for sewing an elongated article such as a curtain, a tent or a lady's dress. More particularly, the present invention relates to a mechanism for drawing an
5 elongated sewn product from a sewing station.

Various apparatus for sewing an elongated fabric article, such as a curtain, a tent or a lady's dress, are known in which an elongated sewn product is discharged from the apparatus by means of an assembly
10 of rollers. However, a common problem with the prior apparatus is that the discharged sewn products would tend to stay in a disorderly fashion on the discharge side of a sewing station, which would often require the workman's hand to assist in discharging the sewn
15 products in an orderly fashion, thus enabling only a limited rate of production. Yet, for drawing the elongated sewn product from the sewing station, a considerably long drawing mechanism is needed, which necessarily makes the whole apparatus objectionably

large.

According to a first aspect of the present invention, there is provided a mechanism for drawing an elongated sewn product from a sewing station defined by a sewing machine, said mechanism comprising: a fixed horizontal guide rail; a slide supported on said guide rail and movable therealong; at least one gripper pivotally mounted on said slide for gripping a leading end of the sewn product; means for moving said slide, with said gripper assuming a horizontal position, along said guide rail between a retracted position (in which said gripper is disposed adjacent to the sewing station) and an advanced position (in which said gripper is disposed remotely from the sewing station); means, responsive to arrival of said slide at said advanced position, for angularly moving said gripper downwardly through a predetermined angle from said horizontal position to a lowered position; and means for closing said gripper to grip the leading end of the sewn product while said slide is in said retracted position, and also for opening said gripper, upon arrival of the latter at said lowered position, to release the leading end of the sewn product.

According to a second aspect of the invention there is provided apparatus for sewing of a slide fastener to fabric, comprising a sewing machine defining a sewing station, a fabric guide arranged upstream of the sewing

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machine, a slide fastener guide disposed above the fabric guide, a drawing mechanism according to the said first aspect of the invention supported on the sewing machine downstream of the sewing station, and a stacker disposed
5 underneath the drawing mechanism.

It is believed possible by means of the present invention to provide a relatively short mechanism for drawing an elongated sewn product from a sewing station by a distance equal to or greater than the length of the
10 sewn product to be discharged, thus reducing the size of the entire apparatus to a minimum.

It is also believed possible by means of the present invention to provide a relatively short drawing mechanism in which the successive elongated sewn
15 products can be discharged without staying in a disorderly fashion on the discharge side of the sewing machine.

The invention will be described by way of example with reference to the accompanying drawings,
20 wherein :

Figure 1 is a side elevational view of a sewing apparatus having a sewn-product drawing mechanism embodying the present invention;

Figure 2 is an enlarged perspective view, with
25 parts broken away, of the drawing mechanism of Figure 1;

Figure 3 is a fragmentary side elevational view similar to Figure 1, showing the drawing mechanism in lowered position; and

Figures 4A, 4B and 4C are plan views illustrating the manner in which a sewn product is progressively drawn from a sewing station.

Figure 1 shows an apparatus for sewing a slide fastener 29 to a pair of elongated fabric pieces 28, 28, e.g. of a lady's dress.

10 The sewing apparatus generally comprises a table 1, a sewing machine 2 mounted centrally on the table 1 and defining a sewing station 4, a fabric guide 3a supported on the table 1 upstream of the sewing station 4, a slide-fastener guide 3 supported on the
15 table 1 and disposed above the fabric guide 3a, a drawing mechanism 31 supported on the sewing machine 2 downstream of the sewing station 4, and a stacker 32 supported on a base 1a of the table 1 and disposed underneath the drawing mechanism 31.

20 The sewing machine 2 may be a conventional type on the market. The sewing machine 2 includes a presser foot 2a, a pair of feed dogs (not shown), and a pair of sewing needles 2b, 2b. Upon depression of a start
25 then the sewing of the slide fastener 29 and the fabric pieces 28 in "lock stitch" takes place. This lock-stitch

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sewing is followed by back-tucking, cutting of the sewing threads (not shown) and raising of the presser foot 2a in this order. The details of the sewing machine 2 itself are not pertinent here and its detailed description is omitted for clarity.

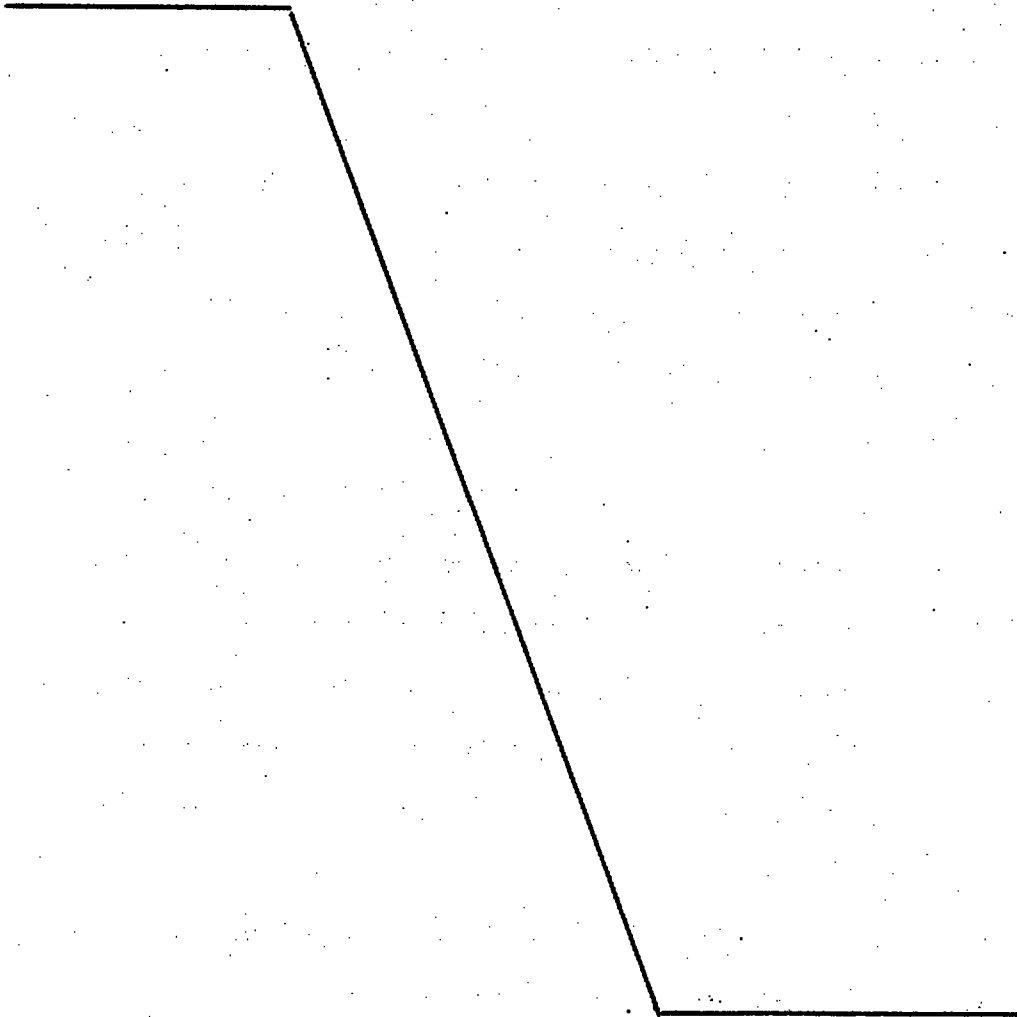
The fabric guide 3a includes a pair of transparent horizontal guide plates (only one shown in Figure 1) spaced apart from the upper surface of the table 1 by a gap slightly larger than the thickness of the individual fabric piece 28. As the pair of fabric pieces 28,28 are supplied to the sewing station 4, each fabric piece 28 passes through the gap between the corresponding guide plate and the table 1.

The slide-fastener guide 3 includes an elongated flanged guide plate sloping downwardly toward the sewing station 4 for guiding the slide fastener 29 in open position to the sewing station 4.

The purposes of the drawing mechanism 31 are only to quickly discharge the sewn product 30, i.e. the slide fastener 29 with the fabric pieces 28,28, but to keep the tension of the slide fastener 29 and the fabric pieces 28,28 constant during the sewing.

As shown in Figures 1,2 and 3, the drawing mechanism 31 includes a pair of laterally spaced grippers 16,16, each gripper 16 being composed of an upper grip member 22 and a lower grip member 21. As

best shown in Figure 2, the lower grip member 21 is secured to an arm 15 mounted on a shaft 14 which is rotatably supported by the slide 9. The upper grip member 22 is pivotally connected to the arm 15 near the downstream end of the lower grip member 21. The upper grip member 22 is also connected to an air cylinder 23 via a link 22a which is connected to a piston rod 23a of the air cylinder 23. The two air cylinders 16, 16 are pivotally mounted on the arm 15 remotely from the



grippers 16, 16. Upon energization and de-energization of the two air cylinders 23, 23, each piston rod 23a projects and is retracted to close and open the respective grippers 16.

5 The drawing mechanism 31 also includes a holder 5 which is fixed to the downstream side of the sewing machine 2 and from which a guide rail 6 extends horizontally in the direction of discharging the sewn product 30, a downstream end of the guide rail 6 is
10 fixed to a bracket 8 supported by a hanger rod 7 (Figures 1 and 3). The slide 9 is slidably mounted on the guide rail 6 and is fixed to an endless belt 12 wound around a pair of pulleys 10, 11 rotatably mounted the holder 5 and the bracket 8, respectively. The
15 pulley 10 is operatively connected to a servo motor 13 (Figure 2) for driving the slide 9 forwardly (downstream) and backwardly (upstream) and also for changing the speed of movement of the slide 9 depending on the load.

20 The backward or upstream movement of the slide 9 is limited by a stop 17 projecting therefrom and engageable with the holder 5; thus the backward travel of the two grippers 16, 16 terminates in a retracted position close to the sewing station 4. At that time,
25 the approach of the slide 9 is detected by a proximity switch 5a (Figure 2) which issues a signal to reduce the rate of rotation of the servo motor 13, and the

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arrival of the slide 9 is detected by a limit switch 5a (Figure 2) which has an actuator engageable with the stop 17 and which is responsive to this engagement to issue a signal to terminate the rotation of the servo motor 13. The forward or downstream movement of the slide 9 is limited by a contact member 20 extending therefrom and engageable with an actuator of a limit switch 19 which is adjustably mounted on a support rod 18 extending between the holder 5 and the bracket 8 in parallel relation to the guide rail 6. When the actuator of the switch 19 is hit by the contact member 20, the limit switch 19 produces a signal to stop rotation of the servo motor 13, thus terminating the forward movement of the slide 9. As a result, the forward movement of the two grippers 16, 16 terminates in an advanced position, which is adjustable by changing the position of the limit switch 19 on the support rod 18. The stroke of the slide 9 is considerably shorter than the length of the sewn product.

As shown in Figure 2, a drive 24, such as a motor or an air cylinder, is operatively connected to the shaft 14 for turning the same through a predetermined angle, e.g. 90° as in the illustrated embodiment. In response to clockwise turning (Figure 1), the arm 15 is angularly movable about the shaft 14 in the direction of an arrow b from the phantom-line



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position (horizontal) of Figure 1 to the solid-line position (vertical) of Figure 3, whereupon the piston rod 23a of each air cylinder 23 assumes a retracted position to open the respective gripper 16 for releasing the sewn product 30. This arrangement is particularly advantageous in that in spite of the short stroke of the slide 9, a relatively long sewn product can be discharged without staying in a disorderly fashion on the discharge side of the sewing machine 2. Accordingly it is possible to reduce the length of the drawing mechanism 31 and thus the size of the entire sewing apparatus to a minimum.

As shown in Figures 1 and 3, the stacker 32 is disposed underneath the drawing mechanism 31 for receiving the successive sewn products 30 (released from the grippers 16, 16) one over another and for discharging a stack of the sewn products 30 out of the sewing apparatus when such stack reaches a predetermined amount.

The stacker 32 includes a generally T-shaped hanger having a horizontal transverse pipe 25 connected to an upper end of a support arm 26 pivotally mounted on the base 1a of the table 1. An air cylinder 27 is pivotally supported on the base 1a, and a piston rod 27a of the air cylinder 27 is pivotally connected to the support arm 26 at a midportion thereof. In timed relation to the forward movement of the two grippers

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16, 16, the piston rod 27a of the air cylinder 27 projects to cause the stacker 26 to pivotally move in the direction of an arrow d in Figure 3 from a retracted (solid-line) position to an advanced (phantom-line) position where the sewn product 30 released from the grippers 16, 16 is received on the transverse pipe 25. Thereafter, when the piston rod 27a of the air cylinder 27 is retracted, the stacker 32 is returned to its original or retracted position, with the sewn product 30 hanging from the transverse pipe 25 as shown in Figure 1.

In operation, before the sewing work is started, a pair of fabric pieces 28, 28 and a slide fastener 2a are introduced into the sewing station 4 in superimposed condition. At that time, the slide 9 and thus the grippers 16, 16 are disposed in retracted or upstream position close to the sewing station 4 (Figure 1), each gripper 16 being open. The stacker 31 is also disposed in retracted or upstream position.

When a start button (not shown) of the sewing machine 2, the presser foot 2a and the sewing needles 2b, 2b are lowered to start sewing. As the sewing progresses, each fabric piece 28 and the corresponding stringer of the slide fastener 29 are advanced leftwardly in Figure 1 by the action of the non-illustrated feed dogs of the sewing machine 2. The arrival of the leading end portions of the fabric

pieces 28, 28 and of the slide fastener 29 at the grippers 16, 16 is detected by a photosensor (not shown) disposed at a suitable position in the sewing machine 2. This photosensor is responsive to this
5 detection to issue a signal to the air cylinder 23, 23, whereupon the piston rod 23a of each air cylinder 23 projects to cause the respective gripper 16 to grip the sewn end portions of the respective fabric piece 28 and of the corresponding stringer of the slide fastener 29.

10 The slide 9 is then moved forwardly as the pulley 10 is driven, by the servo motor 13 (Figure 2), to rotate counterclockwise. Thus the grippers 16, 16 pull the sewn product 30 away from the sewing station 4 in the direction of an arrow a (Figure 1) at a
15 predetermined speed substantially equal to the speed in which the sewn product 30 is advanced by the feed dogs (not shown) of the sewing machine 2, as shown in Figures 4A and 4B.

Immediately before a slide fastener slider (not
20 numbered) disposed at the bottom end portion of the slide fastener 29 reaches the sewing station 4, a slider detector (not shown) issues a signal to the sewing machine 2 to stop the lock-stitch sewing and then to start back-tucking. The sewing threads are
25 cut, and the presser foot 2a is raised to terminate the operation of the sewing machine 2.

After the sewing operation of the sewing machine

2 is stopped, the slide 9 and thus the grippers 16, 16 are continued to pull the sewn product 30 until the contact member 20 on the slide 9 hits the actuator of the limit switch 19 which then issues a signal to the
5 servo motor 13 (Figure 2) to stop the counterclockwise rotation of the pulley 10 (Figures 1 and 3). Figure 4B shows the grippers 16, 16 having reached their advanced position, with the trailing end portion of the sewn product 30 remaining in the sewing station 4.

10 In their advanced position, the grippers 16, 16 are pivotally moved, by the drive 24 (Figure 2), in the direction of an arrow b from the horizontal (phantom-line) position of Figure 1 to the vertical (solid-line) position of Figure 3, thereby drawing the
15 sewn product 30 in the direction of an arrow c (Figure 3). As a result, the sewn product 30 has been removed from the sewing station 4, but the trailing end portion of the sewing product 30 remains on the upper surface of the table 1, as shown in Figure 4C.

20 Then the piston rods 23a, 23a of the two air cylinders 23, 23 are retracted to open the grippers 16, 16, thereby releasing the sewn product 30. The sewn product 30 thus released falls partly by gravity and partly by inertia onto the transverse pipe 25 of the
25 stacker 26 in advanced position, as shown in Figure 3. At that time, the trailing end portion of the sewn product 30 is removed from the upper surface of the

table 1.

Finally, the grippers 16, 16 in open position are returned to their horizontal (phantom-line) position of Figure 1 and thence to their original or retracted position close to the sewing station 4. The stacker 31 is also returned to their original or retracted position. Thus a single cycle of sewing operation has been completed, and the sewing apparatus is now in condition for start of the next cycle of the sewing operation.

With the drawing mechanism 31, it is possible to discharge even a relatively long sewn product from the sewing station 4 reliably in an orderly fashion, without increasing the length of the drawing mechanism, partly because after their relatively short horizontal travel, the grippers 16, 16 are pivotable downwardly from the horizontal path of travel to thereby increase the entire stroke of drawing the sewn product.



C L A I M S :

1. A mechanism for drawing an elongated sewn product from a sewing station defined by a sewing machine, said mechanism comprising :

(a) a fixed horizontal guide rail;

5 (b) a slide supported on said guide rail and movable therealong;

(c) at least one gripper pivotally mounted on said slide for gripping a leading end of the sewn product;

10 (d) means for moving said slide, with said gripper assuming a horizontal position, along said guide rail between a retracted position (in which said gripper is disposed adjacent to the sewing station) and an advanced position (in which said gripper is disposed
15 remotely from the sewing station);

(e) means, responsive to arrival of said slide at said advanced position, for angularly moving said gripper downwardly through a predetermined angle from said horizontal position to a lowered position; and

20 (f) means for closing said gripper to grip the leading end of the sewn product while said slide is in said retracted position, and also for opening said gripper, upon arrival of the latter at said lowered position, to release the leading end of the sewn
25 product.



2. A drawing mechanism according to claim 1,
further including a holder adapted to be fixed to the
sewing machine and supporting one end of said guide
rail, and a bracket fixed to the other end of said
5 guide rail, said moving means including a pair of
pulleys rotatably mounted on said holder and said
bracket, respectively, an endless belt wound around
said pulleys and connected to said slide, and a servo
motor operatively connected to one of said pulleys for
10 driving said endless belt and thus said slide forwardly
and backwardly.

3. A drawing mechanism according to claim 2,
further including a stop projecting from said slide
and engageable with said holder to terminate the backward
15 movement of said slide, a contact member projecting from
said slide, and a limit switch disposed adjacent to said
advanced position and responsive to engagement of an
actuator of said limit switch with said contact member
for issuing a signal to said servo motor to terminate
20 the forward movement of said slide.

4. A drawing mechanism according to claim 3,
further including a support rod extending parallel to
said guide rod, said limit switch being adjustably
mounted on said support rod.



5. A drawing mechanism according to any preceding claim, said angularly-moving means including a shaft rotatably supported by said slide, an arm mounted on said shaft and supporting said gripper, and a drive
5 operatively connected to said shaft for turning the latter through said predetermined angle.

6. A drawing mechanism according to claim 5, said gripper including a lower grip member fixed to a free end of said arm and an upper grip member
10 pivotally connected to said arm.

7. A drawing mechanism according to claim 6, said closing-and-opening means including at least one air cylinder pivotally supported by said arm and having a piston rod pivotally connected to said
15 upper grip member.

8. A drawing mechanism according to claim 5, 6 or 7, said drive including an air cylinder.

9. A drawing mechanism according to claim 5, 6, 7 or 8, said drive including a motor.

20 10. A drawing mechanism substantially as described with reference to and as illustrated in Figures 2 and 3 of the accompanying drawings.

11. Apparatus for sewing of a slide fastener to



to fabric, comprising a sewing machine defining a sewing station, a fabric guide arranged upstream of the sewing machine, a slide fastener guide disposed above the fabric guide, a drawing mechanism according

- 5 to any preceding claim supported on the sewing machine downstream of the sewing station, and a stacker disposed underneath the drawing mechanism.

12. Apparatus substantially as described with reference to and as illustrated in Figures 1 to 3.
