

[54] TYING DEVICE

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[52] U.S. Cl. **289/17**

[51] Int. Cl. **D03j 3/00**

[58] Field of Search..... 289/1.5, 17

[56] **References Cited**

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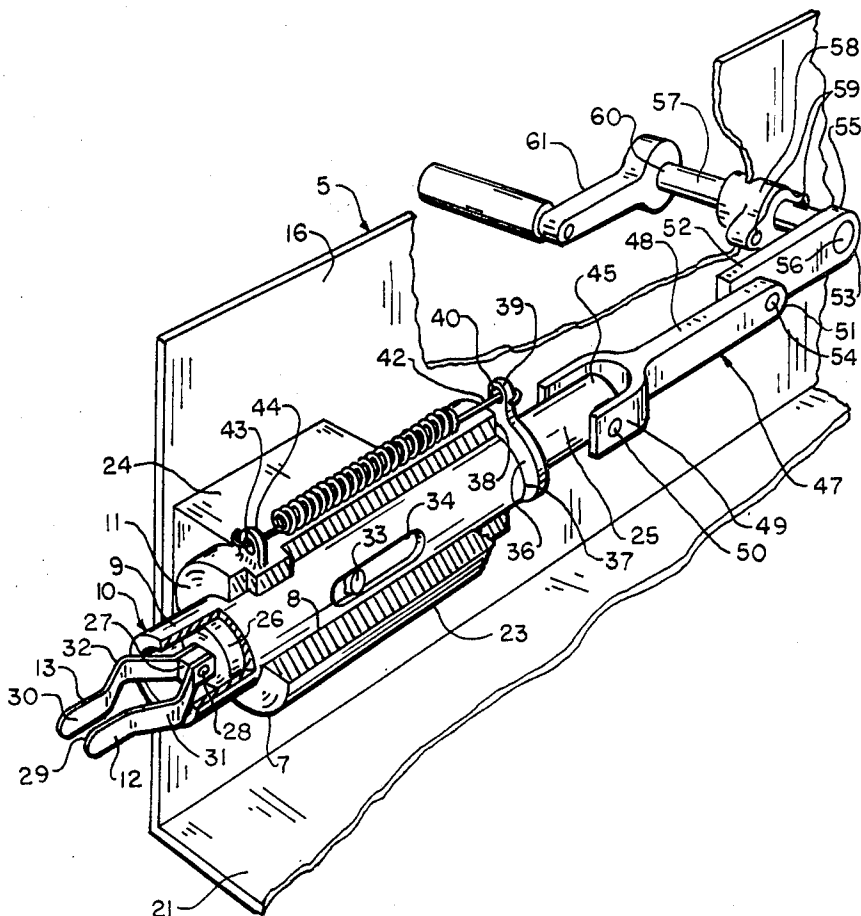
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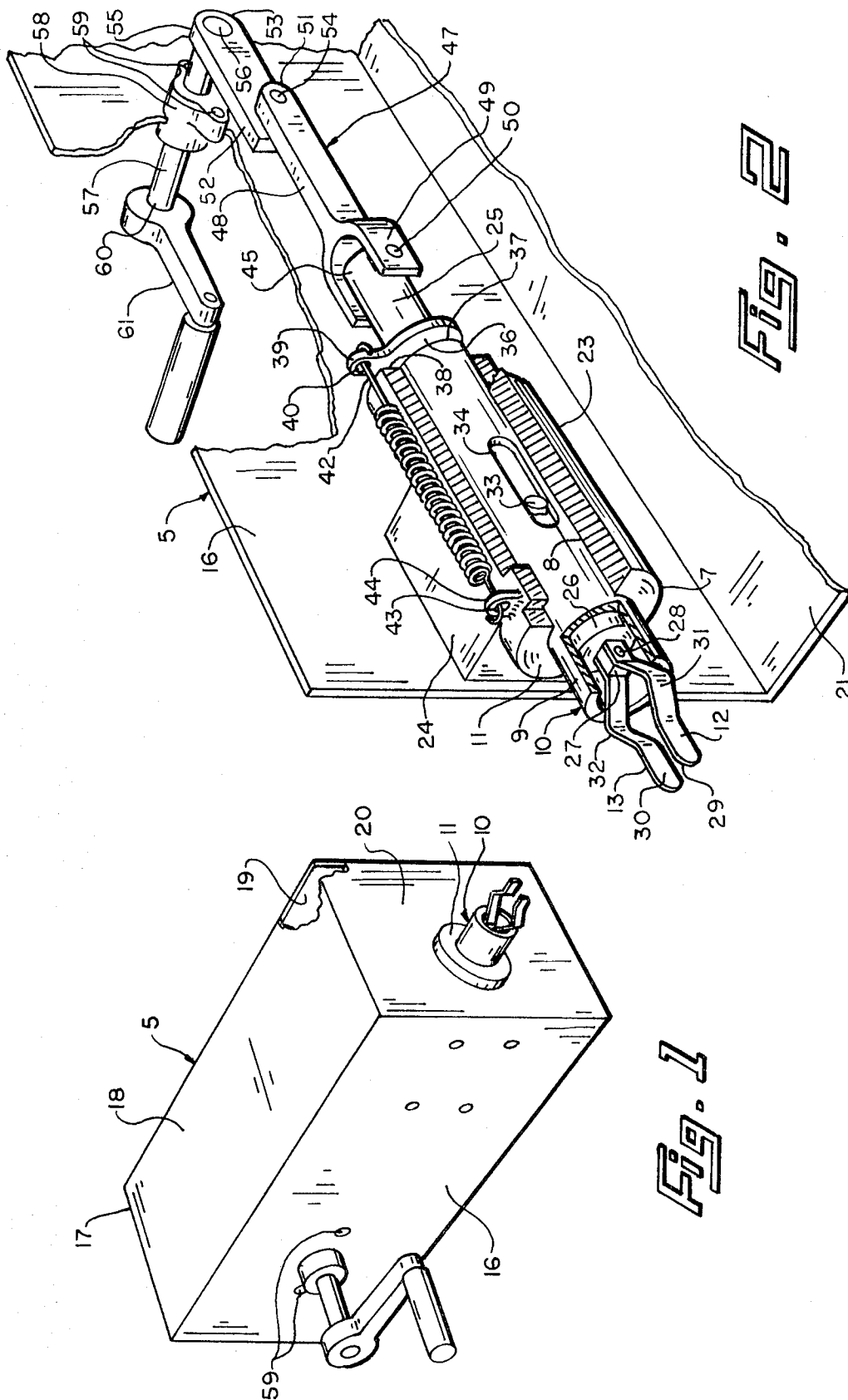
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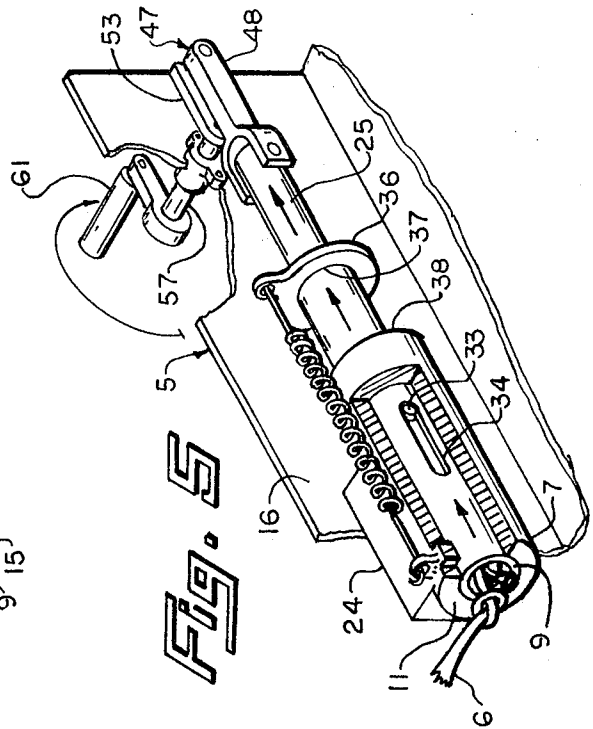
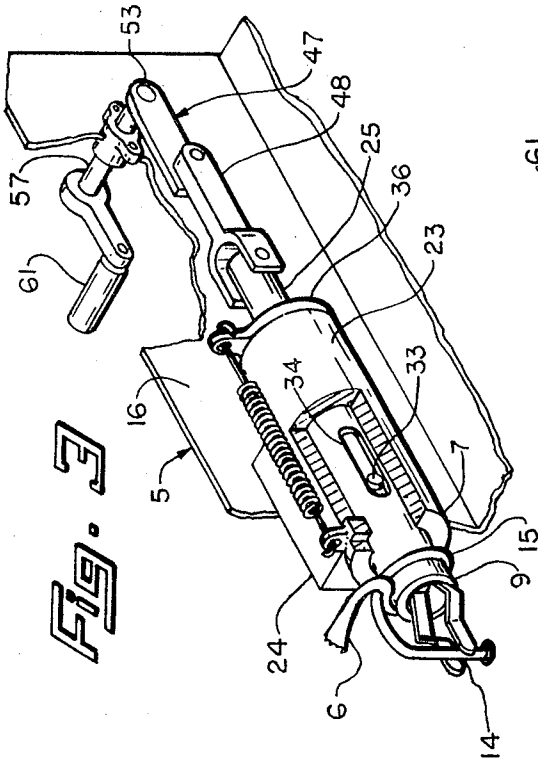
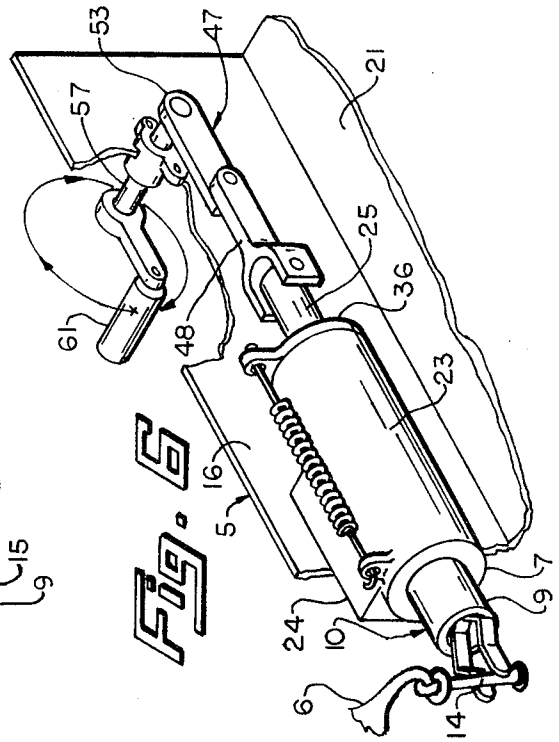
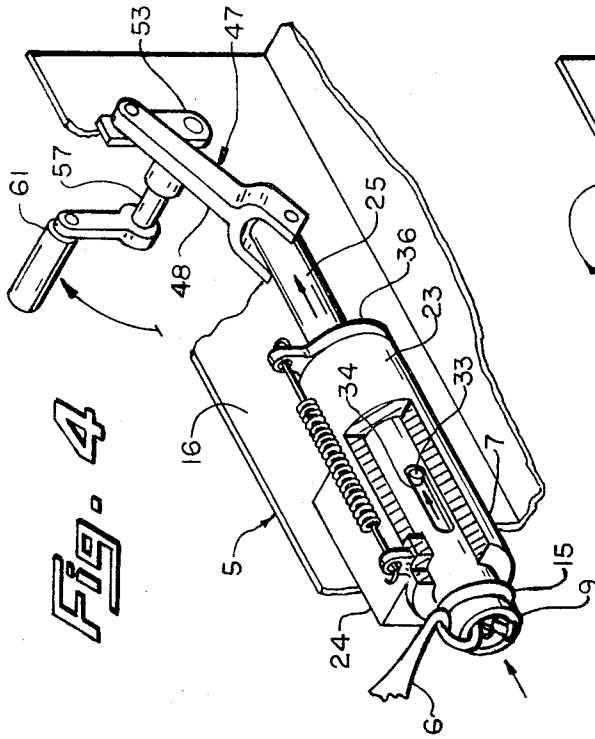
[57] **ABSTRACT**

A tying device is disclosed for forming a knot in an article. The tying device includes a forming collar about which a portion of the article to be tied can be wrapped and one end then inserted between a pair of gripping arms that are movable between open and closed positions with respect to one another. The gripping arms are retracted to a position within the collar carrying the gripped portion of the article therewith and the collar is then retracted within a support to dislodge the portion of the article wrapped around the collar therefrom and thus form a knot. The collar and gripping arms are then extended to permit the tied article to be removed from the device, the device then being ready to receive and tie a new article.

17 Claims, 6 Drawing Figures







1

TYING DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to tying typ- ing device and, more particularly, relates to a mechan- ical device for forming a knot in an article and a method for forming such a knot.

2. Description of the Prior Art

It is oftentimes necessary to form a knot in an article. While situations where formation of a knot in an article are commonplace today, equipment for forming such a knot that is simple and yet dependable is not so commonly found; and this has been found to be particularly true in specialized situations, for example, forming a knot in resilient material such as a rubber product like a balloon.

For industrial uses, complicated and often expensive machinery has been developed, while the occurrence of a need for an occasional knot has been most often met by hand tying the needed knot since it is usually not commercially feasible to utilize complicated and often expensive machinery for such an infrequent event. But where, however, many knots need to be tied over a relatively short period of time, such as, for example, in the case of inflated balloons offered for sale, it is desirable to be able to utilize a tying device particularly if such a device could be simple, inexpensive, dependable and yet be capable of quickly forming the needed knots.

SUMMARY OF THE INVENTION

This invention provides a simple device for tying an article that is simple and dependable and yet is relatively inexpensive and capable of quickly tying a knot in an article.

It is therefore an object of this invention to provide a simple yet dependable device for tying an article.

It is another object of this invention to provide a tying device that is suitable for quickly forming a knot in an article.

It is yet another object of this invention to provide a tying device that is simple and relatively inexpensive.

It is still another object of this invention to provide a tying device that is particularly well suited for forming a knot in resilient material.

With these and other objects in view, which will become apparent to one skilled in the art as the description proceeds, this invention resides in a novel construction, combination and arrangement of parts substantially as hereinafter described and, more particularly, defined by the appended claims, it being understood that such changes in the precise embodiment of the herein disclosed invention are meant to be included as come within the scope of the claims.

DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate a complete embodiment of the invention according to the best mode so far devised for the practical application of the principles thereof, and in which:

FIG. 1 is a perspective view of the device of this invention shown in loading position;

FIG. 2 is a perspective view of the device shown in FIG. 1 with a portion of the housing removed; and

FIGS. 3 through 6 are partial perspective views with an article to be tied loaded onto the device of this in-

2

vention and illustrating the various stages of forming a knot in the article utilizing the device of this invention.

DETAILED DESCRIPTION

Turning now to the drawings in which like numerals have been used for like characters throughout, the numeral 5 refers generally to the device of this invention. The device is particularly well suited for tying a knot in a resilient material, for example, a rubber product such as an inflated balloon. As shown in FIGS. 3 through 6, an elongated section 6 of the article to be tied is inserted, or loaded, onto the device and a knot is automatically tied therein by actuation of the device through a complete cycle.

As shown in the drawings, the device preferably includes a support, or jacket, 7 having an opening, or bore, 8 therethrough, which opening is received a collar, or tubular member, 9, having a length greater than that of support 7 so that in the loading position, as shown in FIG. 3, the front portion 10 of the collar extends from the front face 11 of support 7 allowing the article to be tied to be loaded onto the device by wrapping a portion of the article around the front portion of the collar. Collar 9, in turn, has received therein a pair of cooperating arms 12 and 13, which arms receive a portion 14 (defined herein as including the part gripped by the arms and the part adjacent thereto extending toward the collar) of the article after a second portion 15 of the article has been wrapped around the collar.

As shown best in FIG. 2, support 7 is mounted on the side wall 16 of housing 17, which housing, as shown in FIG. 1, may also conventionally include a top wall 18, a second side wall 19, end walls 20 (only one being shown in FIG. 1), and a bottom wall 21, which, as shown in FIG. 2, may be integrally formed with side wall 16, if desired. For simplicity, conventional means for fastening walls together has been omitted.

As shown best in FIG. 2, support 7 preferably includes a cylindrical section 23 having a central bore 8 therethrough, the bore being slightly greater in diameter than collar 9 which is received therein so that collar 9 is constrained to movement in opposite axial directions within the bore. Support 7 also includes a base 24 which may be integral with the cylindrical section 23, which base is conventionally fastened to side wall 16 of housing 17.

Collar 9, as best shown in FIG. 2, also has a shaft, or rod, 25 received therein, which rod of slightly smaller diameter than collar 9 is constrained to movement in opposite axial directions within the collar. At one end 26 of rod 25, a tab 27 extends outwardly in the axial direction and arms 12 and 13 are mounted on this tab by means of mount pin 28. As shown best in FIG. 2, arms 12 and 13 are shorter in length than rod 25; but, in total length, the arms and rod exceed that of collar 9.

Arms 12 and 13 are mounted on rod 25 by pin 28 so that the free ends 29 and 30 can be brought together to grip an article therebetween and release the article when the free ends are separated from one another. Intermediate the free end and the mount point of each arm is a shoulder, identified as shoulders 31 and 32, respectively, of arms 12 and 13. Shoulders 31 and 32 extend outwardly (if the arms are pivoted for horizontal movement as shown in the drawings) so that as the arms are retracted within collar 9, the shoulders contact the inner wall surfaces of collar 9 to move the arms

toward one another so that the free ends 29 and 30 of the arms are brought toward engagement with one another to grip an article therebetween, this gripping force being maintained until the arms are moved out of the collar a sufficient distance such that the shoulders (arms 12 and 13 are preferably constructed of resilient material and are biased to a normally separated position).

A pin 33 is mounted on the body of rod 25, which pin projects outwardly from the rod a short distance and is received in elongated slot 34 in collar 9. Slot 34 is preferably of sufficient axial length to permit the rod and arms mounted thereon to move within the collar a sufficient distance to extend the free ends and shoulders of the arms from the collar in the loading position and retract the arms completely within the collar when in the tying position.

A flange 36 is mounted at the rear edge 37 of collar 9, which flange is engageable with the rear edge 38 of cylindrical section 23 of support 7 when the device is in the loading position with the arms extended from the collar which, in turn, has the front portion 10 extended from the support. Flange 36 has an upwardly extending shoulder 39 with an aperture 40 therein to receive one end of a spring 42, the other end of which is received in aperture 43 in shoulder 44 extending upwardly from the front portion of the cylindrical section of support 7. This spring biases the collar 9 to the extended, or loading, position, as shown in FIGS. 2 and 3.

End 45 of rod 25, which extends rearwardly from the cylindrical section of support 7, is connected with an actuating mechanism 47. This actuating mechanism includes a linking arm 48, one end 49 of which is bifurcated and pivoted to end 45 of rod 25 by means of pivot pin 50 extending through the bifurcated ends of the linking arm and rod 25. The opposite end 51 of the linking arm is pivoted on one end 52 of crank arm 53 by means of pivot pin 54; the other end 55 of the crank arm is fastened to one end 56 of crank shaft 57, which shaft extends through a bearing 58 in side wall 16 of housing 17, which bearing is mounted on the side wall by means of bolts 59 with the shaft being freely rotatable within the bearing. End 60 of shaft 57 extends beyond bearing 58 and may have attached thereto a handle 61 (as shown in FIG. 1 by way of example) for rotating the shaft, one rotation of the shaft establishing a complete tying cycle of the device. It is to be appreciated, of course, that other actuating means could be utilized, as could other shapes of components of the device, without department from the intended scope of this invention.

FIGS. 3 through 6 illustrate the operating sequence of the device of this invention. FIG. 3 illustrates the loading position wherein the free ends of the arms 12 and 13 are spaced apart to accept a portion 14 of an article to be tied. In operation, the article to be tied has one portion 15 wrapped or stretched around the exposed end portion 10 of collar 9 forwardly of front face 11 of the support 7. One end of the article (normally the running end) is then held and the other end (normally the free end), after a twist of the two ends, is threaded between the free ends of the arms 12 and 13.

The tying cycle is then commenced by rotating crank shaft 57 to retract rod 25. As rod 25 retracts, the free ends 29 and 30 of arms 12 and 13 are brought together by shoulders 31 and 32 of the arms engaging the inner

walls of collar 9 to move the arms toward one another. As the arms close, the free ends 29 and 30 of the arms grip the portion 14 of the article and maintain this grip so that the arms and gripped portion of the article are retracted to a position within the collar 9, as shown in FIG. 4. At this point of the cycle (which is approximately 90° rotation of shaft 57, as shown in FIG. 4), the pin 33 reaches the back edge of slot 34 so that further movement of the rod 25 will cause, simultaneously, movement of collar 9 and rod 25 rearwardly as shaft 57 continues to rotate.

At about 180° rotation of shaft 57, the collar has been retracted to a point where the front edge is substantially flush with the front face 11 of support 7, as shown in FIG. 5; and this is the most rearwardly position of the collar and rod. During retraction of the collar, the portion 15, wrapped around the collar, is dislodged from the collar over the free end thereof and contacts portion 14 of the article just outside of arms 12 and 13. When the article is of resilient material that has been stretched, the material will, of course, compress upon being dislodged from collar 9 to thus form a knot, which knot could obviously be formed in other material by a pulling force exerted on an end of the article.

As shaft 57 continues to rotate, the rod 25 moves forwardly from the rearmost position (the tying position) toward the forward position (the loading position). During the initial part of travel of rod 25, collar 9 moves forward simultaneously with the rod under the influence of the bias provided by spring 42. When flange 36 reaches the back edge of support 7, however, collar 9 has reached its fully extended position and further movement of rod 25 extends arms 12 and 13 from the collar so that, when the full 360° rotation of shaft 57 has occurred, the free ends 29 and 30 of arms 12 and 13 are outside collar 9, as are shoulders 31 and 32 of the arms (as shown in FIG. 6), so that the free ends can separate to remove the article and the device is thereafter ready to handle another article.

To tie a single knot in the article, the portion 14 threaded between the arms 12 and 13 is maintained as closely adjacent as possible to the portion 15 surrounding collar 9. Thus, when the portion surrounding collar 9 is dislodged, it will contact the closely adjacent second portion 14, a part of which is grasped by the arms 12 and 13 to form a single, tight knot. A slip knot may also be tied utilizing the device of this invention by providing spacing between the portion 15 wrapped around collar 9 and the portion 14 grasped by arms 12 and 13. By providing sufficient spacing between the two, a loop of portion 14 extends outside the dislodge portion 15 to thus form a slip knot.

As can be seen from the foregoing, this invention provides a simple, yet dependable, novel device and method for tying a knot in an article.

What is claimed is:

1. A tying device, comprising: forming means adapted to receive an elongated article with a first portion of said article surrounding said forming means near a free end thereof; contacting means engageable with a second portion of an article having a first portion surrounding said forming means, said contacting and said forming means being relatively movable at least to and from a tying position at which said contacting means is substantially within said forming means near the free end thereof, the second portion of an article

engaging said contacting means being constrained to engagement therewith at least while at said tying position; and disengaging means to enable the first portion of an article surrounding said forming means to be dislodged therefrom at the free end of said forming means so that a knot may be formed in said article when said contacting means and said forming means are at said tying position.

2. The tying device of claim 1 wherein said forming means is a hollow cylinder into which said contacting means is received at said tying position.

3. A tying device of claim 1 wherein said contacting means is movable and includes means to grip an article prior to said contacting means reaching said tying position and maintaining said grip while said contacting means is at said tying position.

4. A tying device of claim 3 wherein said gripping means includes a pair of arms movable toward and away from one another to grip an article therebetween.

5. The tying device of claim 1 wherein said disengaging means is contiguous to said forming means, said forming means and said disengaging means being relatively movable with respect to one another with said forming means being received within said disengaging means to dislodge an article on said forming means.

6. A tying device of claim 5 wherein said disengaging means has an aperture therein of a size to snugly receive said forming means to dislodge an article on said forming means.

7. The tying device of claim 1 further characterized by means for causing predetermined relative movements between said forming means, contacting means and disengaging means to automatically cause said contacting means and said forming means to be brought to said tying position relative to one another and an article surrounding said forming means to be dislodged while said contacting means is at said tying position and thereby form a knot in said article.

8. The tying device of claim 1 wherein an article in which a knot is formed is a resilient material that is stretched around said forming means and contracts upon being dislodged in forming said knot.

9. A tying device, comprising: forming means adapted to receive an elongated article with a first portion of said article surrounding said forming means near a free end thereof; contacting means having article gripping means movable between an open position to receive a second portion of an article having a first portion surrounding said forming means and a closed position to grip said second portion, said contacting means and said forming means being movable relative to one another between a loading position in which said gripping means is open to receive a second portion of an article to be tied and a tying position in which said contacting means is substantially surrounded by said forming means and said gripping means is closed, said disengaging means and said forming means being relatively movable between a loading position in which said forming means can be surrounded by the first portion of an article to be tied and a tying position in which said forming means is substantially surrounded by said disengaging means to dislodge a surrounding portion of an article therefrom; and actuating means for causing said relative movements between said forming means, contacting means and disengaging means and said movement of said gripping means, said gripping means being caused to close during relative movement between said

forming means and said contacting means, and said relative movement between said contacting means and said disengaging means to said tying position being caused to occur after the occurrence of relative movement between said forming means and said contacting means to said tying position whereby a knot is substantially tied in an article placed on said tying device while in the loading position.

10. The tying device of claim 9 wherein the contacting means is retracted within said forming means and said forming means is retracted within said disengaging means by said actuating means with the gripping means of said contacting means having been moved to the closed position as said contacting means is retracted.

11. The tying device of claim 9 wherein said actuating means causes relative movement between said contacting means and said forming means to said loading position after the occurrence of relative movement between said forming means and said disengaging means to said loading position with said gripping means being caused to open during relative movement between said forming means and said contacting means whereby a tied article is automatically released.

12. A tying device of claim 9 wherein said forming means is a hollow cylinder about which an article of resilient material is stretched and the ends twisted and wherein said gripping means includes a pair of arms between which one end of said resilient material is threaded before said arms are closed to grip the same.

13. A tying device of claim 12 wherein said end gripped by said arms is closely adjacent to said portion surrounding said hollow cylinder whereby a single knot is formed.

14. The tying device of claim 12 wherein slack is permitted between said end gripped by said arms and said portion surrounding said hollow cylinder whereby a slip knot is formed.

15. A tying device, comprising: support means having wall means defining an opening therein; a hollow member received in said opening in said support means for movement in predetermined opposite directions therein; a shaft member received in said hollow member for movement in said predetermined opposite directions therein; a pair of arms mounted on an end of said shaft member, at least one of said arms having a shoulder thereon cooperable with said hollow member to cause the free ends of said arms to assume a contiguous position with respect to one another when said arms are retracted a predetermined distance within said hollow member during relative movement therebetween in one of said predetermined directions; cooperating means connected with said shaft member and said hollow member to permit movement of said shaft member independently of said hollow member within predetermined limits in said predetermined opposite directions and to constrain said shaft member and hollow member to simultaneous movement outside said predetermined limits in said predetermined opposite directions; and actuating means for causing movement in at least said one predetermined opposite direction in which said arms are first retracted into said hollow member and then said hollow member and said shaft member are retracted so that at least the end of said hollow member having said arms thereon is within said support means.

16. A tying device of claim 15 wherein said actuating means further causes movement of said hollow member

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and said shaft member in the other of said predetermined opposite directions wherein said hollow member extends from said support means and said arms mounted on said shaft member extend from said hollow member.

17. A tying device; comprising: support means having wall means defining a bore therein; a tubular member received in said bore of said support means for movement in axial directions therein; a rod received in said tubular member for movement in axial direction therein; a pair of arms mounted on said rod near one end, said arms having shoulders thereon engageable with said tubular member to cause said arms to be moved toward one another so that the free ends are contiguous when said arms are moved predetermined distances into said tubular member; a pin member mounted on said rod; means defining an elongated slot in said tubular member for receiving said pin and thus

8

allowing said rod to move in axial directions independently of said tubular member within predetermined limits as defined by said slot and to be constrained to movement in axial directions with said tubular member outside said predetermined limits; a spring biasing said tubular member in one of said axial directions; and an actuator connected with the other end of said rod for causing movement of said rod in said opposite axial directions, movement in the first direction causing said arms to be retracted within said tubular member and overcoming the bias on said tubular member so that said end of said tubular member having said arms therein is retracted within said bore, and movement in the opposite direction permitting said spring to extend said end of said tubular member with said arms therein from said bore and causing said arms to extend from said tubular member.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,752,517

Dated August 14, 1973

Inventor(s) Ralph H. Warmack

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, lines 5 and 6 change from "to tying typing device" to - to a tying device -

Column 4, line 52 reads "dislodge" should be - dislodged -

Signed and sealed this 8th day of October 1974.

(SEAL)

Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents