

June 28, 1960

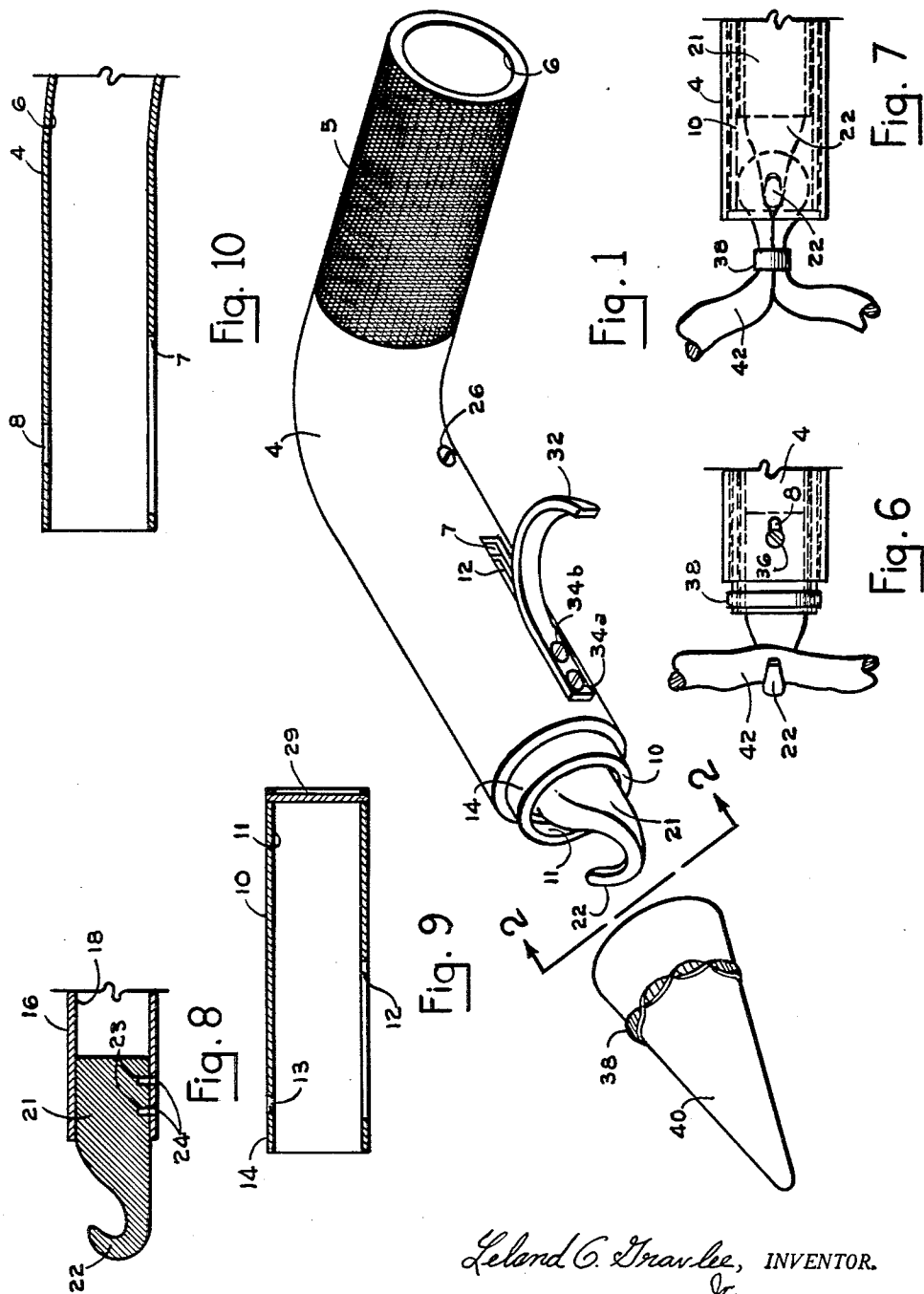
L. C. GRAVLEE, JR

2,942,604

APPARATUS FOR APPLYING AN ELASTIC TIE

Filed June 2, 1958

2 Sheets-Sheet 1



Leland C. Gravlee, Jr., INVENTOR.
BY Eugene Buntz
Attorney

June 28, 1960

L. C. GRAYLEE, JR

2,942,604

APPARATUS FOR APPLYING AN ELASTIC TIE

Filed June 2, 1958

2 Sheets-Sheet 2

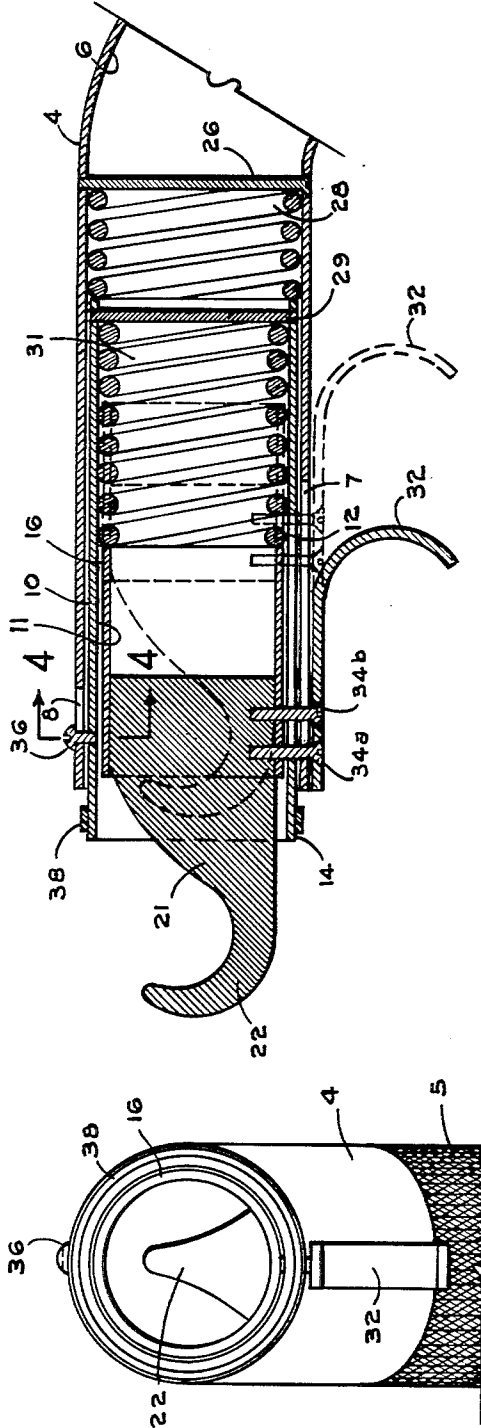


Fig. 2

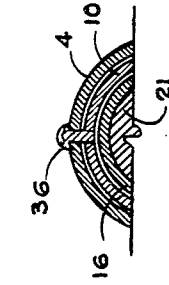


Fig. 4

Fig. 3

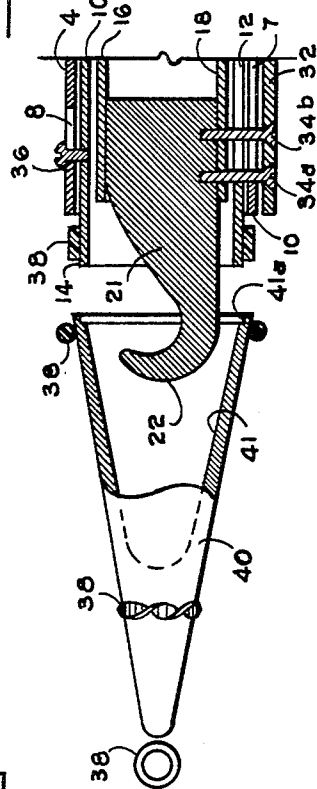


Fig. 5

Leland C. Graylee, Jr., INVENTOR.

BY J. Eugene Burts,
Attorney

1

2,942,604

APPARATUS FOR APPLYING AN ELASTIC TIE

Leland C. Gravlee, Jr., Birmingham, Ala., assignor of one-third to Robert Parker, Birmingham, Ala.

Filed June 2, 1958, Ser. No. 739,210

9 Claims. (Cl. 128—303)

This invention relates to means for the application of an elastic tie for the purpose of preventing the flow of fluid through a tube or the like, and it refers more particularly to apparatus for applying an elastic tie to an umbilical cord during surgery incident to birth.

A primary object of my invention is to provide apparatus wherewith an effective tie may be quickly and efficiently applied to an umbilical cord prior to severing the same incident to the surgery performed immediately after childbirth.

Accordingly, an important feature of my invention resides in the effective application of such a tie, in a manner to completely preclude substantial bleeding, and obviate the necessity for complicated follow-up procedure presently necessary to prevent further bleeding.

The umbilical cord has been a bleeding problem since the creation of man. There have been many methods devised to tie the umbilical cord. All of them have their weaknesses as no one method is being used universally.

A series of experiments has been conducted in various hospitals involving the delivery of four hundred babies. These babies have their umbilical cords tied with cotton cord ties, the same type which has been used for the past sixty or seventy years. One hundred and eight of these four hundred had to have their cords retied in the nursery because of bleeding from the cord. One fetal death due to exanguination from the cord was recorded in this series.

Using the cotton tie technique, the baby is delivered and placed upon the abdomen of the mother; the cord is then clamped in two places and cut with the scissors between the clamps; the baby then placed on the table so that the cord can be tied in two places using six to nine knots, and the umbilical cord is cut again with the scissors about two centimeters distal to the tie. When using this technique the mother is left unattended for a period of from two to four minutes. It is important that she be observed for hemorrhage and delivery of the placenta during this time.

I have devised an apparatus wherein an elastic band, in an expanded condition, is carried by a telescoping barrel. This barrel, or sleeve member, is provided with a longitudinal bore in which is placed a piston provided with a hook which projects beyond the outer portion of the sleeve. By means of this apparatus, and the trigger mechanism which will be described, the hook is used to engage the umbilical cord drawing the same within said sleeve member, while the elastic tie is at the same time disengaged over the cord, so withdrawn, constricting and tying the same. This device will be more particularly described hereinafter.

In comparison, when my invention is used, the baby is placed on the abdomen of the mother; the cord, at the desired distance from the baby, is placed in the hook. Upon pulling the trigger or operating lever of my apparatus, a loop of cord is pulled inside of the sleeve and the sleeve pulled back inside its larger housing in one action. In this operation an expanded elastic ring is tripped off of the sleeve around the cord. When the op-

2

erating lever or trigger is released, the automatic mechanism which I have provided delivers the cord tied securely and prepared for the severing operation. The distal cord is then clamped; the cord is cut with the scissors and the scissors and the baby handed to the nurse. Thus, the mother is not left unattended and the entire process takes only a few seconds. The apparatus is designed to be handled with one hand. Should the occasion arise, the cord could be tied, clamped and cut with one hand. The tie which is placed upon the cord is all that is needed in this case, and it remains in place until the cord drops off some seven to eleven days after delivery.

To this end, another important feature of my invention resides in the fact that the apparatus is so simple in design and easily operated that the most inexperienced medical student or nurse could tie the cord just as masterfully as the most skilled obstetrician.

In the experiment conducted in the development of this apparatus, another series of four hundred deliveries, using this apparatus experimentally has been done, and not a single case of bleeding was recorded.

It will be obvious that another important feature of my invention resides in the fact that I have provided an apparatus which can easily be sterilized and subjected to the heat of an autoclave as in the case with other medical instruments.

Other and further objects of my invention, together with the features of novelty, will appear in the course of the following description.

In the accompanying drawing which form a part of the instant specification and are to be read in conjunction therewith, and in which like reference numerals are employed to identify like parts of the various views:

Fig. 1 is a perspective and isometric view of the apparatus of my invention including the loading mechanism.

Fig. 2 is a fragmentary sectional view of my invention taken along the lines 2—2 of Fig. 1 as indicated.

Fig. 3 is an end view of my invention.

Fig. 4 is a fragmentary sectional view taken along the lines 4—4 of Fig. 2 in the direction indicated, to show the stop mechanism for the sleeve member.

Fig. 5 is a view partially cut away and in section of the loading member of my invention, together with its application to the apparatus.

Fig. 6 is a partial plan view of the apparatus, showing the engagement of the cord by the hook in its initial position.

Fig. 7 is a view similar to Fig. 6, showing the hook withdrawn into the apparatus with the tie in place on the cord.

Fig. 8 is a section view of the piston member, as in Fig. 2, disassembled from the apparatus.

Fig. 9 is a section view of the sleeve member of the apparatus, as in Fig. 2, disassembled from the apparatus.

Fig. 10 is a fragmentary sectional view of the housing member, as in Fig. 2, shown in the disassembled condition.

Referring more particularly to the drawings, in Figs. 1 and 2, it can be seen that the housing of my invention comprises essentially a cylindrical barrel, elongated at its forward end and curved at its rearward end, to provide a hand grip with a plurality of serrations 5 provided to enable the handle to be grasped firmly. The housing member is provided with a longitudinal bore or channel 6, of uniform diameter, extending throughout its length.

The housing member is also provided, near its forward end, with an extended slot or keyway 7, as clearly shown in Figs. 1, 2 and 10. Reciprocally disposed in the forward end of the housing member, such that it may telescope therein, is a second barrel or sleeve member 10, provided with a longitudinally extending channel or bore 11 of uniform diameter, as shown. Sleeve member 10 is provided at the lower portion of its forward end with

a keyway or slot 12 which, when aligned with the forward end of the slot 7, would allow the projection of the sleeve member beyond the housing member to provide an extending shoulder portion 14. This shoulder portion projects from the end of the housing with the mechanism in the forward position as shown in Fig. 1. In operation, the sleeve member is slidably fitted into the housing member as indicated.

Reciprocally disposed in the sleeve member channel, as indicated, is a third barrel or piston member 16 having a uniform channel or bore 18 as shown. In this embodiment of my invention there is wedged into the channel of the piston member a plastic plug 21, having its outer end shaped to form a hook 22. The plug 21 is provided with a pair of threaded screw bores 23 which are aligned with screw holes 24 located in the bottom of the piston as shown.

In the assembled condition, the housing member is provided with a screw pin 26 which retains a coiled spring 28, which fits the diameter of the bore of the housing, and impinges upon the rearward portion of the sleeve member 10, as shown in Fig. 2, biasing this member in a forward position.

The sleeve member is similarly provided with a pin 29 which retains a coiled spring 31, carried by the bore of the sleeve member, impinging upon the rearward surface of the piston member, as shown, biasing the piston member in the forward position.

As assembled, the apparatus is provided with an operating lever or trigger 32, carrying screws 34a and 34b, which extend through slots 7 and 12, as shown, through holes 24, and are received by the bores 23 of the plug 21.

The housing member 4 is also provided on its surface with a small slot or keyway 8. In the assembled condition, slot 8 carries a retaining screw 36, which is received by a threaded screw bore 13 in the sleeve member. Slot 8 is so located, in cooperation with slot 12, such that when the operating lever 32 is in the forward position, as shown, with the screw 34a against the forward end of slot 7 and slot 12, that retaining screw 36 will be against the forward end of slot 8 such that a portion of sleeve member 10 is allowed to project to form shoulder 14 extending beyond the housing.

With sleeve member 10 and piston member 16 biased in the forward position, as shown in Figs. 1 and 2, slots 7 and 12 are so arranged that, with screw 34a resting against the forward end of slots 7 and 12, as indicated, the piston member 21 is so located that hook 22 extends beyond the edge of sleeve member 10 as shown. At the same time, sleeve member 10 is restrained by screw 36 against the forward edge of slot 8 such that the sleeve member extends beyond housing member 4 to provide the projection 14 as shown. Slot 12 in member 10 is of such length that, when the operating lever or trigger 32 is moved rearwardly in slot 7, screw 34b engages the rearward end of slot 12 after hook 22 has been withdrawn beyond the forward edge of sleeve member 10, and sleeve member 10 is then drawn rearwardly into the housing member 4 until restrained by screw 36 against the rearwardly end of slot 8; slot 8 being of such length that the withdrawal of the sleeve member 10 is allowed until the outer edge of such member is flush with the outer edge of the housing member 4. The length of slot 7 in the housing member is greater than the length of slot 12 in the sleeve member by approximately the same length as slot 8. Slot 7 could be longer in its rearwardly direction, but for operational purposes this approximate length is sufficient, the purpose being to allow the withdrawal of the sleeve member to a position with its outer edge flush with the outer edge of the housing member.

In the loaded position, as shown in Fig. 2, the apparatus carries on the projection 14 of sleeve member 10 an expanded elastic ring 38. The elastic ring 38 is very strong, and may be made of cut sections of small diameter surgical tubing. However, such ring may be made

in any suitable manner of very strong rubber such that in its unexpanded condition the ring is very strong with a very small diameter on the inside.

It is obvious that a problem would be encountered in loading such a strong expanded ring 38 in position on the projection of the sleeve member. In the modification of my invention shown, I have provided for this purpose a loading cone 40. This loading cone is tapered, as shown in Figs. 1 and 5, and provided with an appropriate tapered inner bore 41 of sufficient size to receive the hook 22 when the cone is placed over the outer edge of sleeve member 10. The bore 41 is of sufficient size and enlarged at its outer edge for a distance to provide a shoulder 41a sized and adapted to receive in a snug fit the end of the outer projecting edge 14 of sleeve member 10. It can readily be seen in that the small diameter ring 38 may be threaded onto the pointed end of the loading cone 40, as indicated in Fig. 5, and ride upwardly thereon until it reaches the larger diameter end of said cone. With a hand against the trigger mechanism 32, in order to keep the sleeve member 10 in the forward position, the shoulder 41a of the loading cone may be placed over the forward edge of sleeve member 10, pushed firmly against said member, and the elastic ring 38 rolled off onto the surface 14 of the sleeve member. It will be obvious that any number of elastic rings may be carried on the length of said cone, and placed in position such that the sleeve member may be reloaded very quickly.

Referring more particularly to Figs. 6 and 7 of the drawings, we can see how the apparatus of my invention is used in operation. I have shown therein diagrammatically a portion of umbilical cord 42 ready for tying. With the apparatus loaded, with an expanded elastic ring 38 on the shoulder 14 of the sleeve member, as described, the section of the cord 42 to be tied is grasped in the curvature of hook 22. The trigger 32 of the apparatus is then drawn rearwardly, first withdrawing piston plug 21 and hook 22 with the engaged cord into the bore of the sleeve member 10. With the cord 42 thus withdrawn into the sleeve member 10, the trigger continues rearwardly, until the rearward edge of slot 12 is engaged, whereupon the sleeve member itself begins to be withdrawn into the housing member 4. It can be seen that the outer edge of the housing member 4 will impinge upon the elastic ring 38 and push said ring off of projection 14 as the sleeve member 10 continues to be withdrawn, in the manner indicated. With the portion of the cord 42 drawn into the mechanism, as shown, the disengaged elastic ring 38 will contract over the folds of the cord 42 thus withdrawn, and in this manner firmly ties said cord to prevent the flow of any fluid therethrough. When the trigger is released, the hook 22 then projects again from the housing and can be disengaged from the loop of the cord 42 which has been tied. In the case of an umbilical cord, the distal cord is then clamped with a surgical instrument and the cord is cut with scissors between the clamped portion and the tied portion, and the baby severed from his connection with the mother. Thus, the mother is not left unattended and the entire process takes only a few seconds.

In the drawings shown, Figs. 4, 6 and 7 are diagrammatic, for the purpose of showing the operation of the mechanism. Fig. 2 has been modified by the broken lines to show the alternate position of the trigger and piston mechanism as the apparatus is operated.

Considering the apparatus as a series of telescoping barrels, constructed in the manner indicated, in the delivery of a baby, the use of this apparatus is quite efficient and simple. The baby is simply placed on the abdomen of the mother; the cord, at the desired distance from the baby, is placed in the hook. Upon pulling the trigger a loop of cord is pulled inside the smaller barrel, or sleeve member, and the smaller barrel is pulled back inside the larger barrel or housing member in one action. This action results in "tripping" the rubber tubing or

5

elastic band off around the cord. The trigger is released and the automatic mechanism delivers the cord tied securely out of the barrel. The distal cord is clamped; the cord is then cut with the scissors and the scissors and the baby are both handed to the nurse. This is a great improvement over the old method where the mother must be left unattended while the surgeon is making the ties in the cord by hand.

There are certain advantages to this apparatus which will be at once obvious. It ties the cord securely so that no bleeding occurs. The tying operation does not divert the obstetrician's attention from the mother for more than a few seconds. The pistol type grip and trigger facilitate handling of this instrument, because everyone is familiar with the general contour and workings of a pistol. It does not require a highly trained person to tie the cord very securely. The time is cut to a minimum. The instrument, with the hollow bore extending throughout its members can be sterilized with any of the conventional methods. The mechanism of the apparatus is very simple and one instrument should last for a life time. The cost of rubber tubing, or the elastic tie as we described it, is very small. The gun can be loaded when needed by any maid or nurse's aide. This apparatus should be ideal for a physician who delivers a baby in the home, or sends them home shortly after delivery. Under these circumstances the baby and the cord will not be under the scrutiny of trained medical personnel. The rubber tubing, or elastic tie, can be allowed to remain in place until the cord drops off from seven to eleven days after delivery. This also obliterates the necessity of removing the tie or instrument several hours after delivery.

It can also readily be seen that this apparatus for making a tie could be applied to other operations where a cord must be tied in such manner. Its unlimited application will be obvious from its method of operation.

From the foregoing, it will be seen that the invention is well adapted to attain the ends and objects hereinbefore set forth together with other advantages which are obvious and which are inherent to the invention.

It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and sub-combinations. This is contemplated by and is within the scope of the claims.

Inasmuch as many possible embodiments of the invention may be made without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim:

1. An apparatus for applying an elastic tie of the character described comprising, a housing member, a sleeve member and a piston member, each provided with a longitudinally extending channel, said sleeve member reciprocally telescoping into the channel of the housing member and biased forwardly thereof with means limiting the forward projection of the sleeve to provide a projection thereof adapted to receive an expanded elastic ring, said piston member reciprocally telescoping into the channel of the sleeve member and biased forwardly thereof to provide a projection of the piston extending from the sleeve adapted to receive and hold a cord to be tied, operating means for said members including a lever engaging said sleeve member and piston member adapted to first withdraw the piston and cord into the sleeve and then withdraw said sleeve into the housing member, thereby to displace the elastic ring onto said cord constricting and tying the same.

2. Apparatus as in claim 1, including in combination therewith means for loading an expanded elastic ring onto the projection of the sleeve member comprising a loading member having a bore adapted to receive the projection of said piston, a flared shoulder at the opening of said bore adapted to fit the end of the projection

6

of the sleeve member and encompass a portion of the same, said loading member having sides converging to the opposite end thereof adapted to receive a contracted elastic ring, whereby said ring may be rolled into expanded position on said sleeve projection.

3. Apparatus as in claim 1, wherein said operating means comprises a pair of juxtaposed longitudinal keyways in said housing member and sleeve member, said keyway in the sleeve member being of lesser length than the keyway of the housing member and aligned with the keyway of said member at its forward end to cause said projection of the sleeve member beyond the housing, a key extending through said ways affixed at its inner end to the piston member such that in its extreme forward position the projection of the piston extends forwardly from the sleeve, said key adapted when moved rearwardly in said way to first withdraw the piston projection into the sleeve and impinging upon the rearward end of the way in the sleeve then to withdraw the sleeve into said housing member.

4. Apparatus as in claim 1, wherein said means for limiting the forward projection of the sleeve member comprises a keyway in said housing member and a key extending through said way affixed at its inner end to the sleeve member adapted to limit the forwardly biased movement of the sleeve member to provide a limited projection thereof when said key impinges against the forward edge of said way.

5. Apparatus for applying an elastic tie of the character described comprising, a housing member, a sleeve member and a piston member, each provided with a longitudinally extending channel, said sleeve member mounted to reciprocate and telescope into the channel of the housing member, said piston member mounted to reciprocate and telescope into the channel of the sleeve member and provided with an extension at its forward end having a configuration adapted to receive and hold a cord to be tied, means biasing said sleeve member and piston member forwardly in their respective channels to provide a projection of the sleeve member from the housing adapted to receive an expanded elastic ring and the projection of said piston extension beyond the sleeve in the forward position, restraining means limiting the projection of the sleeve member adapted to receive said ring, operating means for said members including a pair of juxtaposed longitudinal keyways in said housing member and sleeve member, said keyway in the sleeve member being of lesser length than the keyway of the housing member, a key extending through said ways affixed at its inner end to the piston member such that in its forward position in the keyways against the forward ends thereof said piston extension projects forwardly from the sleeve member with said sleeve member projecting forwardly from the housing member, said key adapted when moved rearwardly in said ways to first withdraw the piston extension with a cord to be tied into the sleeve and impinging upon the rearward end of the way in the sleeve member to withdraw the sleeve projection into the housing member, thereby to displace the elastic ring onto said cord constricting and tying the same.

6. Apparatus as in claim 5, including in combination therewith means for loading an expanded elastic ring onto the projection of the sleeve member comprising a loading member having a bore adapted to receive the projection of said piston extension, a flared shoulder at the opening of said bore adapted to fit the end of the projection of the sleeve member and encompass a portion of the same, said loading member having sides converging to the opposite end thereof adapted to receive a contracted elastic ring, whereby said ring may be rolled into expanded position on said sleeve projection.

7. Apparatus as in claim 5, wherein said means biasing the sleeve member and piston member respectively in their forward position comprises a spring in the channel of said housing member in contact with the rearward

7

end of the sleeve member urging the sleeve member forwardly, and a spring in the channel of the sleeve member in contact with the rearward end of the piston member urging the piston member forwardly.

8. Apparatus as in claim 5, wherein the extension of said piston member comprises a plug having a configuration thereof extending outwardly and forward from said member to form a hook.

9. Apparatus as in claim 5, wherein the housing mem-

8

ber has a configuration of its rearward end to form a handle and said key is provided with an operating handle extending from the housing member.

References Cited in the file of this patent

UNITED STATES PATENTS

302,509	Mauthner	July 22, 1884
2,619,964	Thaete	Dec. 2, 1952