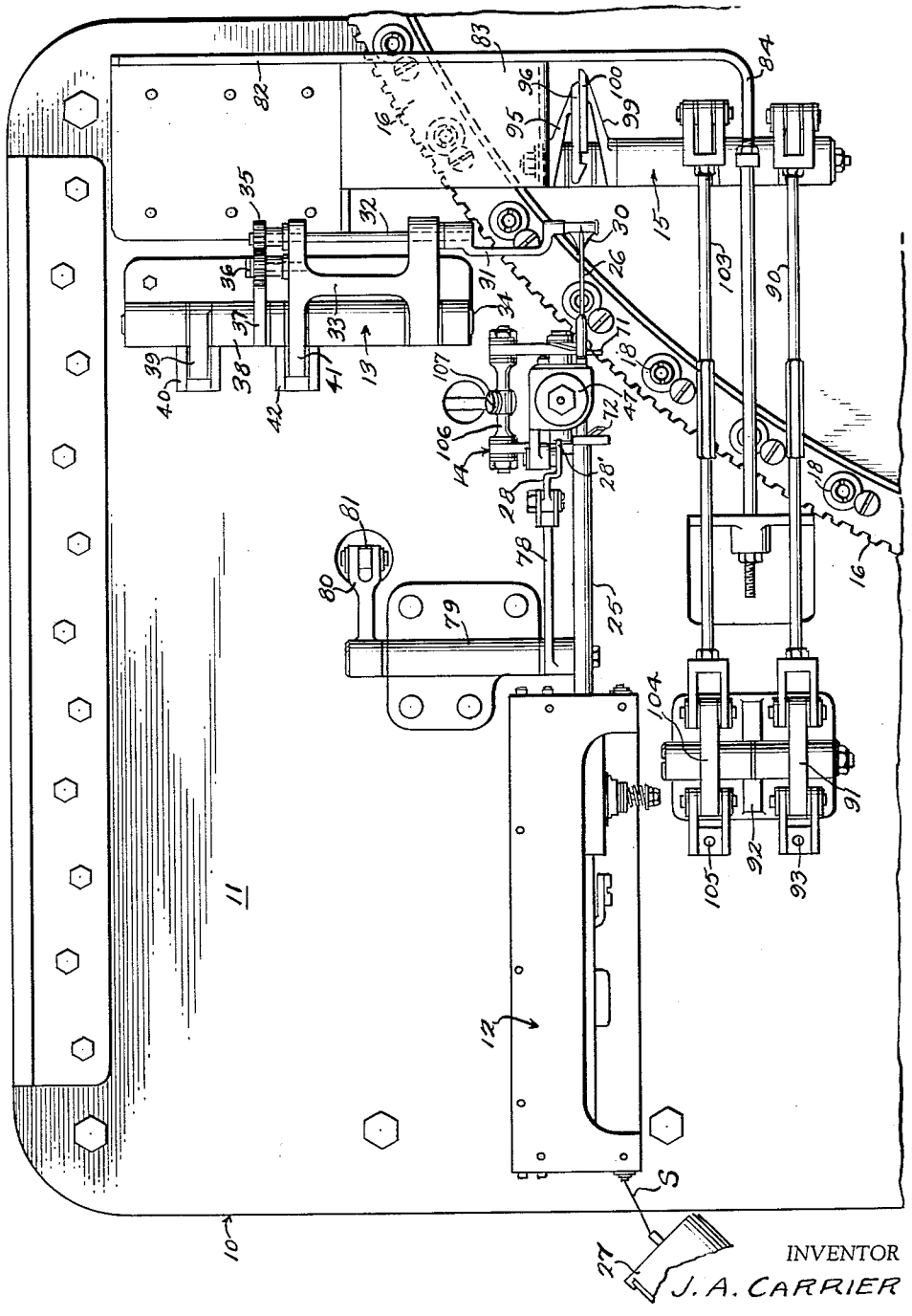
Aug. 16, 1955 J. A. CARRIER 2,715,374

TAMPON WITHDRAWAL STRING SEWING MACHINE

Filed Nov. 20, 1950 6 Sheets-Sheet 1



INVENTOR
J. A. CARRIER

BY G. W. Dallas

ATTORNEY

Aug. 16, 1955 J. A. CARRIER 2,715,374

TAMPON WITHDRAWAL STRING SEWING MACHINE

Filed Nov. 20, 1950 6 Sheets-Sheet 2

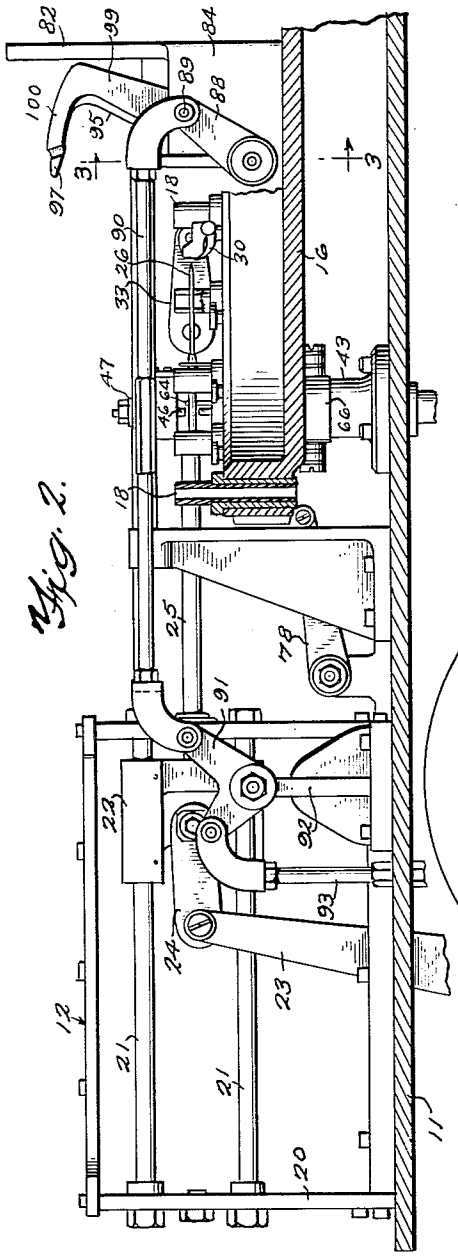


Fig. 2.

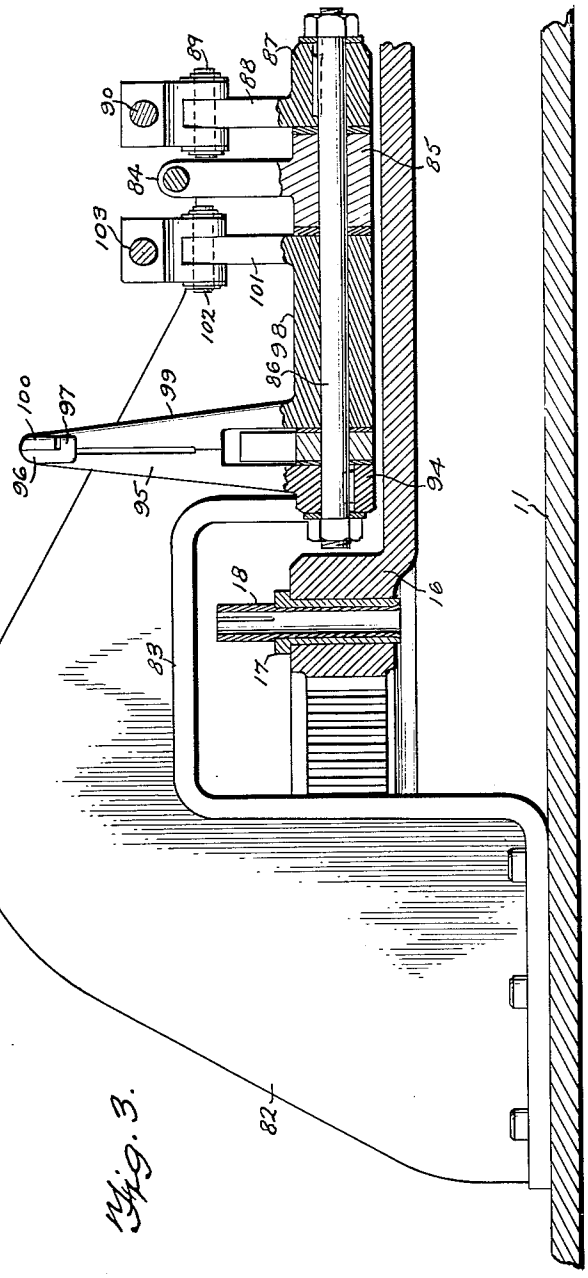


Fig. 3.

INVENTOR
J. A. CARRIER

BY G. W. Dallen

ATTORNEY

Aug. 16, 1955 J. A. CARRIER 2,715,374

TAMPON WITHDRAWAL STRING SEWING MACHINE

Filed Nov. 20, 1950 6 Sheets-Sheet 3

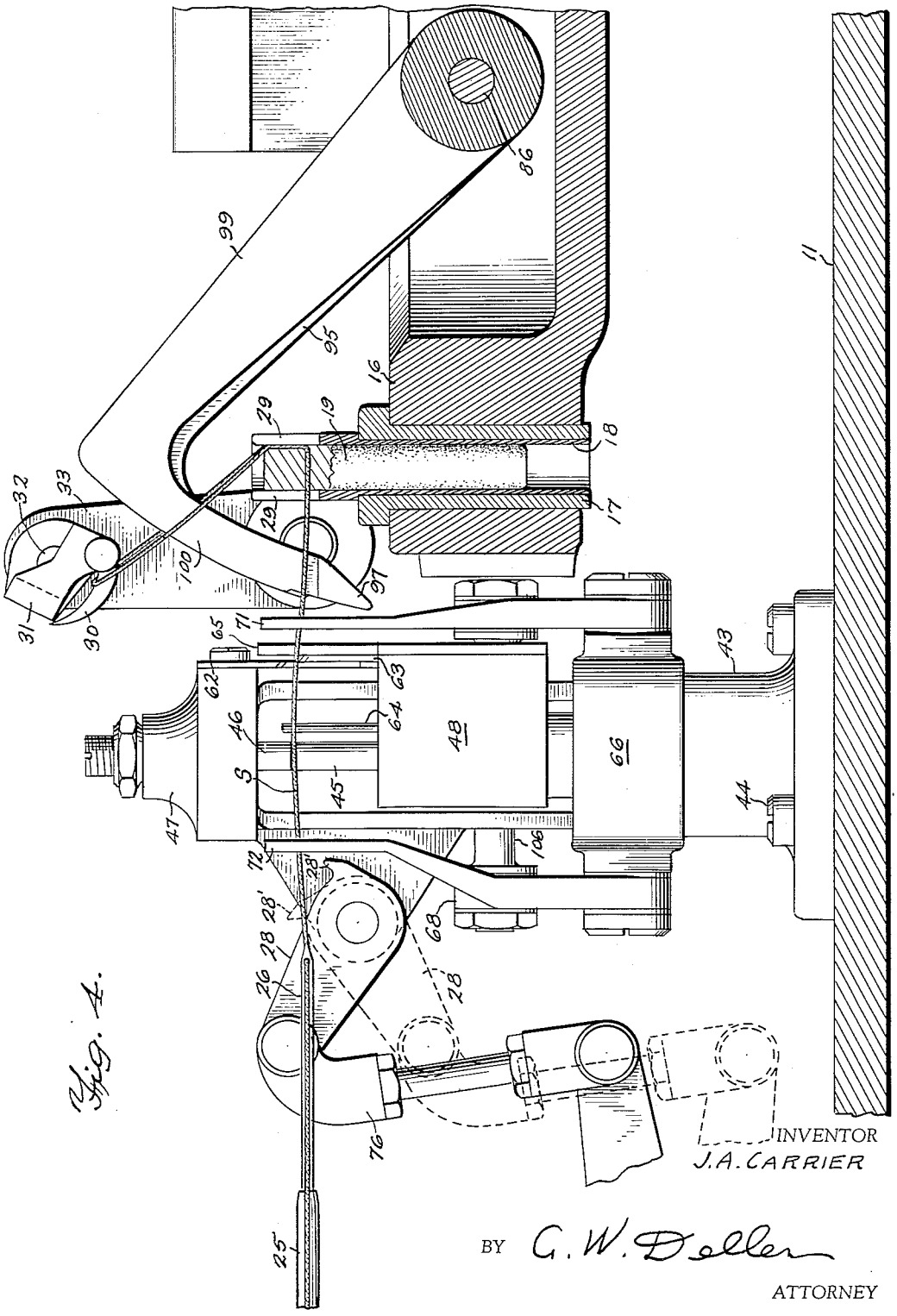


Fig. 4.

INVENTOR
J. A. CARRIER

BY G. W. Dallen

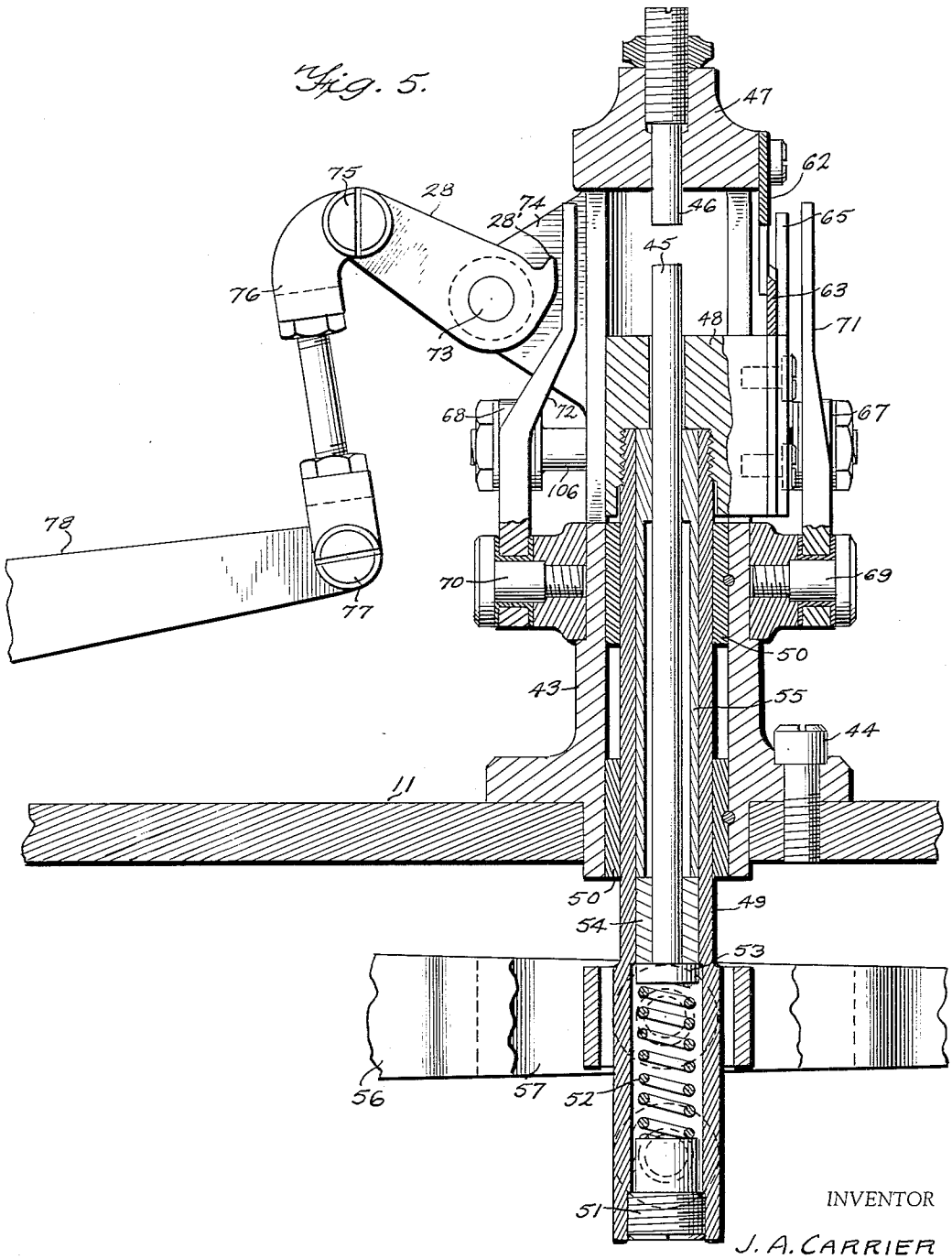
ATTORNEY

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TAMPON WITHDRAWAL STRING SEWING MACHINE

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Fig. 5.



INVENTOR

J. A. CARRIER

BY G. W. Dellen

ATTORNEY

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TAMPON WITHDRAWAL STRING SEWING MACHINE

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Fig. 8.

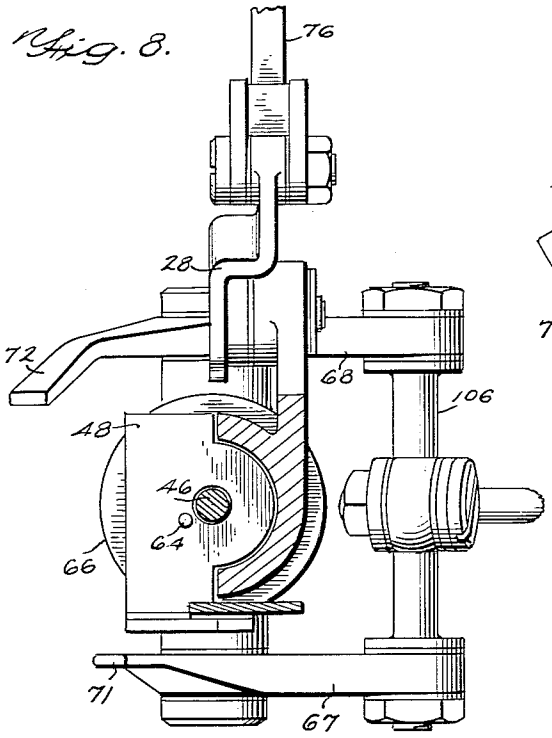


Fig. 6.

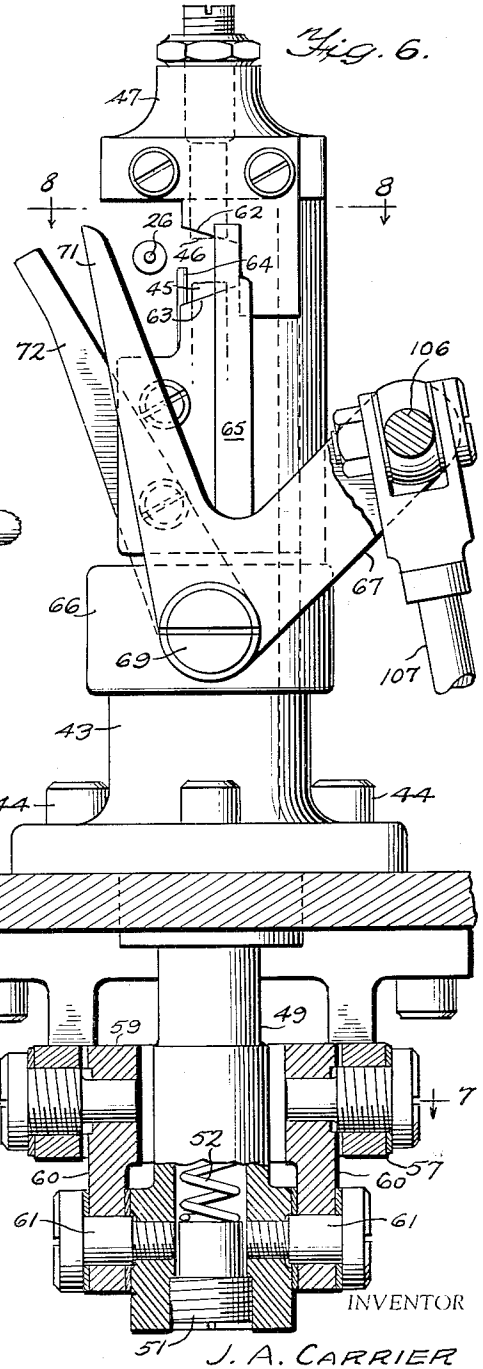
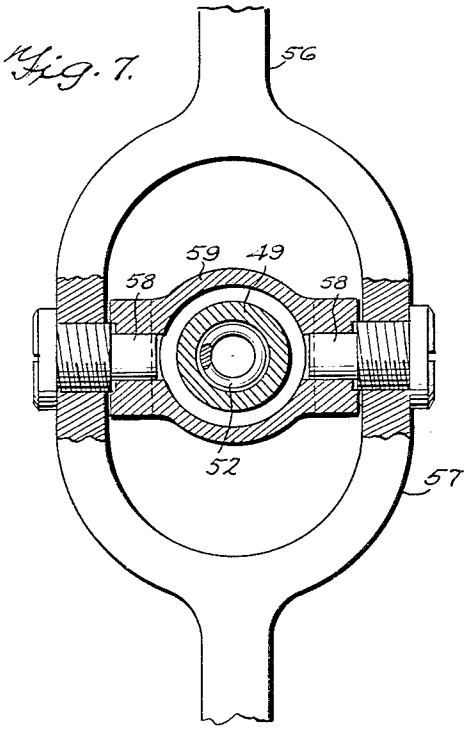


Fig. 7.



INVENTOR
J. A. CARRIER

BY G. W. Dollen
ATTORNEY

Aug. 16, 1955 J. A. CARRIER 2,715,374

TAMPON WITHDRAWAL STRING SEWING MACHINE

Filed Nov. 20, 1950 6 Sheets-Sheet 6

INVENTOR
J. A. CARRIER

BY G. W. Deller

ATTORNEY

United States Patent Office 2,715,374 Patented Aug. 16, 1955

2,715,374

TAMPON WITHDRAWAL STRING SEWING MACHINE

John A. Carrier, Lexington, Mass., assignor to Sanitary Products Corporation, Taneytown, Md., a corporation of Illinois

Application November 20, 1950, Serial No. 196,618

22 Claims. (Cl. 112—2)

This invention relates to the manufacture of vaginal tampons and the like, and deals particularly with the attachment of withdrawal strings thereto.

Heretofore tampons incorporating withdrawal strings have been manufactured in general by manual labor, under assembly line conditions in which the withdrawal strings were attached by hand. Manual assembly methods are necessarily slow as compared to automatic machine operation, and from the standpoint of sanitation they leave much to be described. The present trend in the industry is to the entire replacement of manual labor by automatic machine operation, which includes the attachment of withdrawal strings as one phase thereof. In this phase, however, it has proved difficult to procure fast, smooth, economical and highly efficient operation. The present invention is designed to overcome the difficulty.

It is, therefore, an object of the invention to provide automatic mechanism of novel design for attaching withdrawal strings to tampons.

Another object is to provide automatic mechanism for attaching withdrawal strings to tampons, in which the strings are sewed directly to the tampons.

Still another object is to provide a novel method of attaching withdrawal strings to tampons.

Other objects and advantages will be apparent from the following description taken in conjunction with the accompanying drawings, in which:

Figure 1 is a top plan view of a machine embodying the invention;

Figure 2 is substantially a front elevation thereof;

Figure 3 is a vertical sectional view on the line 3—3 of Figure 2;

Figure 4 is an enlarged fragmentary elevation, partly in section, illustrating a step in the operation of attaching a tampon withdrawal string;

Figure 5 is substantially a sectional view taken vertically through the string clamping and cutting unit of the mechanism;

Figure 6 is an elevation, partly in section, viewed from the right of Figure 5;

Figure 7 is a horizontal sectional view on the line 7—7 of Figure 6; and

Figure 8 is a sectional view on the line 8—8 of Figure 6.

Figures 9–9*i* are, respectively, diagrammatic views illustrating successive steps of the method.

In the practice of my invention, a conveyor carrying a number of holders each with a tampon positioned therein is indexed to carry the holders in a step by step movement serially past a sewing station at which, during each interval of rest of the conveyor between successive step movements, a predetermined length of withdrawal string is threaded through an eye previously formed in an end portion of the tampon. While the tampon still is at rest, a loop is formed in that portion of the string passed through the tampon eye, the loop is carried across and over the adjacent end of the tampon, the string is severed from its supply source, and the free ends of the string

are pulled through the loop which thereupon tightens on the end of the tampon with the free ends of the string dangling from the tampon alongside its holder.

Specifically, the invention includes a base casing **10** housing the mechanical movements and operating connections by which the various instrumentalities of the machine are actuated. The casing is closed at its top by a horizontal cover plate **11** which provides a support mounting the units of the sewing mechanism for attaching withdrawal strings to tampons. These units comprise a needle assembly designated generally as **12**, a loop forming means designated generally as **13**, a string clamping and cutting unit designated generally as **14**, and a loop tightening means designated generally as **15**. A conveyor **16**, here shown as an indexing turret, travels horizontally above the plate **11** and carries a peripheral series of vertically disposed tubular sockets **17** each of which is adapted to receive and support an open ended tubular holder **18** that contains a tampon **19** held frictionally within its bore.

The needle assembly **12** comprises an upright frame **20** secured to the base cover plate **11** and mounting a pair of guides **21** for a reciprocable cross head **22**. The cross head is reciprocated within the frame by oscillation of a vertical lever **23** which has a link connection **24** to the cross head. The lever **23** plays in an appropriate aperture in the plate **11** and is driven by the operating means, not shown, housed in the casing of the base. A needle holder **25** carrying a needle **26** is fixedly mounted on the cross head and passes in an appropriate bearing through the adjacent end of the frame for reciprocation of the needle **26** in a horizontal plane across the sewing station when the machine is in operation. The normal retracted position of the needle is as shown in Figure 4. A string supply source **27**, appropriately mounted on the machine base, delivers withdrawal string S along the outer side of the needle to the eye at the end, at which point the string is directed through the eye and passes behind a slack producing member **28**, here shown as a hook, and thence forwardly to the clamping means by which it is normally held. It is within the purview of the invention that the string supply may be effected in other ways than as shown; for example, from a bobbin or spool carried directly by the needle holder.

The sewing station is the point at which an extension of the axis of a tampon holder on the turret conveyor intersects an extension of the axis of the needle **26**. As best seen in Figure 4, the upper end portion of each tampon holder **18** is diametrically slotted inwardly from its end to form a pair of aligned slots **29** of sufficient width to allow free passage of the needle therethrough as well as a doubled length of the string. The tampon holders are so arranged on the turret that when each arrives at the sewing station its slots **29** are aligned accurately with the axis of the needle.

The loop forming means **13** includes a loop spreader hook **30** of triangular shape fixedly attached at its base to the outer end of an offset arm **31** which, in turn, is fixedly secured at its inner end to the outer end of a rotatable shaft **32**. The shaft is journalled in one pair of arms of an H-shaped rocker frame **33** whereof the other pair is pivoted on a fulcrum mount **34** that is common to both. A gear **35** fixedly mounted on the inner end of the shaft **32** is in constant mesh with a loose spur gear **36** journalled on a stub shaft carried by the rocker frame. The meshed gears are driven by a segment gear in mesh with the gear **36**, the segment gear being carried by a fixed arm **37** which extends from a rotatable sleeve **38** journalled on the fulcrum mount **34** inwardly of the rocker frame **33**. The sleeve **38** is provided also with a second and oppositely directed fixed arm **39** which has pivotal connection with the upper end of an actuator **40**. The actuator

40 passes freely through the plate 11 and is vertically reciprocated by operating mechanism in the base. In like manner, an angled extension 41 of an arm of the rocker frame 33 has pivotal connection with the upper end of another actuator 42 which also passes freely through the plate 11 and is given vertical reciprocation by operating mechanism in the base. It is apparent, therefore, that when appropriate movement is imparted to the actuator 40 the shaft 32 will be rotated to move the loop spreader hook through a corresponding arc, and that when appropriate movement is imparted to the actuator 42 the H-shaped frame 33 will be rocked to move the entire assembly of hook 30, shaft 32, and gears 35 and 36 through a corresponding arc whose axis is the axis of the fulcrum mount 34.

The string clamping and cutting unit 14, best shown in Figures 5–8, includes a vise operative to clamp and hold the string between its jaws, cooperating knives to sever the held string, and means for shifting the string laterally into the zone of influence of the vise and knives. The entire assembly is carried by a vertical, cylindrical casing 43 having a base flange that is rigidly secured to the plate 11 by attaching means 44. An upper portion of the casing wall is removed to provide a front opening section permitting traverse of the needle and the string. As shown in Figures 1 and 6, the casing 43 is located in back of the needle 25 in such position that the needle traverses the open section on a line constituting a chord of a circle whose circumference is that of the casing.

Operative axially within the bore of the casing 43 is a vise having a movable lower jaw 45 and a fixed upper jaw 46. The upper jaw extends through the upper end 47 of the casing and has threaded engagement therewith for vertical adjustment. The lower jaw 45, as here shown, consists of a plunger having its upper end portion slidable in and through an axial bore in a vertically reciprocable head block 48 in the open upper section of the casing. The head block is fixedly attached to the upper end of a cylindrical tubular stem 49 which extends through and below the plate 11, and which is reciprocable axially within the casing 43 in bearings 50 keyed to the casing wall. The lower end of the tubular stem 49 is closed by a plunger 51 detachably threaded therein. An expansion spring 52 seated on the plug 51 bears against a head 53 on the lower end of the plunger comprising the movable jaw 45. Spring 52 constantly urges the head 53 upwardly against an abutment 54 at the lower end of a spacer sleeve 55 mounted within the tubular stem 49.

The entire movable jaw assembly is reciprocable as a unit through an operating connection at its lower end to an actuator lever 56 that is mounted for oscillation in a vertical plane as a part of the operating mechanism housed within the machine base. The lever 56 has a divided portion 57 loosely encompassing the lower end portion of the tubular stem 49 and providing arms in which trunnions 58 are mounted. These trunnions provide pivotal support for an annulus 59 that also encompasses the stem 49 in spaced relation thereto, and which has a pair of links 60 depending therefrom. Trunnions 61 provide pivotal connection between the links and the lower end portion of the tubular stem 49. When the lower jaw assembly of the vise is elevated to bring the jaws into clamping engagement, the spring 52 permits a relative overtravel of the head block 48 with reference to the jaw 45 sufficient to bring the string cutting means into operation.

The string cutting means comprises a stationary upper knife 62 attached to the casing end 47, and a movable lower knife 63 attached to the head block 48. The knives are located on the side of the vise unit adjacent the sewing station. It is apparent in Figure 6 that the cutting point of the knives is located rearwardly with reference to the vise jaws and the needle. In cooperation with the knives and the vise jaws, string guides are provided on the head block 48. One guide consists of a vertical pin

64 extending upwardly from the top face of the head block to a height sufficient to dispose its upper end appreciably above the top of the movable jaw 45. The pin is located in front of the vise jaws and slightly to one side in the direction of the knives, and a second guide 65 is also carried by the head block alongside the knives. This second guide is in the form of a vertically disposed finger of sufficient height to extend above the plane of the clamping point of the vise jaws at all times, and has a frontal straight edge offset somewhat rearwardly relative to the vise jaws but forwardly of the cutting point of the knives.

The unit 14 is provided also with means for shifting the string laterally into position for engagement by the vise jaws and the knives at a certain phase of the machine operation. This means comprises a collar 66 fixedly secured on the supporting casing 43 at an appropriate height above the plate 11 and mounting a pair of bell crank levers 67 and 68 pivoted on fulcrum studs 69 and 70, respectively, attached to the collar at diametrically opposed points on a line that intersects the axis of the movable jaw 45. The lever 67 is pivoted on the side of the collar adjacent the knives and has its long arm 71 directed upwardly and forwardly to oscillate in a vertical plane past the string guide 65 when actuated. In like manner the lever 68 has its long arm 72 inclined upwardly and forwardly on the side of the assembly adjacent the slack producing hook 28 to oscillate in a vertical plane past the hook when actuated, the arm being offset to pass between the bill of the hook and the side of the casing 43. The hook 28 is in the form of a lever pivoted intermediate its ends to oscillate in a vertical plane on a stud 73 carried by a mounting lug 74 integral with the upper section of the casing 43. The upwardly directed bill 28' of the hook lever moves adjacent the path of travel of the string shifter arm 72; and the hook has a pivotal connection 75 at its outer end to a depending link 76 that is in pivotal connection 77 at its lower end with the end of an actuator lever 78. The lever 78 is fulcrumed at its other end on a mount 79 for vertical oscillation under the drive of operating means 80 having an operating connection 81 with the mechanism housed within the base casing.

The loop tightening means 15, see particularly Figures 2, 3 and 4, embodies an oscillatory puller that operates to pass through the formed and elevated loop of the string to grasp the severed end portions of the string and pull them back through the loop, thereby tightening the string length on the tampon end. In order to carry out this operation the cover plate 11 has fixed thereon an upstanding bracket 82 having a forwardly directed bridge portion 83 spanning the turret 16 and terminating adjacent the front of the machine in a support arm 84. The support arm is provided with a bearing 85 which journals a rocker shaft 86 that extends rearwardly in spaced relation above the turret in parallel relation to the shaft 32 of the loop forming unit 13. A collar 87 splined to the outer end portion of the shaft 86 carries an integral upwardly directed crank arm 88 having a pivotal connection 89 with one end of a throw link 90 which extends above the plate 11 in front of the units 12, 13, and 14, and above the turret. The opposite end of the throw link has pivotal connection with one arm of a bell crank rocker 91 that is pivoted on a standard 92 to oscillate in a vertical plane. The standard is secured on the plate 11. The other arm of the rocker 91 has pivotal connection to the upper end of an actuator rod 93 which reciprocates vertically through the plate 11 by operation of the mechanism housed in the base casing.

A collar 94 splined to the inner end portion of the rocker shaft 86 has an integral upwardly directed arm 95 that normally is inclined away from the sewing station. The upper end of this arm is directed toward the sewing station as a curved bill 96 that terminates in a small lateral tip 97 directed frontally of the machine. The arm, bill, and tip constitute a half section of the string puller.

The other half section of the puller is capable of movement relative to the first half, and comprises a sleeve **98** freely rotatable on the shaft **86** and provided at its inner end portion with an upwardly inclined arm **99** similar to the arm **95** and in juxtaposition thereto frontally of the machine. The arm **99** also has a bill **100** lying alongside the bill **96** and which terminates at its point of meeting engagement with the tip **97** on bill **96**. The outer end portion of the sleeve **98** carries an integral crank arm **101** having a pivotal connection **102** with one end of a throw link **103**. The link **103** is similar to the link **90**, with which it is parallel, and has a pivotal connection at its other end with one arm of a bell crank rocker **104** similar to the rocker **91** and also pivoted on the standard **92**. The other arm of the rocker **104** has pivotal connection with the upper end of an actuator rod **105** which reciprocates vertically through the plate **11** by operation of the mechanism housed within the base casing. Prior to movement through an operating cycle, the two sections of the string puller are in the position shown in Figure 2, with the arm **95** slightly advanced relative to the arm **99** and with the terminal of the bill **100** spaced from the tip **97**.

Operation

The method of procedure is as follows: Prior to the start of machine operation the string S is drawn from its supply source and threaded through the eye in the needle **26** from the front side of the needle which then is at its maximum retraction, in the position shown in Figures 4 and 9. At this stage the bill **28'** of the slack hook **28** is in the fully elevated dotted line position of Figure 4. The string is then passed transversely behind the bill **28'**, and led in rear of the forwardly inclined shift finger **72** into the vise between the jaws **45** and **46**. Also at this stage, the loop spreader hook **30** and the arms **95** and **99** of the loop tightening unit occupy the positions of Figures 1 and 2, and a tampon holder with tampon therein is at the sewing station. Each tampon prior to its arrival at the sewing station is pierced transversely in line with its holder slots **29**, by means not a part of this invention, to provide an eye for passage of the needle and string.

When the machine is set in operation, the vise jaws hold the string, the needle goes forward toward the sewing station, and the needle carries the string past the hook bill **28'** and across the front of the guide pin **64** on the head block **48**. If it were not for the presence of the pin **64**, which guides the string outwardly in a gradual curve in front of the vise jaws, the string would be broken by being snapped off at the vise jaws. When the needle is at rest, prior to moving forward toward the tampon, the string is clamped by the vise jaw and hooked by the hook bill **28'**. When the needle is moving toward the tampon the string is released by the hook bill, allowing slack in the string on this side of the needle eye before and during the passage of the needle thru the compressed tampon. This prevents excessive tension on the string at the needle eye and moving of the string thru the needle eye while it is passing thru the tampon. The additional length of string required does not have to be pulled thru the eye because it is produced on the vise side by the release of this hooked loop.

When the needle eye gets thru the tampon it starts to drag string thru the eye and at this point the tension on the string at the point of the vise jaw is increased. The pin **64** causes the pull of the string at the vise jaw to be normal to the string in the jaw while the needle motion is parallel to the bite, thereby relieving the possibility of a break in the string at the jaw. Just before the needle reaches the sewing station the hook **28** is rocked to lower its bill **28'** and thereby release the string on its tension side with reference to the needle, as shown in Figure 9*a*. That portion of string between the hook **28** and the eye of the needle is sufficient, when released, to provide enough slack to allow the needle to pull the string easily through the tampon without tension. This provision of slack is an important feature of the invention for otherwise the string would break. The needle continues through the tampon, trailing the string along both sides, and reaches its point of farthest advance where it overlies the loop former hook **30** as shown in Figures 1 and 9*b*. It then retracts slightly and stops in its position of Figure 9*c*. The slight retraction is sufficient to provide a slack loop in the string between the eye of the needle and the eye of the tampon, so that the point of the looper hook **30** can enter and hold the loop when the needle is fully retracted.

Immediately after the needle comes to rest, the actuator **40** operates through the connections described to rotate the shaft **32** clockwise and thereby bring the point of the triangular hook **30** upwardly between the legs of the slack loop as in Figure 9*d*, whereafter the needle goes back to its initial position. This action is followed immediately by operation of the actuator **42** to rock the H frame **33** on its fulcrum **34** and thereby to carry the still rotating shaft **32** and hook **30** bodily through an arcuate path counterclockwise into the elevated position shown in Figure 4 and indicated in Figure 9*e*, at which point the elements of the unit come to rest. This upward travel of the hook **30** extends the loop and pulls it up and over the end of the tampon and its holder, and at the same time the continuing entrant action of the triangular hook spreads the legs of the loop apart to allow passage of the puller bills **96** and **100**, as shown in Figure 4.

The spread loop is held for an interval in elevated position, during which time the arms **95** and **99** are actuated to pass the bills **96** and **100**, still opened as in Figures 2 and 3, down into hooked engagement with that portion of the string between the severing knives and the sewing station. This step is shown in Figure 9*f*. The string slides over the tip **97** on the bill **96**, whereupon the tip and the bill **100** are brought together with the string clamped between them and the vise jaws open to release the string. While the string is being engaged and clamped by the bills **96** and **100**, the bell cranks **67** and **68**, which have a common pivotal connection **106** with a vertically reciprocable actuator **107**, are rocked to carry their long arm fingers against the string to shift it laterally in a rearward direction in the step shown in Figure 9*g*. The finger **71** moves the string bodily against the guide **65** and between the spaced apart knives **62** and **63** in proper position to be cut thereby. The guide **65** has a further function in that it fends the string away from the knives when the needle is advanced to the sewing station, thereby preventing a premature cut. The guide **65** locates the string for clamping by the vise jaws when the arms **71** and **72** force it into the vise and also to fend it away from the cutting blades **62** and **63**. Due to the overlapping of the blades of the knife, the string could be forced against the cutting edge of either blade when it is thrown into the path of the jaws and when the end of the released string is being pulled out of the vise by arm **71**. The jaws only have to open slightly to release the string and at this instant a V is formed by the two blades and guide **65** covers up this V on the release of the string. The finger **72** shifts the tension side of the string bodily to extend from the guide pin **64** between the open jaws of the vise in back of the still lowered hook bill **28'**, so that when the hook **28** is next actuated to lift the bill the string will be caught behind it in position for the next sewing operation.

When the string is thus positioned, the head block **48** is moved upwardly to close the vise jaws on the string and, through its permissible overtravel relative to the vise jaw **45**, to elevate the knife **63** against the knife **62** and cut the string. Cutting of the string leaves it as two free ends on the tampon.

Following severance of the string, the elevated loop spreader hook **30** is reversely rotated to release the loop, the H frame **33** is rocked back to its original position, and the bills **96** and **100** are retracted upwardly through the loop to pull the doubled string and free ends beneath the descending bight of the loop, constricting the loop on

the adjacent end of the tampon, in the step shown in Figure 9*h*. The bills **96** and **100** continue to retract and thus exert a pull which tightens the loop firmly; and as the bills near the end of their return stroke the arm **99** moves ahead of the arm **95** to separate the bill **100** from the tip **97** and release the string so that its free ends fall and dangle alongside the tampon holder through the adjacent slot **29** in the final step shown in Figure 9*i*.

Before the shift finger **72** moves back to its original position, the slack producer hook **28** will have been actuated to lift its bill **28'** back to fully elevated position, so that when the needle is next actuated toward the sewing station the string is caught behind the hook bill in the manner in which it was trained at the outset. As the various parts return to their initial positions the head block **48** lowers slightly to open the cutting knives but not far enough to open the vise jaws, so that the string remains held at that point. The turret is indexed to move a following tampon and holder to the sewing station, and the cycle of machine operation is repeated.

In its method aspect, the invention contemplates a series of steps in which the string is drawn from a supply source, trained through the eye of a needle, and anchored at a point spaced from the needle at one side of the needle. A tampon is disposed at a sewing station. The needle is advanced past the point of string anchorage and is passed through the tampon to carry a doubled length of string through and beyond the tampon. However, before the needle is advanced a restraint is imposed on the string by interposing a member across the path of bodily movement of the string incident to advance of the needle. This restraint is removed just before the needle enters the tampon, and provides a slack in that portion of the string between its point of anchorage and the eye of the needle, preventing breakage.

After the needle reaches its point of farthest advance it is slightly retracted and stopped, thereby creating a slack loop. The loop is then held while the needle is fully retracted, and during this period the loop is spread and is carried bodily up over and across the adjacent end of the tampon. While the loop is elevated puller means is inserted therethrough and the string is grasped by the puller means at a point between the point of anchorage and the tampon. Coincident with this action the string is released at the point of anchorage. Thereafter the string is shifted bodily to bring its tension side to the point of anchorage, it is anchored at that point, and the string is then cut between the point of anchorage and the point at which it is grasped by the puller means, leaving two free ends. The free ends are then pulled back together through the loop to tighten and fasten it on the tampon, and the ends are released to dangle alongside the body of the tampon. A restraint is again imposed on the string between the point of its anchorage and the eye of the needle, another tampon is brought to the sewing station, and the cycle is repeated.

It is considered unnecessary to illustrate and describe herein all the various mechanical movements and machine elements by which the synchronized operation of the several parts of the apparatus is effected, as all such are conventional and well known to persons skilled in the art. Although the present invention has been described in conjunction with preferred embodiments, it is to be understood that modifications and variations may be resorted to without departing from the spirit and scope of the invention, as those skilled in the art will readily understand. Such modifications and variations are considered to be within the purview and scope of the invention as claimed.

I claim:

1. Automatic mechanism for attaching withdrawal strings to tampons comprising, in combination, a string supply source, a sewing station, means for positioning a tampon at said station, a needle reciprocable through a tampon at the station and having an eye through which the string is threaded to form a loop on advance of the needle, string holding means between the sewing station and the position of retraction of the needle, means adjacent the point of farthest passage of the needle and string through the tampon operative to extend the loop in the string between the eye of the needle and the tampon, means for severing the string between its holding means and the tampon following extension of the extended loop, and means operative through the loop to grasp the severed string and pull it through the loop whereby to tighten it on the tampon.

2. Automatic mechanism for attaching withdrawal strings to tampons comprising in combination, a string supply source, a sewing station, means for positioning a tampon thereat, a needle reciprocable through a tampon at the station and having an eye through which the string is threaded to form a loop on advance of the needle, string holding means between the sewing station and the position of retraction of the needle, a member rotatable into engagement with the string adjacent the point of farthest passage of the needle and string through the tampon whereby to extend the loop in the string between the eye of the needle and the tampon, said member being bodily movable to carry the bight of the loop over and across the tampon, means for severing the string between its holding means and the tampon following extension of the loop, and means operative through the extended loop to grasp the severed string and pull it through the loop whereby to tighten it on the tampon.

3. Automatic mechanism for attaching withdrawal strings to tampons comprising, in combination, a string supply source, a sewing station, means for positioning a tampon thereat, a needle reciprocable through a tampon at the station and having an eye through which the string is threaded to form a loop on advance of the needle, string holding means between the sewing station and the position of retraction of the needle, a member adjacent the point of farthest passage of the needle and string through the tampon for engaging in and extending the loop in the string between the eye of the needle and the tampon, means for moving said member bodily across and over the tampon while engaged in the loop, means for severing the string between its holding means and the tampon following extension of the loop, puller means operative through the loop while on said member to engage and grasp the string, means for withdrawing said member from the loop, and said puller means being retractive through the released loop to pull the severed string through the loop and tighten it on the tampon.

4. Automatic mechanism for attaching withdrawal strings to tampons comprising, in combination, a string supply source, a sewing station, means for positioning a tampon thereat, a needle reciprocable through a tampon at said station and having an eye through which the string is threaded to form a loop on advance of the needle, a vise operative at one side of the needle between its position of retraction and the sewing station to hold an end of the string during travel of the needle, means adjacent said vise and operative to produce slack in the held string before the needle reaches the tampon, means adjacent the point of farthest passage of the needle through the tampon for extending the loop in the spring between the eye of the needle and the tampon, means for severing the string between the vise and the tampon following extension of the loop, and means operative through the extended loop to pull the severed string therethrough and tighten the loop on the tampon.

5. Automatic mechanism for attaching withdrawal strings to tampons comprising, in combination, a string supply source, a sewing station, means for positioning a tampon thereat, a needle reciprocable through a tampon at the station and having an eye through which the string is threaded to form a loop on advance of the needle, string holding means between the sewing station and the position of retraction of the needle, string severing means

between said holding means and the sewing station, means operative adjacent the point of farthest passage of the needle and string to extend the loop in the string between the eye of the needle and the tampon, means operative through the extended loop to grasp the string between the holding means and the tampon to pull the string through the loop, and means operative in timed relation to the string pulling means to carry the string bodily to a position for operation thereon by the severing means.

6. Automatic mechanism for attaching withdrawal strings to tampons comprising, in combination, a string supply source, a sewing station, means for positioning a tampon at the sewing station, a needle reciprocable through a tampon at said station and having an eye through which the string is threaded to form a loop on advance of the needle, string gripping means at one side of the needle between its position of retraction and the sewing station, loop extending means engageable with the string on the needle adjacent its point of farthest passage through the tampon, puller means adapted for passage through a string loop when extended, said puller means being movable through the loop in one direction into holding engagement with the string between the gripping means and the sewing station, means for severing the string between the gripping means and its point of engagement by said puller means, and said puller means being movable in an opposite direction to pull the engaged and severed string through the loop whereby to tighten it on the tampon.

7. In a machine for attaching withdrawal strings to tampons, a string handling assembly comprising a vise having a fixed jaw and a movable jaw, a reciprocable operating member carrying the movable jaw, a fixed knife adjacent the fixed jaw, a movable knife cooperating with the fixed knife for cutting string held between said jaws, said movable knife being mounted on said operating member for movement therewith, and there being a connection between the movable jaw and the operating member permitting overtravel of the latter relative to the movable jaw.

8. In a machine for attaching withdrawal strings to tampons, a tampon holder apertured to receive a needle transversely therethrough, a needle adapted for reciprocation through said holder to carry a doubled length of string therethrough, a hook rotatable adjacent said holder on an axis disposed transversely of the path of travel of the needle to engage string thereon, said hook being of substantially triangular shape whereby to spread the string as extended loop, a frame rotatably mounting said hook and fulcrumed adjacent said holder for oscillation in a plane parallel to the longitudinal axis of the holder whereby to carry said hook bodily in an arcuate path over and across an end of the holder, and string puller means mounted for oscillation across the path of bodily travel of said hook in the plane of its travel and between said hook and the adjacent end of the tampon holder.

9. In the structure of claim 8, said puller means including a pair of arms relatively movable in close juxtaposition, a bill directed laterally from one arm, a second bill directed laterally from the other arm parallel to and of greater length than the first named bill, and a tip on said first named bill directed laterally across the path of travel of the second bill to form therewith a string clamping means.

10. In a machine for attaching withdrawal strings to tampons, which includes means for disposing a doubled length of string through an end portion of a tampon as a loop extended axially across and over the tampon end; means for pulling a portion of the string through the loop to tighten it, which comprises, a pair of arms in parallel relation pivoted on a common fulcrum for oscillation, a bill on each arm parallel to the other bill, a tip on one bill directed transversely across and beyond the end of the other bill, said bills being movable in unison through the string loop as said arms are oscillated whereby to engage and pull a portion of string through the loop, and means for imparting a relative movement to said arms during their cycle of oscillation whereby to bring said tip and the end of the other bill together in clamping relation on the engaged string at one point of the cycle and to separate said other bill end and the tip to release the string at another point of the cycle.

11. In a machine for attaching withdrawal strings to tampons, which includes a needle adapted for reciprocation through a tampon to pass a doubled length of string therethrough; a vise at one side of the path of travel of the needle for holding an end of the string, a member movable between the vise and the needle across the path of bodily movement of the string incident to advance of the needle to impart a tension to the string, and means operative in timed relation to the operation of the needle for removing said member from said path of bodily movement of the string immediately prior to entry of the needle in the tampon, whereby to provide slack in the string.

12. In a machine for attaching withdrawal strings to tampons, which includes a needle adapted for reciprocation through a tampon to pass a doubled length of string therethrough; a vise at one side of the path of travel of the needle for holding an end of the string, a member adapted for interposition across the path of bodily movement of the string incident to advance of the needle and disposed adjacent the point of farthest retraction of the needle to impart a tension to the string as the needle is advanced, means operative in timed relation to the operation of the needle for removing said member from said path of bodily movement of the string prior to entry of the needle in the tampon to establish a condition of slack in the string, and a string guide associated with said vise and constantly interposed across the path of bodily movement of the spring incident to advance of the needle.

13. In string attaching mechanism having a reciprocating needle having a means for receiving a string from a constant supply source for delivery at an attaching point as a loop; means for anchoring the free end of the string during advance of the needle, means between said anchoring means and the tip of the needle when in its retracted position for maintaining an extension bend in the string during advance of the needle, and means operative when the needle nears the attaching point to remove said maintaining means whereby to provide a slack in the string before the needle reaches the attaching point.

14. In string attaching mechanism having a reciprocating needle having a means for receiving a string paid out from a supply source during advance of the needle to an attaching point; means for anchoring the free end of the string at a point between said attaching point and the tip of the needle when in fully retracted position, and means intermediate said anchoring means and the fully retracted position of the needle operative in timed relation to movement of the needle to hold the string extended in tension during advance of the needle and to release the string when the needle tip nears said attaching point, whereby to establish a slack in the string before the needle tip arrives at the attaching point.

15. In a machine for attaching withdrawal strings to tampons, a tampon holder apertured to receive a needle therethrough, a needle adapted for reciprocation through said holder to carry a doubled length of string therethrough, a hook rotatable adjacent said holder on an axis disposed transversely of the path of travel of the needle to engage string thereon, said hook being adapted on rotation to spread the string as an extended loop, and a frame rotatably mounting said hook and mounted for oscillation in a plane substantially parallel to the longitudinal axis of the holder whereby to carry said

hook bodily in an arcuate path over and across an end of the holder.

16. The structure of claim 15, and string puller means operative across the path of travel of said hook between said hook and the end of the holder.

17. Mechanism for attaching a string loop to an article comprising, in combination, an article holder, a needle reciprocable through and beyond an article when in the holder to carry a string loop therethrough, means adjacent the path of travel of the needle operative to spread and hold a loop carried by the needle, means operative to carry the loop spreader means bodily over and across said article holder, and string puller means operative in a cycle to pass between said article holder and the loop spreader means while the latter is in its position over and across the article holder.

18. A string handling assembly comprising a tubular casing apertured for the passage of string transversely therethrough, an operating member reciprocable axially in the casing, a movable jaw carried by said member for movement therewith, a fixed jaw carried by the casing and cooperating with the movable jaw to clamp and hold a string passed through the casing, a knife fixed on the casing, a knife carried by said operating member and movable therewith in cooperation with said fixed knife to cut string held between said jaws, and spring means establishing relative overtravel between said operating member and the movable jaw.

19. A string handling assembly comprising, in combination, a string supply source, a string attaching point, a reciprocating needle threaded with string from said source for delivery at said attaching point as a loop, a vise at one side of the path of travel of the needle between said attaching point and the tip of the needle when in fully retracted position, said vise including a fixed jaw and a movable jaw, a string cutter adjacent said fixed jaw between the jaw and the string attaching point, means operative in timed relation to the needle to hold the vise jaws closed on the free end of the string during a full cycle of reciprocation of the needle and to release it thereafter, means operative adjacent the string attaching point to retain the loop delivered thereto by the needle whereby retraction of the needle trails a doubled length of string from the attaching point to the needle tip past said vise and cutter, means operative through the loop to grasp the doubled length of string between said cutter and the attaching point and pull it through the loop, means operative in timed relation to the puller means to open the vise jaws to release the string, a member movable across the path of travel of the needle to engage and carry the trailing doubled length of string to said cutter for cutting thereby, a second member movable across the path of travel of the needle between the first-named member and the retracted needle tip to engage and carry the free end of the string from the needle tip between said vise jaws, and means operative in timed relation to said second member to close the vise jaws on the free end of the string disposed therebetween.

20. In a string attaching machine having a threaded needle movable to and from a string attaching point to deliver string thereto as a loop, and having means for retaining the loop thereat; means at one side of the path of travel of the needle operative to anchor an end of the string during advance and retraction of the needle whereby to establish on full retraction of the needle a doubled length of string from the attaching point to the vicinity of the anchoring means and a single length of string from the vicinity of the anchoring means to the needle, string cutting means between said anchoring means and the attaching point on the same side of the path of needle travel as the anchoring means, and string shifting means on the opposite side of the path of travel of the needle operative to move bodily across said path of travel against the string to carry its doubled length to the cutting means and its single length to the anchoring means.

21. In a string attaching mechanism including a reciprocating needle having a means for receiving a string led from a supply source and anchored at a point remote from the tip of the needle when it is in retracted position; string extension means operative during advance of the needle to engage the string and maintain in that portion thereof between the tip of the needle and the point of anchorage an extent of string greater than the extent of a straight line between said point of anchorage and the tip of the needle when in its retracted position; and means operative when the needle tip reaches a predetermined point less than final in its advance to disengage said extension means from the string and thereby establish a condition of slack in the string before the needle reaches the final point in its advance.

22. In a string attaching mechanism including a reciprocating needle having a means for receiving a string paid out from a supply source during advance of the needle to an attaching point; means for anchoring the free end of the string during advance of the needle; and string extension means operative in timed relation to the needle to engage that portion of the string between its end anchoring means and said string receiving means of the needle and, during advance of the needle, to dispose said engaged portion of the string out of a straight line between its end anchoring means and the string receiving means of the needle when the needle is in retracted position; and said extension means being operative to release the string just prior to arrival of the needle at said attaching point.

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