

May 13, 1969

R. P. POSEY ET AL
APPARATUS AND METHOD FOR MANIPULATING
NARROW ELASTIC FABRIC

3,443,532

Filed May 31, 1966

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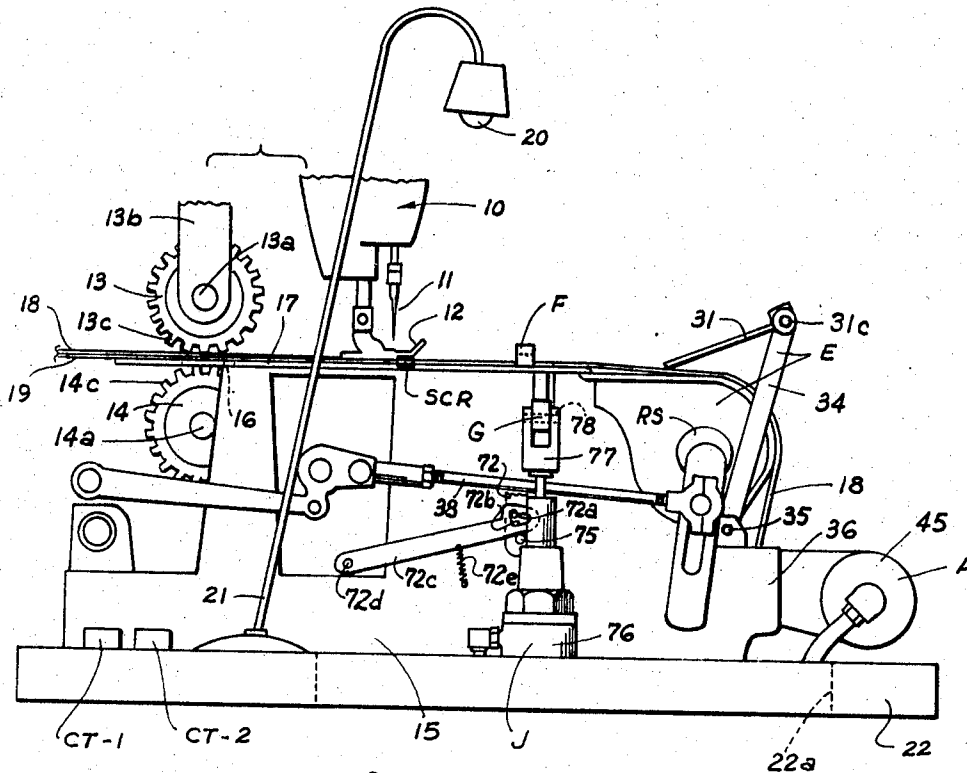


Fig. 1.

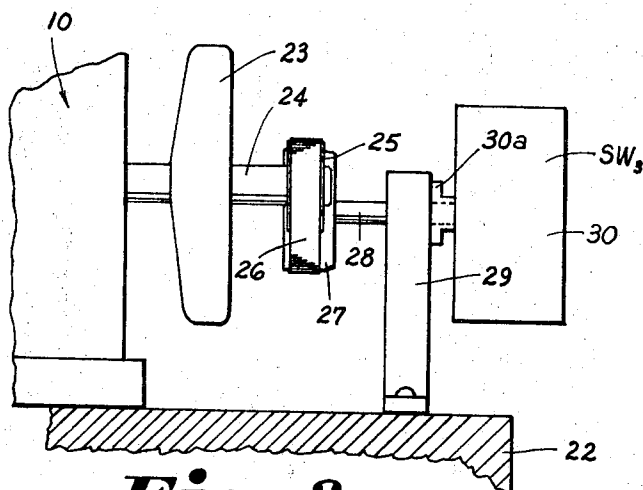


Fig. 2.

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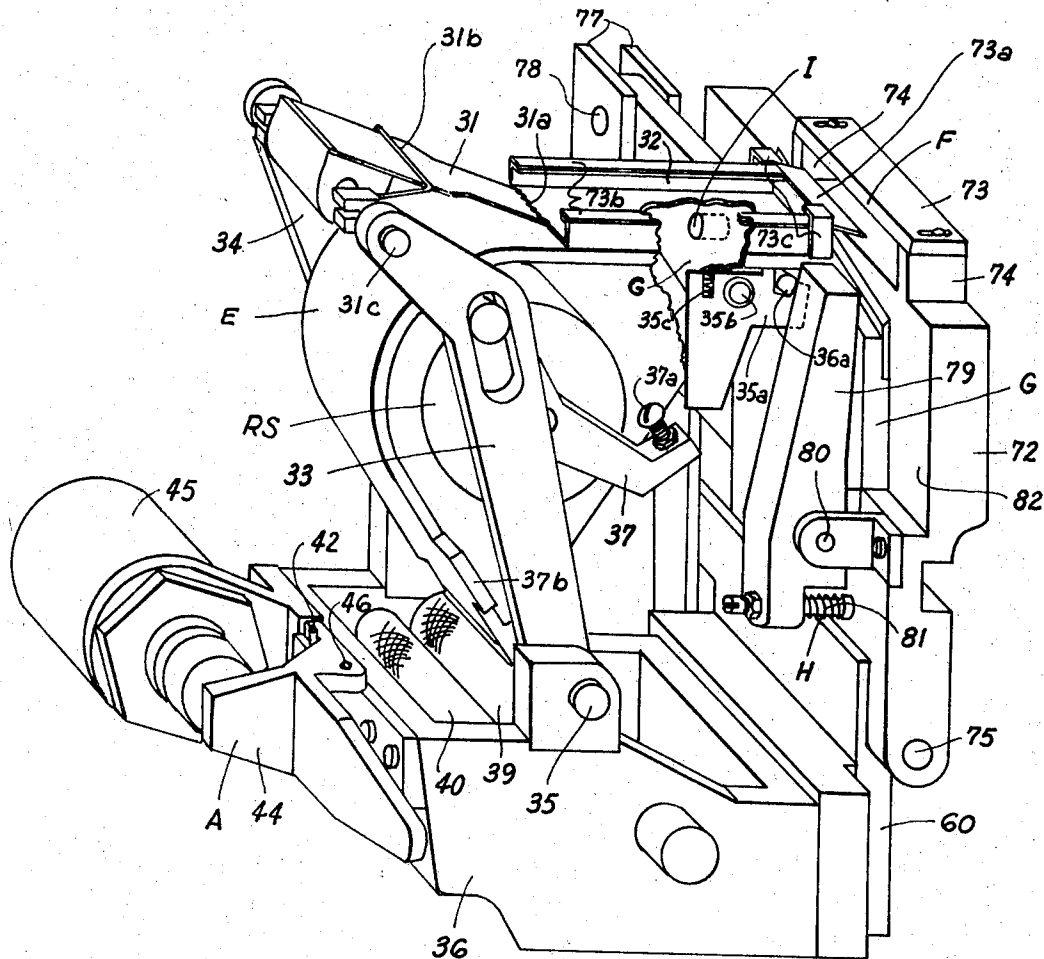


Fig. 3.

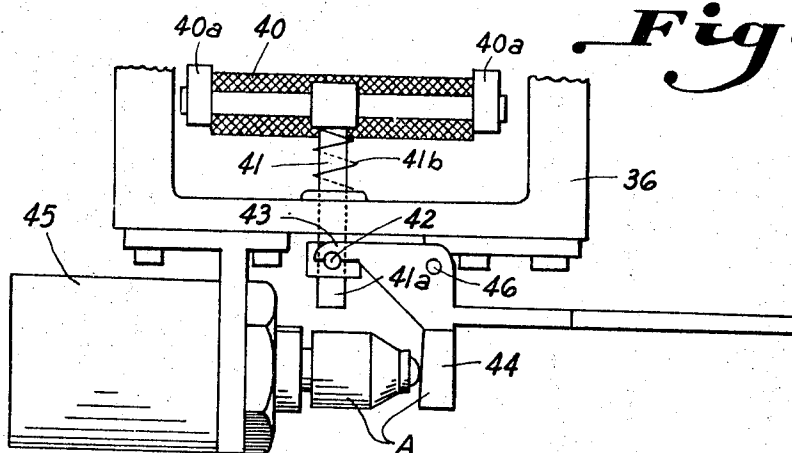


Fig. 4.

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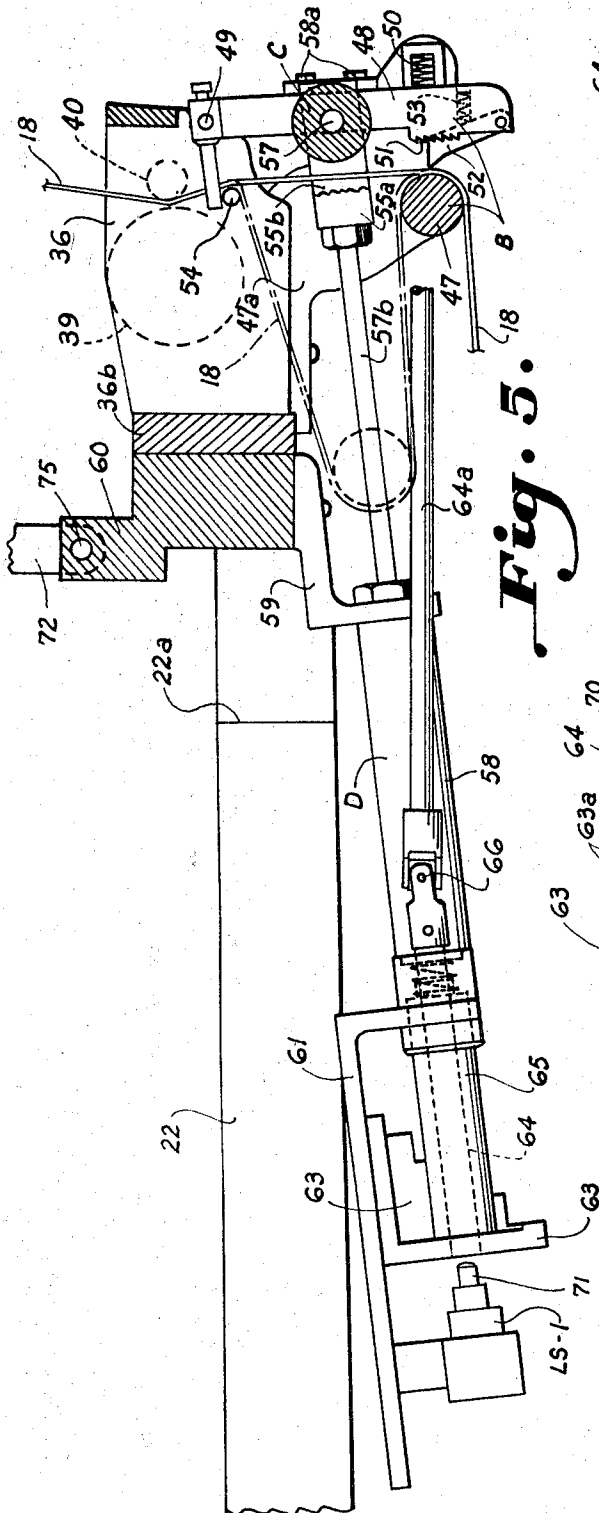


Fig. 5.

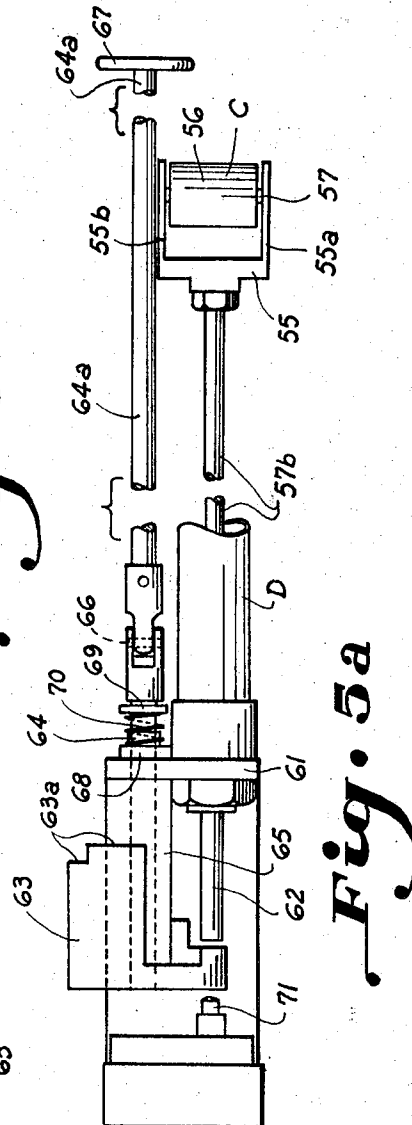


Fig. 5a

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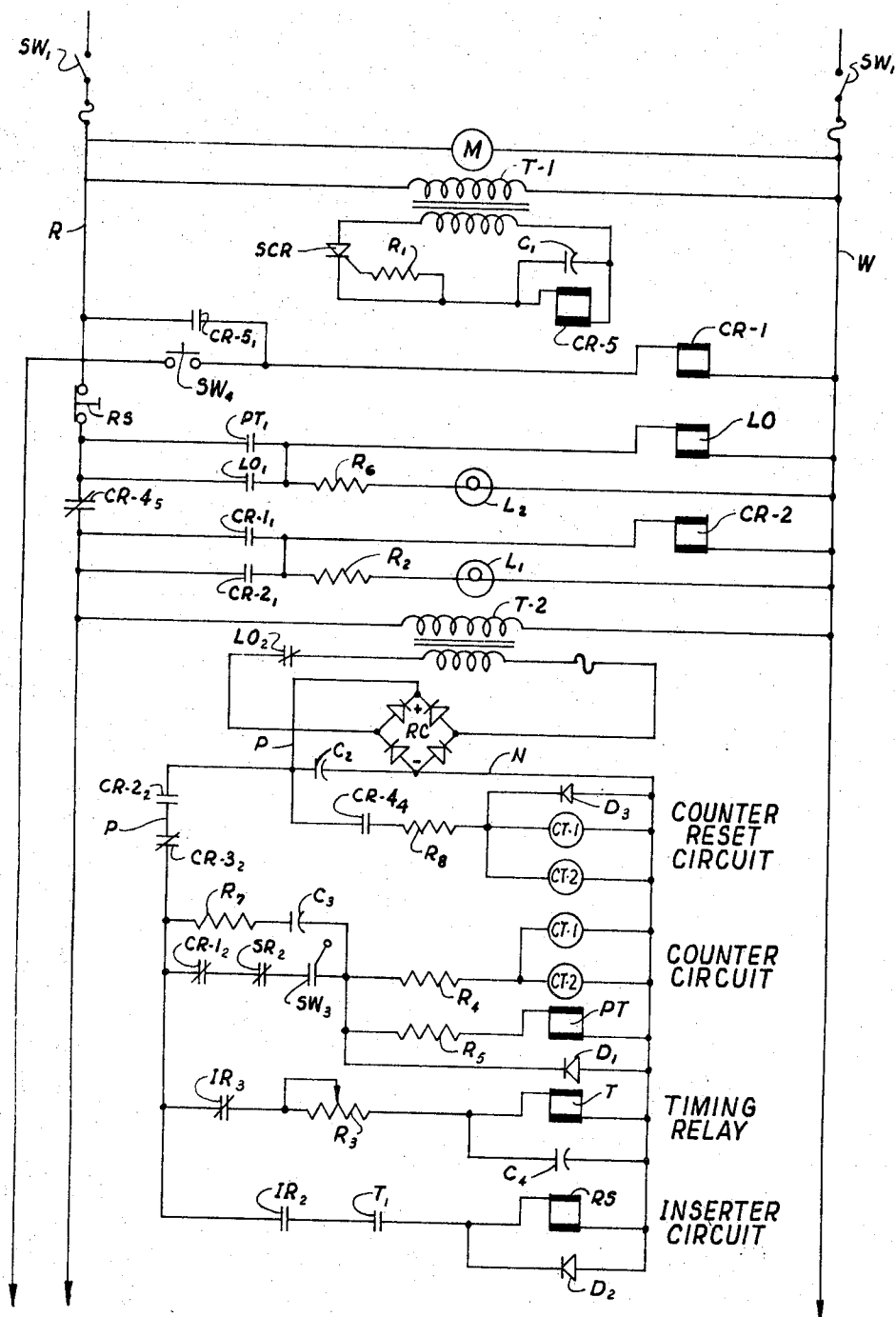


Fig. 6.

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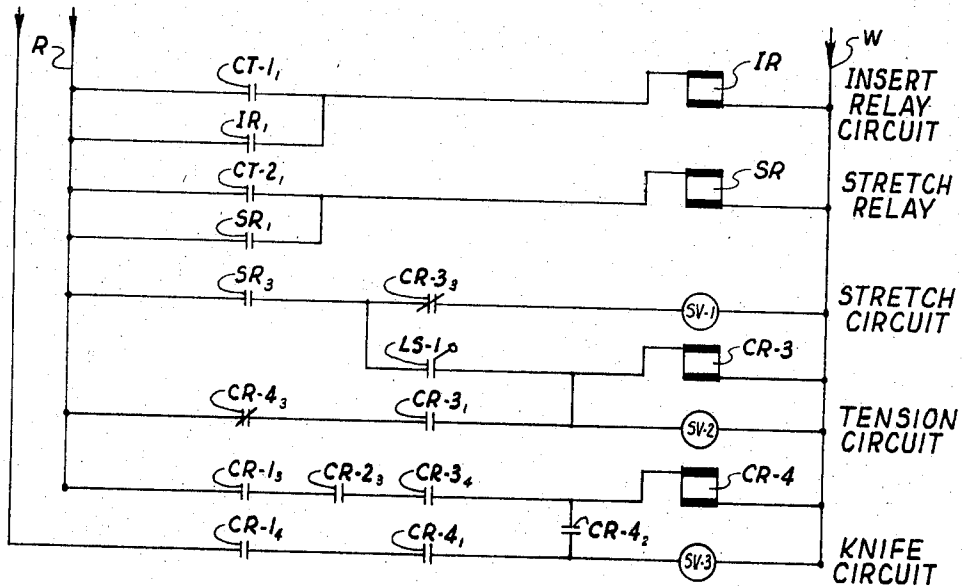


Fig. 6a.

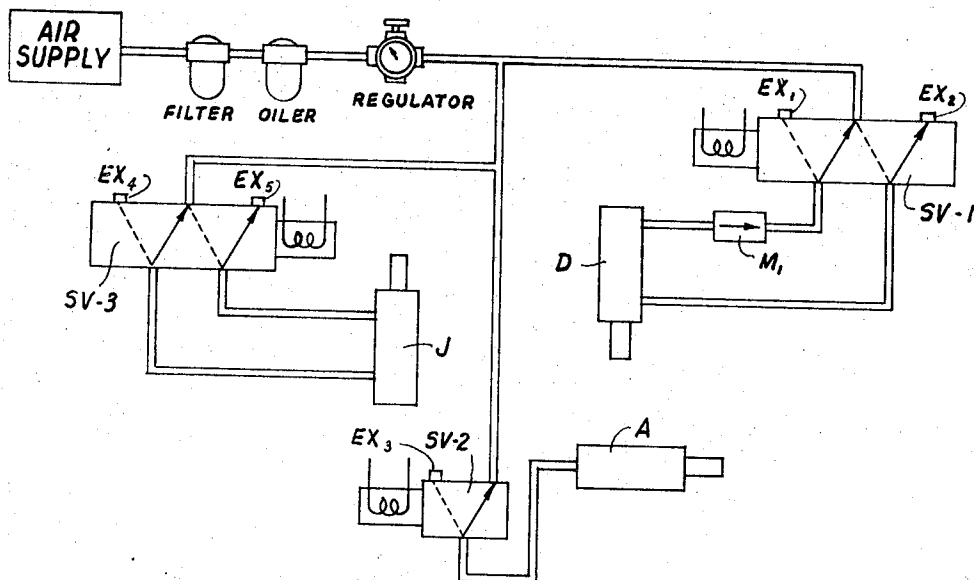


Fig. 7.

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3,443,532

APPARATUS AND METHOD FOR MANIPULATING NARROW ELASTIC FABRIC

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U.S. Cl. 112—2

16 Claims

ABSTRACT OF THE DISCLOSURE

Means for sewing a predetermined number of stitches without elastic are provided in an apparatus capable of subsequently inserting elastic without tension. Means for pretensioning the elastic are provided together with a knife assembly for shearing elastic in a relaxed state at a predetermined point near the completion of the sewing operation.

This invention relates to sewing machine attachments especially for manipulating narrow elastic fabric and the like, and the method of manufacturing garments, such as men's shorts employing elastic strips in the waist.

The sewing of garments requiring the insertion of narrow elastic fabric has, heretofore, been a tedious operation resulting in garments having undesirable variations. For example, in the manufacture of men's shorts it is desirable first to sew a portion of the fabric without elastic and then to sew a smooth portion wherein the elastic is free of tension so as to form a fly. The number of stitches inserted without elastic and the number inserted in the relaxed elastic is presently determined visually by the operator thus, giving rise to the variations. The present invention contemplates improvement of the appearance of the finished garment together with a simplified manufacturing operation. A major difficulty with the present elastic inserting operation may be observed in the curling back of the edges of the elastic strip resulting from the fact that the teeth of the inserter do not grip the elastic entirely across its width when inserting under tension. Another major difficulty is encountered in the cutting of the elastic after a desired amount has been inserted and sewn in the garment due to the fact that such cutting occurs under tension and the cutting edge moves laterally progressively across the elastic resulting in an irregular edge. It may be observed that this irregularity occurs on both ends of the elastic in a single garment.

It is difficult to make suitable adjustments in the amount of stretch placed in the elastic of shorts of varying sizes. For example, the larger sizes require a lesser degree of stretch than the smaller sizes. Since the stroke of conventional inserters is fixed, the amount of tension placed on the elastic may be either too much or too little. While conventional metering devices, which are constantly operating, are adjustable to tension the elastic to the degree desired for any size shorts, the inserter always initially places the same amount of tension in the elastic. Such amount will be either excessive or insufficient except possibly for a given size shorts which requires such tension as is produced by the stroke of the inserter. At best, even suitable adjustments will rarely permit uniform tension throughout the entire length of the elastic in a given garment. The complexities and difficulties inherent in the present operation make the training of operators expensive and then too, many manual operations are required since the elastic must, in some cases, initially be inserted under the presser foot by the finger of the operator. The operator must judge when to insert the elastic and must make a decision as to when to cut the elastic. All this makes for a relatively slow sewing operation.

Accordingly, it is an important object of this invention to provide a method and apparatus for improving the uniformity and appearance of items manufactured with inserted elastic.

Another important object of the invention is to provide a means for delivering elastic to the sewing machine under more nearly uniform tension.

Still another important object of the invention is the provision of automatic means for counting the number of stitches first applied in the manufacture of men's shorts and the like, and then inserting elastic without tension and applying stitches prior to placing the elastic under relatively uniform tension thus, cutting down on the laborious nature of the sewing operation from the operator standpoint.

Yet another important object of the invention is the provision of improved cutting means for severing the elastic at the conclusion of elastic sewing, preferably without tension in the elastic.

Another object of the invention is to minimize the curling back of the elastic strip at its edges resulting from the uneven application of tension thereto by the inserter.

Still another object of the invention is the provision of an improved knife structure and inserter which are conveniently positioned for sewing and which may be easily moved to permit operator access to the underneath portion of the sewing machine.

Another important object of the invention is the simplifying of the operator functions in manufacturing a garment, such as men's shorts, by eliminating decisions, without interruptions in the sewing, which must be made by the operator based more or less on guess work.

A preferred embodiment of the invention, when used in the manufacture of men's shorts, contemplates automatically sewing a predetermined number of stitches without elastic. The invention also contemplates the provision of an apparatus for subsequently inserting elastic without tension. A pretensioning device, for placing proper tension upon the elastic between the sewing machine presser foot and the metering device after sewing a second predetermined number of stitches without tension, is also contemplated. A metering device then tensions the elastic during the sewing operation until cutting of the elastic is contemplated. A novel knife assembly shears elastic evenly, preferably with the elastic in a relaxed state as a result of releasing same from the metering device, at a predetermined point near the completion of the sewing operation.

The construction designed to carry out the invention will be hereinafter described, together with other features thereof.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings forming a part thereof, wherein an example of the invention is shown and wherein:

FIGURE 1 is a schematic side elevation illustrating a sewing machine provided with attachments constructed in accordance with the present invention,

FIGURE 2 is an enlarged schematic front elevation of the opposite end of the sewing machine illustrating the manner of actuating stitch counting devices constructed in accordance with the present invention.

FIGURE 3 is a perspective view looking from the right-hand rear portion of FIGURE 1 illustrating an inserter and metering device used in connection with a knife constructed in accordance with the present invention, with parts omitted,

FIGURE 4 is a plan view illustrating means for relieving and means for applying a tensioning action to the elastic through the metering device, with parts broken away.

FIGURE 5 is a side elevation, at a somewhat enlarged scale, illustrating an elastic stretching device constructed in accordance with the present invention positioned below the sewing table illustrated in FIGURE 1, with parts omitted.

FIGURE 5a is a bottom elevation of a portion of the device illustrated in FIGURE 5.

FIGURE 6 is a schematic electrical diagram illustrating the operation of various electrical components of the device constructed in accordance with the present invention.

FIGURE 6a is a continuation of the schematic drawing of FIGURE 6 and,

FIGURE 7 is a schematic illustration of the pneumatic system of the embodiment of the invention illustrated.

The drawings illustrate apparatus, for use with a sewing machine having needles and an adjustable metering device normally engaging elastic which passes therethrough from a suitable supply in its normal path to the needles, for pretensioning the elastic after engagement thereof by the needles. A releasing means for relaxing the engagement of the metering device, which normally applies a predetermined amount of tension to the elastic, with the elastic is illustrated at A. A gripping means B is spaced remotely of the needles and is positioned in alignment with the metering device for restricting the elastic against movement relative thereto. A movable element C is provided for engaging the elastic positioned between the metering device and the gripping means. Fluid pressure operated means D is provided for moving the element a predetermined distance laterally of the normal path of the elastic for stretching the elastic. Means are provided for deactivating the releasing means A and for restoring the normal engagement of said metering device with the elastic while the elastic is stretched. Means carried by the movable element A is also provided for releasing the restricting action of the gripping means spaced remotely of the needles after the engagement of the metering device has been restored. Means including a cam are also provided for adjusting the distance element C is moved thus, adjusting amount of stretch placed in the elastic.

The invention also contemplates an article actuated switch means SCR positioned adjacent the needles. A first counter CT-1 is driven by said sewing machine, for counting the stitches applied to the article by the sewing machine, and is actuated by the switch. An elastic inserter E is actuated by the first counter when a predetermined number of stitches have been applied to the article for advancing elastic in relaxed condition to the needles. A second counter CT-2 is driven by the sewing machine for counting the stitches applied by the sewing machine to the article while the elastic is in a relaxed condition. In actual practice the second counter may begin counting at the same time as the first counter so long as it operates a predetermined number of stitches after elastic insertion. Tension is then applied to the elastic between the needles and the metering device, responsive to operation of the second counter.

A knife for cutting the narrow elastic fabric being fed to the needles of a sewing machine under tension includes a fixed blade F under which the elastic is fed from a guide to the needles extending across the elastic. A movable blade G extends across and under the elastic. Spring means H are provided for urging the movable blade laterally against the fixed blade to insure a firm sliding engagement between the blades for effective shearing action of the knife. A pivotal mounting I carries said movable blade and is positioned laterally of said fixed blade in an intermediate portion thereof. Means are provided for relaxing the tension on said elastic and power operated means J connected to the movable blade laterally of the pivotal mounting remote from said fixed blade are provided for pulling said movable blade downwardly. Thus, a portion of the movable blade adjacent the fixed blade is moved upwardly opposite said fixed blade shearing the elastic therebetween. The unstretched elastic between the

knife and the needles is then sewn off to form part of a second fly portion.

FIGURE 1 illustrates a sewing machine, broadly designated at 10, having a plurality of needles 11 operating in conjunction with the usual presser foot 12 for carrying out a sewing operation. Opposed pull through rollers are illustrated at 13 and 14. The roller 13 is carried by a shaft 13a mounted in a support 13b. The roller 14 is carried on a shaft 14a, which has suitable mounting within the frame 15. The pull through rollers have teeth 13c and 14c, respectively, which engage through a slot 16 within the work supporting base 17 for pulling the elastic 18 and a cloth 19 after a sewing operation for forming a garment, such as men's shorts.

Initially cloth, which has been precut, is inserted by the operator into a conventional cloth folding device (not shown) from whence it is guided beneath the presser foot 12. The cloth initially, and the elastic after it has been inserted into the fold of the cloth are received under the presser foot are held thereby since the presser foot holds down against conventional feed dogs (not shown). Some of the tension is taken off the presser foot by the subsequent successive engagement of the cloth and the elastic by the pull through rolls. It will be observed that a light actuated silicon control rectifier SCR is placed adjacent the needles for operation by a light 20 positioned directly thereabove. Any suitable article actuated switch could be used here in lieu of the silicon control rectifier, such as a pneumatic switch. The light 20 is carried by a suitable lamp stand 21, which has fixed mounting upon the sewing table 22. The cloth for the garment when initially passed by the operator to the cloth folding device also passes same between the light 20 and the silicon control rectifier SCR to initiate a stitch counting operation. During insertion of the elastic and for a predetermined time thereafter, there is no tension on the elastic since a solenoid operated means has been provided to hold open a metering device, which is running at all times. A predetermined number of stitches are placed in the fabric without the elastic and such number of stitches is determined by a predetermining magnetic counter CT-1.

The counter CT-1 is actuated by a distributor SW₃ which is driven from the hand-wheel 23 of the sewing machine, as illustrated in FIGURE 2. For this purpose a stub shaft 24 extends from the hand-wheel 23 and drives a pulley 25 carrying a belt 26. The belt 26 drives a pulley 27 which is carried by a shaft 28. The shaft 28 is mounted for rotation in a bearing stand 29. The distributor SW₃ includes a casing 30 which has fixed connection through a bracket 30a to the bearing stand 29. It will be observed that the bearing stand 29 has suitable fixed mounting upon the table 22 as does the sewing machine 10. The casing carries a fixed means for operating in conjunction with a movable means (not shown) carried by the shaft 28 to signal the counter. A second predetermining counter CT-2, which is also actuated by the distributor SW₃, counts the number of stitches to be placed in the elastic and fabric prior to a pretensioning operation which will be described below.

An elastic inserter device E includes a rotary solenoid RS (FIGURES 1, 3 and 6) for advancing the inserter finger 31. A helical spring (not shown) is provided for returning the inserter finger 31 after its inserting stroke. It will be noted by reference to FIGURE 3 that the inserter finger 31 has a plurality of teeth 31a adjacent its free-end for positively gripping and inserting the elastic within a channel shaped guide 32. The inserter finger 31 is carried on a shaft 31c between a pair of vertical links 33 and 34 which have pivotal connection as at 35 with a bracket 36 which supports the metering device. A spring 31b, having fixed mounting upon the shaft 31c, urges the finger 31 in a clockwise direction in FIGURE 3 into engagement with the elastic. The inserter is maintained in operative position by a latch 35a which is pivoted as at 35b. The latch engages a fixed member 36a carried by the

bracket 36. A spring 35c urges the latch into engagement, but such may be manually overcome for releasing the latch to rotate the inserter about the pivot 35 away from the knife.

The inserter may be of the same general type illustrated in Patent No. 3,011,460, issued to F. Haff, Jr. on Dec. 5, 1961, but further modified as shown and as described below. The knife employed in the Haff patent has also been replaced with a knife constructed in accordance with the invention as described below. It will be observed by reference to FIGURE 3 that an arm 37 is carried by the rotary solenoid RS to limit the forward movement of the inserter finger 31 by engagement of the screw stop 37a, which may be turned to adjust the stroke of the inserter, prior to engagement of the screw with the fixed stop 37b. The helical spring (not shown) is mounted to reverse the movement of the rotary solenoid RS following a power stroke and thus returns the parts to the position shown in FIGURE 3 after an elastic inserting stroke. After the insertion of the elastic, a number of stitches is sewn in the cloth and the elastic as controlled by the predetermining counter CT-2.

Mechanism is then actuated to prestretch the elastic 18 between the needles 11, which have engaged the elastic and the cloth, and the metering device. After prestretching, the elastic is then fed from the metering device to carry on a regular sewing operation. A knee switch, described below, is provided for the operator to initiate the elastic cutting operation. The knife cuts the elastic but just before this occurs the metering device opens to release the tension in the elastic for a predetermined distance between the knife and the needles. The rest of the garment is sewn off and the light again comes in contact with the silicon control rectifier SCR which sets the operating mechanism to receive another piece of cloth and then flat elastic with no stretch therein. It will be observed that a second fly or flat portion may be formed by thus sewing off the elastic free of tension and then sewing a second portion of cloth without elastic.

The metering device may be of a type sold by Union Special Machine Company, of 2120 Plasters Bridge Rd., NW., Atlanta, Ga., under designation 29486F. The metering device is powered by the usual operating shaft 38 which is driven by the sewing machine. The metering device includes a pair of rolls 39 and 40 (FIGURES 3, 4 and 5). These rolls each have a friction imparting surface and such is illustrated as being knurled.

FIGURES 4 and 5 illustrate a spring 41b which normally urges the roll 40 into engagement with the roll 39 for gripping the elastic passed between the rolls. The roll 40 is mounted upon the usual vertical pivoted arms 40a. The shaft 41 which carries the spring 41b has been extended, and the customary nut removed, as at 41a and a pin 42 positioned thereon. The pin 42 is engaged by a projection 43 integral with an arm 44. The arm 44 forms a part of a releasing means A. A cylinder 45, when actuated, pulls the shaft 41 and its extension 41a forwardly against the spring 41b to release the engagement of the roll 40 with the roll 39 and hence release the tension on the elastic. It will be observed that the projection 43 and the arm 44 are pivotally mounted as at 46 upon the frame 36 of the metering device. In order to positively guide the elastic under the anvil or fixed blade F a hold down mechanism is provided. Such includes a depending lip 73a for depressing the elastic and guiding same under the bar 73. The lip is resiliently urged down by the spring arms 73b which have fixed connection, as by welding with the free flange portions of the channel shaped guide 32. Brackets 73c are provided to limit the upward movement of the arms 73b.

The pretensioning apparatus includes a releasing means for relaxing the engagement of the metering device with the elastic as is illustrated at A. A gripping means B is spaced remotely of the needles and is positioned in alignment with the metering device for fixing the elastic

against movement relative thereto. Referring to FIGURE 5 and 5a, it will be noted that the gripping means includes a roll of 47 which has fixed mounting upon the bracket 47a carried by the frame 15.

A link 48 is pivoted upon the bracket 36 as at 49 and is normally urged by the spring 50, carried by the bracket 47a, to a position wherein the teeth 51 will engage the elastic against the roll 47 during a stretching operation. The link, however, is normally urged, as described below, against the spring 50 into the position shown in FIGURE 5. An anti-backup mechanism includes a pivoted pawl 52 urged by the spring 53 to lightly engage the elastic against the roll 47, when the link is out of engagement, as illustrated in FIGURE 5, to prevent the elastic from falling through the metering device. A guide roll 54 is provided for guiding the elastic between the bifurcated member 55 and the roller 56 which forms a part of the movable element C. The roller has a suitable stub shaft 57 to permit rotation between the arms 55a and 55b of the bifurcated member. It will be observed that the arms 55a and 55b extend forwardly beyond the roller 56 and engage transverse members 58a, carried by the link 48, for maintaining such in disengaged position, illustrated in FIGURE 5. The bifurcated member is carried by a piston rod 57b within the cylinder 58 of the power operated means D.

The cylinder D has fixed mounting on one end within a bracket 59 which has fixed connection with a mounting bracket 60. The bracket 60 is carried by a spacer 36b which has fixed connection with the bracket 36. The piston carries upon its opposite end, a mounting bracket 61, which has bearing upon the table 22. The cylinder 58 is double acting and has a rod 62 projecting from its end opposite the piston rod 57b.

During a prestretching operation the cylinder D urges the piston rod 57b toward the left-hand side of FIGURE 5 to stretch the elastic 18 which has been engaged by the gripping means B. The movable member C, including the roll 57 which engages the elastic, is pulled to broken line position in FIGURE 5.

Since it is desirable to control the degree of stretch placed in the elastic 18, the amount of such movement of the movable means C should be adjustable. This is accomplished by a cylindrical stepped cam 63 which provides stepped surfaces 63a for engagement by the rod portion 62. The stepped cam 63 is mounted upon the shaft 64 which is in turn mounted within the guide 65. The shaft 64 is provided through a pivotal connection 66 with a forward extension 64a. The shaft 64a is connected to a detented hand-wheel 67, which is preferably indexed (not shown) on its front face, for turning by the operator to place a desired stepped surface 63a in alignment with the rod portion 62. The shaft 64 between stops 68 and 69 has a helical spring which normally pushes the shafts 64 and 64a to the right in FIGURES 5 and 5a. However, when the rod 62 engages the cam 63 the cam is moved to the left against the force of the spring 70 to cause the cam to depress the plunger 71 of the micro-switch as described below.

The knife for cutting the narrow elastic fabric includes a fixed blade F under which the elastic is fed to the needles. The blade F extends across the elastic and is carried upon a pivoted bracket 72. The blade F includes a bar 73 carried by spaced supports 74 which are carried by the bracket 72. The bracket 72 is pivoted as at 75. A movable blade G has a pivotal mounting I providing a pivotal attachment to the bracket 72. Power operated means J including a cylinder 76 are connected to the movable blade laterally of the pivotal mounting and remote from the fixed blade for exerting a downward pull on the movable blade at the point of connection. The cylinder 76 extends, as do other parts, through the opening 22a in the table 22. Connection is made by a bifurcated member 77 which carries the movable blade G for pivotal connection upon a pin 78. A link 79 has a

pivotal mounting 80 upon the bracket 72 and is urged in a clockwise direction in FIGURE 3 by the spring H which is carried upon a shaft 81 between the link 79 and the bracket 72 for urging the movable knife blade G against the guiding surface 82 of the bracket 72.

The knife may be tilted out with the inserter by pivoting the knife about the pivot 75 and inserter about the pivot 35. Thus, access may be had to the interior of the sewing machine for threading the loopers (not shown). With reference to FIGURE 1, it will be observed that a pin 72a is carried by the bracket to cooperate with a latching member, having an L-shaped slot 72b, to maintain the knife in operable position shown in the drawings. The latching member 72c, having the slot 72b therein, is pivoted as at 72d. A spring 72e maintains the latching member 72c in engaging position as shown. By moving the arm against the spring the horizontal portion of the L-shaped slot 72b will accommodate the pin 72a to permit limited tilting of the knife.

Electrical operation

Upon closing of line switch SW₁ (FIGURE 6) the sewing machine motor M is energized and an A.C. voltage is placed cross leads R and W energizing transformer T-1 which provides a low voltage to the light actuated silicon control rectifier SCR which in turn energizes control relay CR-5. A capacitor C₁ is connected in shunt with the control relay CR-5 providing a filter circuit for the relay and preventing relay chattering. A current limiting resistor R₁ is connected from gate to cathode of the silicon control rectifier SCR. Such is a conventional manner of wiring silicon control rectifiers. A light source 20 (FIGURE 1) is associated with the silicon control rectifier to energize it. Such a light source has fixed connection with the sewing machine frame, and is positioned directly above the needles so it will be focused on the silicon rectifier.

Contact CR-5₁ of the control relay circuit CR-1 is closed when control relay CR-5 is energized by light on the rectifier. The closing of contact CR-5₁ causes control relay CR-1 to be energized. Energization of control relay CR-1 closes the normally open contact CR-1₁ in the control relay circuit CR-2 causing the control relay CR-2 to be energized. When control relay CR-2 is energized its associated contact CR-2₁ is closed sealing in the circuitry to control relay CR-2 and illuminating green light L₁ through a current limiting resistor R₂ indicating that the control circuit is energized.

The normally closed contact CR-1₂ of the counter circuit is open preventing energization of the counter coils CT₁ and CT₂. Normally open contact CR-1₃ of control relay circuit CR-4 is closed partially completing the circuit to the control relay CR-4. The normally open contact CR-1₄ of the knife circuit (FIGURE 6a) is closed partially completing the circuit to the knife solenoid valves SV-3.

A transformer T-2 is connected between leads R and W and steps the voltage down providing power to a full wave rectifier circuit RC which provides direct current to circuitry connected between leads P and N. A capacitor C₂, connected between the positive lead P and the negative lead N, filters the direct current voltage provided by the rectifier RC. The closing of control relay CR-2 also causes contact CR-2₂ interposed in lead P to be closed applying a voltage to the counter circuitry. Such also causes timing relay T to be energizing through a current limiting resistor R₃ and the closed contact IR-3 of control relay IR. Normally opened contact CR-2₃ of the control relay circuitry CR-4 is closed partially completing the circuit to the control relay CR-4. The circuitry is now ready to initiate the sewing operation.

When cloth, upon which an elastic strip is to be sewn, is fed into the sewing machine it interrupts the light beam focused on the silicon control rectifier SCR which causes a relay CR-5 to be de-energized. Such causes contact

CR-5₁ in the control relay CR-1 circuit to be open, de-energizing the control relay CR-1. Contact CR-1₂ of the counter circuit closes applying power to the cam switch SW₃ in the counter circuit. Cam operated switch SW₃ is mechanically driven from the sewing machine drive shaft and alternatively opens and closes its contacts in synchronism with the sewing operation. When the contacts of cam switch SW₃ are closed current flows through the current limiting resistor R₄ to the operating coils of high speed predetermining magnetic counters CT-1 and CT-2. These counters CT-1 and CT-2 are preset so that counter CT-1 closes its contacts after a first predetermined number of stitches are sewn into the garment and counter CT-2 closes its contacts after a second predetermined number of stitches are sewn into the garment. Power is also applied through current limiting resistor R₅ to a protective timer PT. The protective timer is a safety device for the counter circuitry so that if the operator of the sewing machine leaves the sewing machine when the cam switch SW₃ is closed, after the elapse of a predetermined period of time, the protective timer contacts PT₁ in the lock-out circuit will close. The energization of lock-out relay coil LO causes contact LO₁ to close sealing in the circuit to the lock-out coil. Simultaneously, current flows through the closed contacts LO₁ through the limiting resistor R₆ energizing a red lamp L₂ which indicates that the circuit has been locked-out. The normally closed contact LO₂, in series with the secondary of transformer T₂, is opened by the energization of the lock-out coil LO de-energizing rectifier RC and removing power from the counter-circuit located therebelow. The circuitry can be returned to the state that it was in at the beginning of the operating cycle by momentarily opening the reset button RS interposed in lead R. Referring back to the counter circuit (a diode D₁ is connected in shunt with the operating coils CT-1 and CT-2 and the protective timer PT for limiting inductive discharge of these coils when the cam switch SW₃ is opened to protect the circuitry from spurious voltages. Similarly the resistor R₇ and capacitor C₃ protect the cam switch contact SW₃).

As the cam switch SW₃ is alternately opened and closed in synchronism with the sewing operation, pulses are supplied to the counter coils CT-1 and CT-2 which record the number of pulses and consequently, the number of stitches inserted in the garment by the sewing machine. Upon the insertion of a predetermined number of stitches in the garment, and consequently pulses being supplied to the counter coil CT-1, contact CT-1₁ of the insert relay circuit is closed energizing the relay IR. The normally open contact IR₁ closes sealing in the relay IR. The normally open contact IR₂ of the inserter circuit is closed partially completing the circuit to the rotary solenoid RS (FIGURES 1, 3 and 6). The timing relay T is energized as described previously. Consequently, its contact T₁ in the inserter circuit is closed completing the circuit to the rotary solenoid RS energizing same for operating the elastic inserter for causing the elastic to be inserted under the sewing machine presser foot. When normally closed contact IR₃ of the timing relay circuit is opened the coil of timing relay T is de-energized, but the relay is prevented from opening its contacts immediately because of the time delay capacitor C₄ connected in shunt therewith. After the elapse of a short period of time, time delay contact T₁ of the inserter circuit opens de-energizing the rotary solenoid permitting the elastic inserted to retract. A diode D₂ is connected in shunt with the coil of the rotary solenoid RS protecting the circuitry from spurious signals produced when the rotary solenoid coil is de-energized.

As the operator continues to sew the counters CT-1 and CT-2 continue recording the number of stitches being inserted into the garment and elastic strip. Upon the insertion of a second predetermined number of stitches, counter CT-2 closes contact CT-2₁ of the stretch relay circuit completing the circuit to the stretch relay coil SR.

The normally open contact SR₁ is closed sealing in the circuit to the SR relay coil. Normally closed contact SR₂ of the counter circuit is opened de-energizing the counter circuitry and preventing further counting by the counter CT-1 and CT-2. The normally opened contact SR₃ of the stretch circuit is closed energizing the stretch solenoid valve SV-1. Energization of the solenoid valve SV-1 causes air to be supplied to the stretch cylinder D which controls the elastic stretching mechanism. The piston of the stretch cylinder D is retracted causing a predetermined amount of stretch to be placed into the elastic band. Limit switch LS-1 is closed when the stretch cylinder achieves a predetermined amount of stretch in the elastic band energizing control relay CR-3. Normally opened contact CR-3₁ closes sealing in the coil of control relay CR-3. The normally closed contact CR-3₂ of lead P is opened removing power from the counter circuitry and inserter circuitry.

When control relay coil CR-3 was energized the solenoid valve SV-2 in the tension circuit was also energized. The closing of solenoid valve SV-2 allows air to exhaust from the cylinder A associated with the metering device permitting the rolls of the metering device to engage the elastic strip and hold it under tension. The normally closed contact CR-3₃ of the stretch circuit is then opened de-energizing the solenoid valve SV-1 releasing the tension in the elastic strip between the metering device and the elastic stretching mechanism. It is noted that the circuit to control relay CR-3 was sealed in when its associated contact CR-3₁ was closed. Normally open contact CR-3₄ closes partially completing the circuitry to the control relay CR-4.

The sewing continues until the operator, at a predetermined distance from the end of the garment, closes a knee switch SW₄ of the control relay circuit CR-1 again energizing control relay CR-1. Contact CR-1₃ of the control relay circuit CR-4 is closed energizing the control relay coil CR-4. Contacts CR-1₄ of the knife circuit closes sealing in the control relay CR-4 through its own contacts CR-4₁ and CR-4₂ and simultaneously energizing the knife solenoid valve SV-3. Energization of solenoid valve SV-3 causes air to be supplied to the knife actuating cylinder J causing its piston to be retracted operating the knife to cut the elastic. The contact CR-4₃ of the tension circuit is opened de-energizing the tension circuit in solenoid valve SV-2 releasing tension upon the elastic just prior to the knife cutting operation.

Normally opened contact CR-4₄ of the counter reset circuitry is close energizing counter reset coils CT-1 and CT-2 through the current limiting resistor R₈. The energization of the counter reset coils CT-1 and CT-2 return the counters to the "zero" position. Diode D₃ is connected in shunt with the counter reset coils CT-1 and CT-2 protecting the circuitry against spurious voltages. Normally closed contact CR-4₅ connected in lead R opens de-energizing the entire circuitry shown therebelow in the schematic diagram. Upon release of the knee switch SW₄ by the operator relay CR-1 is de-energized opening the contacts CR-1₃ and CR-1₄ of the control relay circuit CR-4 and the knife circuit, respectively, de-energizing the circuits. The operator now sews the remainder of the garment. Passage of the trailing edge of the garment permits light to be supplied to the silicon control rectifier SCR which is close energizing relay CR-5 and in turn relay CR-1 preparing the sewing machine circuitry for receiving the next garment.

Pneumatic operation

FIGURE 7 illustrates a schematic diagram of the pneumatic system. When the circuit is in the de-energized state the solenoid valves are in the position illustrated. Air is supplied to the solenoid valves from the air supply through a conventional filter, oiler, and pressure regulator. The air being supplied to the stretch cylinder D causes its piston to be extended. When the solenoid valve SV-1 is energized air is supplied to the one end of the

stretch cylinder causing the piston to retract to stretch the elastic. During this operation air is exhausted from the opposite port of the stretch cylinder through metering valve M₁ and the exhaust port EX₁ of the solenoid valve SV-1. Upon de-energization of the solenoid valve SV-1 air is supplied to said opposite port of the stretch cylinder causing the piston associated therewith to be extended. During this operation air is exhausted from the exhaust port EX₂ of the solenoid valve SV-1.

Air is normally supplied through solenoid valve SV-2 to the cylinder A associated with the metering device extending its piston causing the metering device to release the elastic. When the solenoid valve SV-2 is energized, air is permitted to exhaust through exhaust port EX₃ of solenoid valve SV-2. The cylinder A is provided with a spring 41b which causes the piston associated therewith to retract. When the piston retracts one of the metering rolls is placed in engagement with the elastic for holding the elastic under tension.

Air is normally supplied to the lower port of the knife cylinder J causing the piston associated therewith to be extended. When solenoid valve SV-3 is energized, air is supplied to the upper port of the knife cylinder causing the piston to be retracted to cut the elastic strip. During this operation air is exhausted through exhaust port EX₄ of solenoid valve SV-3. When the solenoid valve SV-3 is de-energized, air is supplied to the lower port of the knife cylinder causing the piston to be extended and returning the knife blade to its original position. During this operation air is permitted to exhaust through exhaust port EX₅ of the solenoid valve.

What is claimed is:

1. For use with a sewing machine having needles, and a metering device normally engaging elastic which passes therethrough from a supply in its path to the needles, apparatus for pretensioning the elastic after engagement thereof by the needles comprising; releasing means for relaxing the engagement of the metering device with the elastic; gripping means spaced remotely of the needles, positioned in the path of said elastic, for restricting the elastic against movement relative thereto; a movable element engaging said elastic positioned between said metering device and said gripping means; power operated means moving said element a predetermined distance laterally of the path of the elastic for stretching said elastic; means for restoring the normal engagement of said metering device with the elastic while the elastic is thus stretched; and means for releasing the restricting action of the gripping means, after the engagement of the metering device has been restored.

2. For use with a sewing machine having needles, and an adjustable metering device normally engaging elastic which passes therethrough from a supply in its path to the needles for placing a desired amount of tension in the elastic delivered therefrom, apparatus for pretensioning the elastic after engagement thereof by the needles comprising; releasing means for relaxing the engagement of the metering device with the elastic; a movable element engaging said elastic positioned between said metering device and said supply; means restricting movement of the elastic on the side of said movable element opposite said needles; power operated means moving said element a predetermined distance for placing a predetermined amount of stretch in said elastic; means for adjusting the distance said element is moved thus adjusting the amount of stretch placed in the elastic; and means for restoring the normal engagement of said metering device with the elastic while the elastic is thus stretched; whereby proper tension may be placed initially upon the elastic thus providing more nearly uniform tension during the sewing of the tensioned elastic.

3. In combination with a sewing machine having needles, an elastic inserter for advancing said elastic a predetermined distance, and a metering device normally engaging elastic which passes therethrough in its normal

path to the needles, apparatus for pretensioning the elastic after engagement thereof by the needles comprising; releasing means for relaxing the engagement of the metering device with the elastic; gripping means spaced remotely of the needles for restricting the elastic against movement relative thereto; a movable element engaging said elastic positioned between said metering device and said gripping means; fluid pressure operated means moving said element a predetermined distance laterally of the normal path of the elastic for stretching said elastic; means for restoring the normal engagement of said metering device with the elastic while the elastic is thus stretched; and means for releasing the restricting action of the gripping means, after the engagement of the metering device has been restored.

4. The structure set forth in claim 3 including: a movable cam positioned for limiting the movement of said element; whereby the cam when moved to a desired position determined the movement of said element permitting adjustment of the amount of stretch placed in the elastic.

5. The structure set forth in claim 4 including; a projection carried by said fluid pressure operated means for engaging said cam, resilient means positioning said cam for limited movement responsive to engagement by said projection; and means for restoring the normal engagement of the metering device.

6. Apparatus for use with a sewing machine having needles for sewing elastic in the manufacture of a stretch article comprising, a first counter driven by said sewing machine for counting the stitches applied to the article by the sewing machine, an elastic inserter actuated by said first counter when a predetermined number of stitches have been applied to the article for advancing elastic in relaxed condition to the needles, a second counter driven by the sewing machine for counting the stitches applied by the sewing machine to the article while the elastic is in a relaxed condition, a metering device for applying a predetermined amount of tension to the elastic, and means applying tension to the elastic between the needles and the metering device after the application of a predetermined number of stitches to the garment while the fabric is in a relaxed condition.

7. Apparatus for use with a sewing machine having needles for sewing elastic and the like in the manufacture of an article comprising, an article actuated switch positioned adjacent said needles, a first counter driven by said sewing machine for counting the stitches applied to the article by the sewing machine actuated by said switch, an elastic inserter actuated by said first counter when a predetermined number of stitches have been applied to the article for advancing elastic in relaxed condition to the needles, a second counter driven by the sewing machine for counting the stitches applied by the sewing machine to the article while the elastic is in a relaxed condition, a metering device for applying a predetermined amount of tension to the elastic, and fluid pressure operated means applying tension to the elastic between the needles and the metering device after the application of a predetermined number of stitches to the garment while the fabric is in a relaxed condition.

8. The structure set forth in claim 7 including means for relaxing the tension upon the elastic after a desired number of stitches have been placed in the article, and means for cutting said elastic while thus relaxed.

9. Apparatus for use with a sewing machine having needles and a metering device normally engaging elastic which passes therethrough in its path to the needles for placing a predetermined amount of tension in the elastic delivered therefrom including, releasing means for relaxing the engagement of the metering device with the elastic, an elastic inserter for advancing said elastic to the needles in a relaxed condition, means for stretching said elastic after engagement thereof by the needles and while the engagement of the metering device is relaxed, and means for restoring the normal engagement of said

metering device with the elastic while the elastic is thus stretched, whereby a predetermined amount of tension may be placed upon the elastic.

10. A knife for cutting narrow elastic fabric being fed to the needles of a sewing machine comprising, means feeding said elastic to the needles under tension, a fixed blade under which the elastic is fed to the needles extending across the elastic, a movable blade extending across and under the elastic, resilient means for urging the movable blade against the fixed blade, a pivotal mounting carrying said movable blade positioned laterally of said fixed blade in an intermediate portion of the movable blade, and power operated means connected to said movable blade laterally of said pivotal mounting remote from said fixed blade for pulling said movable blade downwardly, and means relaxing the tension on said elastic prior to actuation of said power operated means, whereby a portion of said movable blade adjacent the fixed blade is moved upwardly opposite said fixed blade shearing said elastic therebetween.

11. In combination with a sewing machine having needles, a narrow fabric inserter including, a finger for advancing the fabric toward the needles, a guide for receiving said fabric from said finger, a knife for cutting the narrow fabric positioned between the guide and the needles including, a fixed blade under which the elastic is fed from the guide extending across the fabric, a movable blade extending across and under the fabric, means urging the movable blade against the fixed blade, power operated means connected to said movable blade for moving said blade upwardly opposite said fixed blade thus shearing the fabric therebetween.

12. The structure set forth in claim 11 including a first pivoted housing carrying said knife, and a second pivoted housing carrying said inserter.

13. The structure set forth in claim 12, wherein said fabric is elastic and is fed under tension to the needles including, means relaxing the tension on said elastic prior to actuation of said power operated means.

14. For use with a sewing machine having needles, and a metering device normally engaging elastic which passes therethrough from a supply in its path to the needles, a first counter driven by said sewing machine for counting the stitches applied to the article by the sewing machine; an elastic inserter actuated by said first counter when a predetermined number of stitches have been applied to the article for advancing elastic in relaxed condition to the needles; a second counter driven by the sewing machine for counting the stitches applied by the sewing machine to the article while the elastic is in a relaxed condition; releasing means actuated by said second counter for relaxing the engagement of the metering device with the elastic; gripping means spaced remotely of the needles, positioned in the path of said elastic, for restricting the elastic against movement relative thereto; a movable element engaging said elastic positioned between said metering device and said gripping means; power operated means moving said element a predetermined distance laterally of the path of the elastic for stretching said elastic; means for restoring the normal engagement of said metering device with the elastic while the elastic is thus stretched; means for releasing the restricting action of the gripping means, after the engagement of the metering device has been restored; a knife for cutting narrow elastic fabric being fed to the needles having; a fixed blade under which the elastic is fed to the needles extending across the elastic; a movable blade extending across and under the elastic; resilient means for urging the movable blade against the fixed blade; a pivotal mounting carrying said movable blade positioned laterally of said fixed blade in an intermediate portion thereof; power operated means connected to said movable blade laterally of said pivotal mounting remote from said fixed blade for pulling said movable blade downwardly, so that a portion of said movable blade adjacent the fixed blade is moved up-

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wardly opposite said fixed blade shearing said elastic therebetween; and means relaxing the tension on said elastic prior to actuation of said power operated means; so that said elastic is cut in a relaxed condition.

15. The method of sewing cloth and elastic, to make men's shorts and the like upon a sewing machine having needles and a metering device for applying tension to the elastic through engagement therewith including, advancing cloth for the shorts to the needles, sewing a predetermined number of stitches in the cloth to form a flap, advancing elastic in a relaxed condition to the needles, sewing a predetermined number of stitches in the cloth and elastic to form a flat portion, releasing the elastic from engagement by the metering device, stretching the elastic by exerting a pull thereon on the portion thereof on the side of the metering device remote from the needles, reapplying the engagement of the metering device with the elastic, and continuing the sewing with the elastic under tension until a desired number of stitches are placed therein.

16. The method set forth in claim 15 including re-

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leasing the tension upon the elastic after a desired number of stitches are placed therein, and cutting the elastic in a relaxed condition a predetermined distance from said needles to form a second flat portion.

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