United States Patent [19]

Farkas et al.

[11] **3,746,055**

[45] **July 17, 1973**

[54] **EJECTING MEANS**

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[73] Assignee: **Thomas & Betts Corporation,** Elizabeth, N.J.

[22] Filed: **June 23, 1972**

[21] Appl. No.: **265,646**

[52] **U.S. Cl.** **140/93.2,** 140/123.6

[51] **Int. Cl.** **B21f 9/02**

[58] **Field of Search** 140/93.2, 93.6, 123.6, 140/123.5; 100/29, 7

[56] **References Cited**

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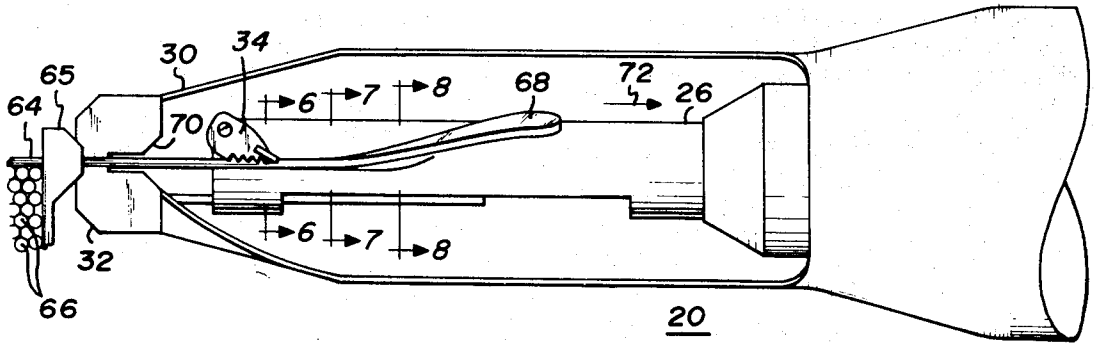
Primary Examiner—Richard J. Herbst

Attorney—David Teschner et al.

[57] **ABSTRACT**

Means for selectively ejecting a resilient elongate article away from the ejecting means comprising a selectively formed deflecting surface providing both longitudinal and axial deformation of the resilient elongate article positionally restrained thereagainst, whereby upon release of the restraining means the deformed portion, in returning to its original state, exerts a composite force against the deflecting surface causing it to be ejected therefrom.

15 Claims, 18 Drawing Figures



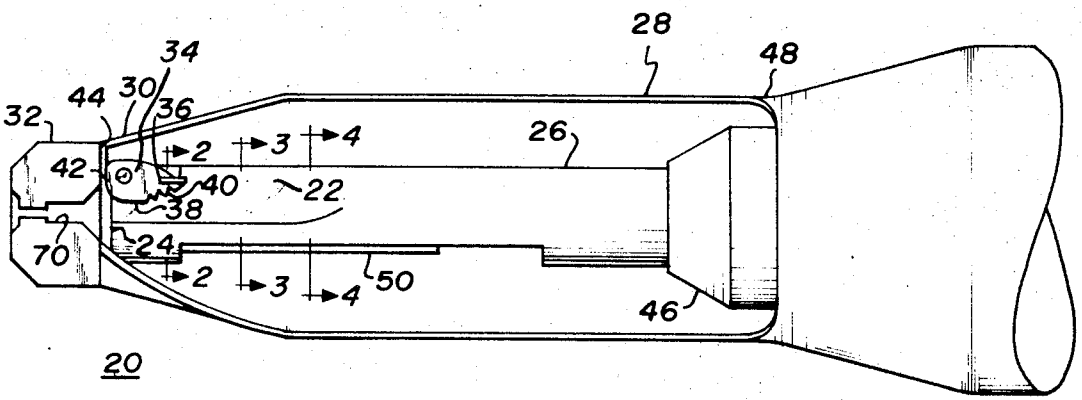


FIG. 1

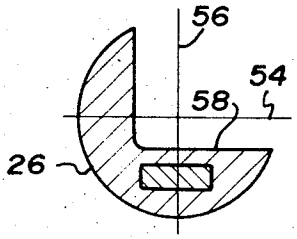


FIG. 2

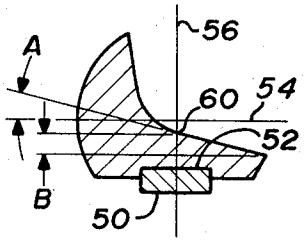


FIG. 3

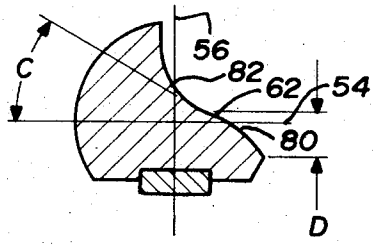


FIG. 4

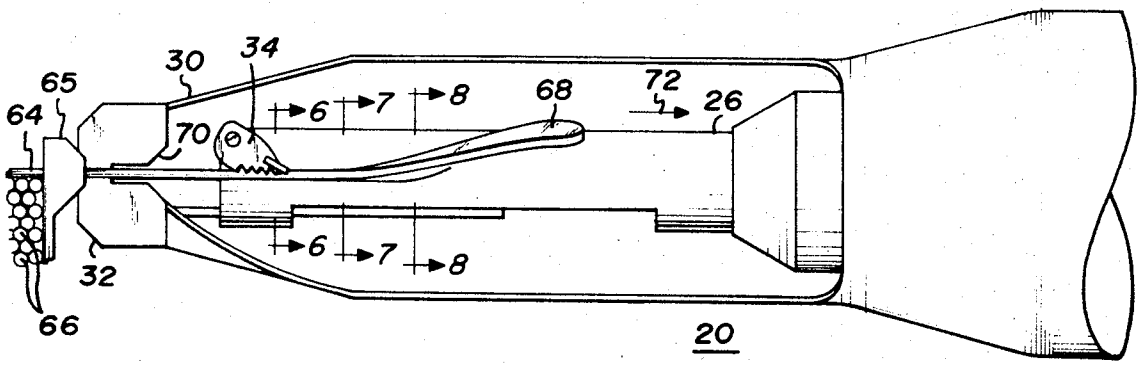


FIG. 5

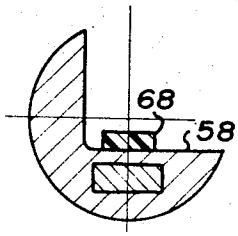


FIG. 6

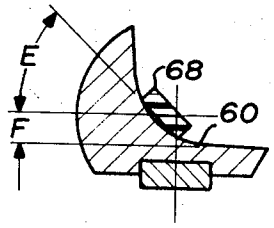


FIG. 7

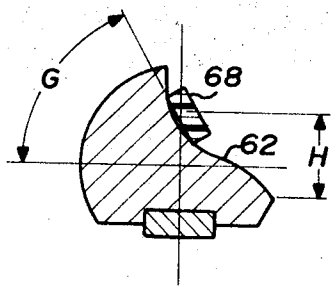


FIG. 8

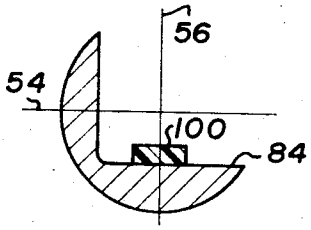


FIG. 9

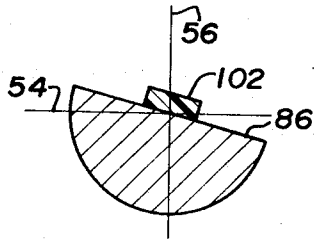


FIG. 10

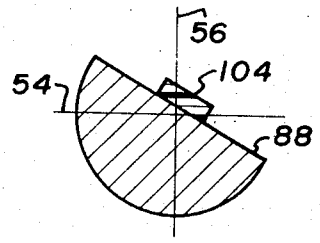


FIG. 11

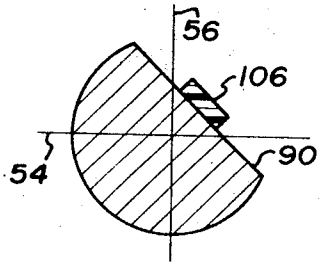


FIG. 12

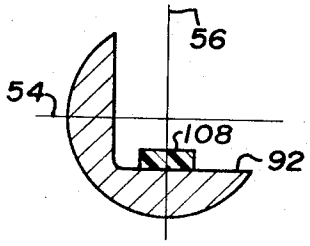


FIG. 13

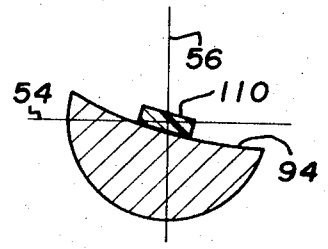


FIG. 14

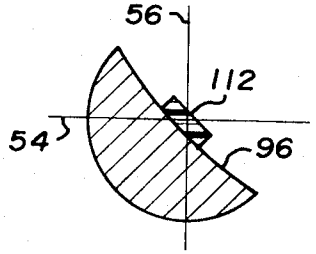


FIG. 15

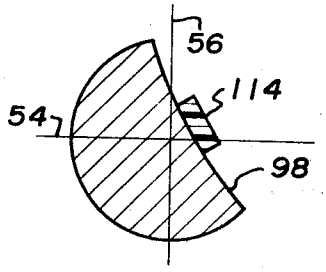


FIG. 16

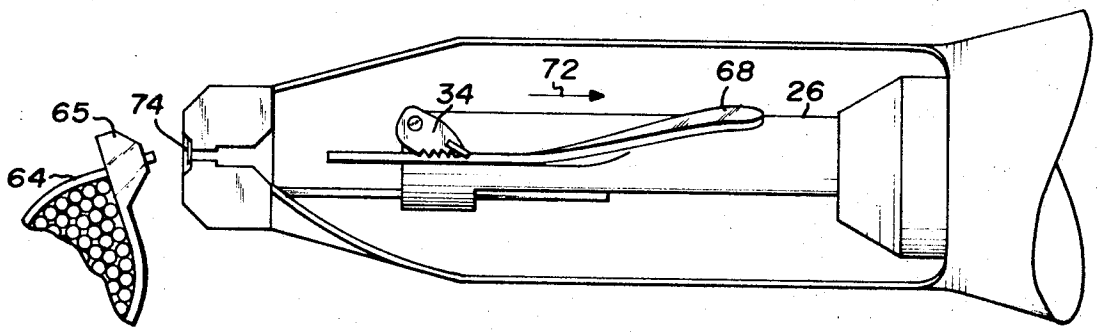


FIG. 17

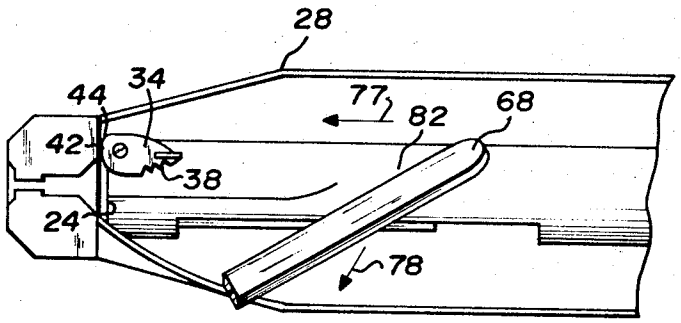


FIG. 18

EJECTING MEANS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention is directed to the field of ejecting means and principally to a device for ejecting a resilient elongate article away from the ejecting means, and applicable for use with strap tensioning tools, and strap tensioning and cut-off tools, of the type disclosed, for example, in U.S. Pat. No. 3,648,738, issued Mar. 14, 1972 to Farkas et al. and U.S. Pat. No. 3,433,275, issued Mar. 18, 1969 to Eppler, both being assigned to the assignee of the instant invention.

2. Description of the Prior Art

To increase the speed, convenience, and simplicity with which various wire harnesses may be bundled, there have been developed various forms of bundling straps which are arranged to be looped about a section of the harness and the tail end of the strap inserted within an appropriately contoured head portion and tightened to form a secure loop thereabout. It is generally highly desirable in such applications to remove the excess portion of the strap extending beyond the head portion to prevent its interference with other cables or components disposed adjacent thereto. Various tools have been developed to accomplish both the tightening of the strap and the severing of the excess portion thereof in a single, relatively simple operation, such tools being exemplified in the aforementioned patents. Briefly, such tool may comprise a nose portion within which is reciprocatingly mounted a support member arranged to receive the tail portion of the strap during the tightening operation. Where necessary or desirable, at the completion of the tightening operation, one form or another of severing means may be employed to sever the excess portion of the strap from the remaining portion circumferentially disposed about the bundle of wires. To prevent malfunction of the tool and to avoid the necessity for manually removing the severed portion of the strap from the zone adjacent the severing blade, it was often necessary to provide some means for causing the severed portion of the strap to be physically disengaged from the tool nose. In one embodiment of such tool, a releasable, spring-biased pawl is utilized to engage and positionally restrain the excess strap portion during the tightening and severing operation. Upon the return or release stroke, the pawl is subjected to a counter-force to release the severed strap portion wich may undesirably, however, either remain in place, or drop indiscriminately from the severing zone. Failure to remove the secured strap portion prior to the next operation generally results in a jam or other malfunction of the tool, while additionally preventing the insertion of a further strap portion at the initiation of the next operation. The manual removal of the severed portion to prevent such problem will, of course, greatly decrease the speed of operation, with an attendant increase in the cost of assembly. This problem is of course, magnified where the tool is adapted to be operated at a relatively rapid rate.

SUMMARY OF THE INVENTION

The invention overcomes the difficulties and limitations noted above with respect to prior art devices by providing a means for efficiently, simply and conveniently selectively ejecting the severed portion of a bundling strap or similar article in a predetermined direction away from the severing zone. The ejecting means comprises a selectively contoured deflecting surface formed in a support member adapted preferably for reciprocating movement in a body member which, in one embodiment, may form the front end portion of a strap tightening and severing tool. The portion of the strap to be deflected or ejected from the support member is held against the deflecting surface by a restraining means which may comprise, in one embodiment, a pivotally mounted pawl having teeth disposed in one surface thereof, both for engaging the extending portion of the strap during the tensioning cycle and for restraining the strap in position against the deflecting surface preparatory to the severing of the tail portion from the remaining body portion of the strap. The strap, which may be formed from a highly resilient material such as nylon or the like, is caused to be both angularly and planarly displaced from its normal plane in general conformance with the deflecting surface of the support member. The forces tending to return the tail portion to its non-deformed configuration are thus directed against the deflecting surface and effectively utilized to eject the severed strap portion away from the surface in a predetermined direction as the restraining means is released from engagement with the surface of the tail portion as the support member is brought into engagement with the release means upon its return stroke. The deflecting surface may be substantially planar throughout the length thereof or may have a first generally planar portion and succeeding curvilinear portions which are either substantially concave or partially concave and partially convex. It is therefore an object of this invention to provide means for selectively ejecting a generally flattened resilient elongate article away from a first zone.

It is another object of this invention to provide means for both angularly and planarly displacing a portion of a generally resilient elongate article out of its normal plane to provide selective forces for the positive ejection of such article away from a first zone.

It is a further object of this invention to selectively eject the severed portion of a bundling strap away from the severing zone of a strap tightening and cutoff tool.

It is yet another object of this invention to provide means for directionally ejecting the severed portion of a bundling strap generally laterally away from the severing zone.

It is yet a further object of this invention to provide a deflecting surface selectively angularly and axially oriented with respect to a pair of mutually perpendicular transverse axes whereby a generally flattened resilient elongate article disposed thereagainst is caused to be both angularly and planarly displaced whereby the forces generated thereby may be effectively utilized to cause the ejection of the elongate article away from said deflecting surface.

Other objects and features of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings which disclose by way of example the principal of the invention and the best modes contemplated for carrying it out.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a fragmentary side elevational view of ejecting means constructed in accordance with the concepts of the invention.

FIGS. 2, 3 and 4 are sectional views taken along the lines 2—2, 3—3, and 4—4, respectively, of the device of FIG. 1.

FIG. 5 is a fragmentary side elevational view of the device of FIG. 1 in an advanced stage of operation.

FIGS. 6, 7 and 8 are sectional views taken along the lines 6—6, 7—7, and 8—8, respectively, of the device of FIG. 5.

FIGS. 9–12 are sectional views of a further embodiment of successive portions of a deflecting surface constructed in accordance with the concepts of the invention.

FIGS. 13–16 are sectional views of still another embodiment of successive portions of a deflecting surface constructed in accordance with the concepts of the invention.

FIG. 17 is a fragmentary side elevational view of the device of FIG. 1 in a further advanced state of operation.

FIG. 18 is a fragmentary side elevational view of the device of FIG. 1 illustrating the ejection of the severed portion of a generally elongate resilient article therefrom.

Similar elements are given similar reference characters in each of the respective drawings.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning now to FIGS. 1 through 8 there is shown ejecting means 20 constructed in accordance with the concepts of the invention. Merely to more clearly illustrate the manner of use of the ejecting means 20 rather than as a limitation or restriction on the use thereof, means 20 is shown generally as the nose or front end portion of a strap applying tool similar to those disclosed and described in the above referenced patents. Means 20 comprises a selectively contoured deflecting surface 22 extending a predetermined distance generally longitudinally from a first end 24 of a support member 26. The deflecting surface 22 may be formed in the support member 26 by machining, grinding, swaging, or other similar metalworking process or operation where the support member is formed of a metallic material, or may be formed of flat stock suitably bent or deformed into the required shape. It will, of course, be readily appreciated that non-metallic materials such as wood or plastic may also be readily employed and suitably shaped to provide the desired contour. Support member 26 is arranged preferably for slidable reciprocating movement in a body member 28 which, in the embodiment illustrated in FIGS. 1–8, is formed to define a generally elongate arcuate housing having a tapered first end 30 terminating in a guide means 32. Pivotally coupled to the first end 24 of support member 26 is a restraining means in the form of a pawl 34 to which is attached a spring 36 for biasing the pawl 34 in a generally clockwise direction generally towards the deflecting surface 22. Pawl 34 may, of course, be slidingly coupled to the support member 26 and linearly movable with respect thereto, where necessary or desirable. A first surface 38 of pawl 34 is provided with a series of teeth 40 disposed along at least a portion thereof for employment in a manner to be more fully described below. The toothed surface 38 of pawl 34 is maintained in spaced arrangement away from the deflecting surface 22 upon the engagement of a second surface 42 of pawl 34 with a release means in the form of a surface 44 extending inwardly adjacent the first end 30 of body member 28 and positioned in such manner as to contact the pawl surface 42 upon the disposition of the support member 26 in a first or forward position substantially as shown in FIG. 1. A bearing type bushing 46 disposed generally adjacent a second end 48 of body member 28 provides both a support and guide for the support member 26. An elongate member 50 extending generally longitudinally from the first end 30 of the body member 28 towards its second end 48 is selectively proportioned to slidingly fit within a longitudinally disposed recess 52 in support member 26 to provide additional support and guidance for the support member 26 where necessary or desirable. It will of course be readily apparent to those skilled in art that the recess 52 and its mating member 50 may be eliminated and the sole support provided by the bushing 46 without departing from the spirit of the invention and within the concepts herein disclosed.

The actual contour of the deflecting surface 22 may be more readily appreciated by examination of FIGS. 2, 3 and 4 which show selective sections of the surface 22 in further detail, as positionally related to a pair of mutually perpendicular first and second transverse axes 54 and 56, respectively, of support member 26. For the sake of convenience, the first transverse axis 54 is shown as an essentially horizontally disposed axis and the second transverse axis 56 is shown as an essentially vertically disposed axis perpendicular to axis 54. The deflecting surface 22 comprises a succession of contiguous, longitudinally extending portions including a first portion 58 extending from the first end 24 of support member 26 approximately to the line designated as 2—2 in FIG. 1, a second portion 60 extending from the line 2—2 to the line 3—3 in FIG. 1, and a further portion 62 extnding from the line 3—3 to the line 4—4 in FIG. 1. It will of course be readily appreciated that the deflecting surface 22 may extend beyond the line 4—4 a predetermined distance to provide a smooth transition to the non-contoured portion of the support member 26. As may be seen in FIG. 2, the first portion 58 of the deflecting surface 22 is disposed in generally parallel planar relationship with the first transverse axis 54. The deflecting surface 22 thereafter undergoes a smooth transition from the first portion 58 to the second portion 60 whereby the surface 22 is now incrementally angularly displaced a first predetermined amount indicated as A in FIG. 3 from the first transverse axis 54, and axially displaced a first predetermined amount B along the second transverse axis 56. The deflecting surface 22 then continues smoothly to a third or further portion 62 shown in detail in the cross sectional view of FIG. 4. Portion 62 is further incrementally angularly displaced a second predetermined amount C from the first transverse axis 54 and axially displaced a second predetermined amount D along the second transverse axis 56, angle C being greater than the angle A and the distance D being greater than the distance B, the aforesaid angles and distances being taken from the generally central portion of the deflecting surface 22.

To more fully appreciate the manner in which the ejecting means 20 may be advantageously employed, reference is now made specifically to FIG. 5. As shown therein, a bundling strap 64 having a head portion 65 is disposed about a bundle of wires 66. To effect the tightening of the bundling strap 64 about the wires 66

the extending portion 68 of bundling strap 64 is inserted through the head portion 65, through a selectively formed slot 70 in the guide means 32, and then between the pawl 34 and the first portion 58 of deflecting surface 22. That part of strap portion 68 extending beyond the pawl 34 is caused to lie against the deflecting surface 22 in general conformance therewith due to the restraining force exerted by the biased pawl 34. The resulting deformation of the strap portion 68 may be more readily appreciated by reference to FIGS. 6, 7 and 8. In FIG. 6, the section of portion 68 adjacent the first portion 58 of the deflecting surface 22 is disposed essentially coplanar with the guide means slot 70 and generally undeflected either angularly or planarly from its normal planar orientation as it exits from the guide means slot 70. In FIG. 7, portion 68 is shown both incrementally rotated about its longitudinal axis a predetermined angle E and axially displaced a predetermined amount F from the position indicated in FIG. 6. In FIG. 8 portion 68, in the area generally adjacent that portion of the deflecting surface 22 indicated by the lines 8—8 in FIG. 5, is shown further rotated about its longitudinal axis a predetermined angle G and further displaced axially a predetermined amount H from the position indicatd in FIG. 6, the angle G and the displacement H being selectively greater than the corresponding angle E and displacement F. The bundling strap 64 may now be subjected to the tensioning operation which is accomplished by urging the support member 26 away from the first end 30 of the body member 28 in a direction indicated by the arrow 72 in FIG. 5. At a predetermined tension level a severing means which may comprise a blade 74 (See FIG. 17) is urged into engagement with that portion of the bundling strap 64 extending beyond its head portion 65, thereby severing the portion 68 of the bundling strap 64 from the remaining portion thereof. After the severing operation, the portion 68 is maintained in position adjacent the deflecting surface 22 by virtue of the pressure exerted on it by the resiliently biased pawl 34. The support member 26 is now permitted to move in the direction indicated by arrow 77 in FIG. 18 wherein the first end 24 of support member 26 is advanced towards the surface 44 of body member 28 causing the surface 42 of pawl 34 to contact the surface 44 wherein the pawl 34 is rotated counterclockwise, thereby disengaging the pawl 44 from the severed portion of the bundling strap 64. Portion 68 is now free to return to its undeflected or undeformed state and the forces tending to return it to such state are thus directed against the deflecting surface 22 whereby the severed portion is thus caused to be generally laterally deflected from the deflecting surface 22 in a direction generally indicated by the arrow 78 (FIG. 18). It may be further appreciated that the speed and direction of ejection may be readily controlled by the specific contour employed in the formation of the deflecting surface 22. For example, where it is desired to eject a relatively stiff article from the deflecting surface 22 it may only be necessary to provide a relatively small angular rotation which may be in the range of from 5° to 15° and which may be accompanied by a planar deflection of a similar amount. On the other hand where the article is highly resilient and relatively soft, a total angular rotation in the order of 15° to 45° which may be accompanied by a planar deflection of similar amount may be found desirable to effect the desired ejection. The length of the deflecting surface 22 should be choosen to insure that a sufficient length of the article to be ejected therefrom is caused to bear thereagainst to provide the desired deflection to such article. By way of example, where the article to be ejected forces a length of approximately 3 to 4 inches, a deflecting surface contrary result. length of 1½ to 2 inches may be found suitable to effect the desired deflection. It will of course be readily apparent to those skilled in the art that the rate of ejection may also be readily controlled by varying, for example, the rate of contact between the surface 42 of pawl means 34 and the release means surface 44 of body member 28, and by varying the amount of tension exerted by the spring 36 biasing the pawl 34 against the article. Thus, a fairly rapid release of the restraining means will permit utilization of a higher percentage of the stored faces in the strap portion for ejection purposes, while a relatively slow release will provide a contray resuly. The portions of the deflecting surface 22, although shown in FIGS. 3 and 4 as essentially curvilinear and at least partially comprising a convex portion 80 and a concave portion 82 (FIG. 4) may be modified, where necessary or desirable, to provide a contour shown in greater detail in FIGS. 9–12. As illustrated therein the entire deflecting surface may be essentially planar and may comprise a first portion 84 essentially parallel to the first transverse axis 54 and generally centrally located about the second transverse axis 56 similar to that arrangement shown in FIG. 2, with succeeding contiguously arranged portions of the deflecting surface each incrementally angularly rotated a predetermined amount from the first transverse axis 54 and incrementally displaced along the second transverse axis 56 a predetermined amount as at 86, 88, and 90 illustrated in FIGS. 10, 11, and 12 respectively. The degree of axial and angular displacement of one of the surface portions 86, 88, and 90 with respect to an adjacent portion may be chosen to have values essentially similar to those described above with respect to FIGS. 2, 3 and 4.

Turning now to FIGS. 13 through 16 there is shown a further embodiment of a deflecting surface constructed in accordance with the embodiments of the invention. The contour of the first, second, third, and further portions of the surface are shown at 92, 94, 96, and 98 respectively. The first portion 92 is formed similar to the portion 58 illustrated in FIG. 2 and the portion 84 illustrated in FIG. 9. The second, third, and further deflecting surface portions 94, 96, and 98, illustrated respectively in FIGS. 14, 15, and 16, are shown as essentially concave curvilinear surfaces each being angularly and axially incrementally displaced from an adjacent surface portion along the first and second transverse axes 54 and 56, respectively, in a manner generally as described above with respect to FIGS. 2 through 4 and FIGS. 9 through 12. As further illustrated in FIGS. 9 through 12 and FIGS. 13–16 the degree of planar and angular displacement of sections of a resilient article shown respectively at 100, 102, 104 and 106 in FIGS. 9 through 12, and at 108, 110, 112, and 114 in FIGS. 13 through 16, with respect to the first and second transverse axes 54 and 56, respectively, is similar to that shown in FIGS. 6 through 8 described above.

Although there has been shown and described ejecting means as employed for use in a strap tensioning and cut-off tool, the embodiments of the invention herein described may of course be readily employed in other

devices in which it is either necessary or desirable to provide a means for selectively ejecting a segment of a generally resilient elongate article away from a particular area while controlling the degree and direction of the ejection therefrom.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. Means for selectively ejecting a generally flattened resilient elongate article away from a first zone comprising: a body member; a generally elongate support member movably mounted to said body member and having mutually perpendicular axes including a longitudinal axis, a first transverse axis, and a second transverse axis, said support member further having a first end, and a continuous, selectively contoured deflecting surface extending longitudinally from said first end a predetermined length; restraining means movably coupled to said support member generally adjacent said first end thereof and having a first surface resiliently biased towards said support member deflecting surface; and release means attached to said body member for selectively moving said restraining means first surface away from said support member deflecting surface; said deflecting surface comprising a succession of contiguous, longitudinally extending portions including a first portion generally adjacent said support member first end and planarly oriented substantially parallel to said first transverse axis, a second portion having a first angular displacement from said first transverse axis towards said second transverse axis, and having a first axial displacement along said second transverse axis, and at least one further portion having a second angular displacement from said first transverse axis towards said second transverse axis, and having a second axial displacement along said second transverse axis, said second angular and axial displacments being greater than said first angular and axial displacements, respectively whereby upon the placement of a generally flattened, resilient elongate article against said deflecting surface in generally parallel longitudinal alignment therewith with one end of such article restrained intermediate said restraining means first surface and said deflecting surface first portion generally adjacent said support member first end, such article is thus caused to be subjected to deforming forces tending to both selectively planarly displace one porton of such article with respect to another, and selectively angularly rotate a portion of such article about its longitudinal axis, wherein upon the selective engagement of said release means with said restraining means causing the release of said restraining means from contact with said one end of such article, such article is free to return to its undeflected state, the stored forces therein being directed against said support member deflecting surface, causing such article to be ejected therefrom.

2. Means as defined in claim **1** wherein said deflecting surface is generally planar.

3. Means as defined in claim **1** wherein said deflecting surface is generally curvilinear.

4. Means as defined in claim **1** wherein said support member is reciprocatingly movable in said body member.

5. Means as defined in claim **1** wherein said deflecting surface first portion is generally planar and at least said second portion and said further portion thereof are generally curvilinear.

6. Means as defined in claim **1** wherein said deflecting surface first portion is generally planar and at least said second portion thereof is generally concave.

7. Means as defined in claim **1** wherein said deflecting surface first portion is generally planar and said further portion is at least partially concave and at least partially convex.

8. Means as defined in claim **1** wherein said body member further includes a first end having guide means attached thereto and disposed adjacent to and in generally longitudinal alignment with said deflecting surface first portion for guiding a generally flattened elongate article from said body member first end towards said support member deflecting surface.

9. Means as defined in claim **8** wherein said guide means has a selectively proportioned slot extending axially therethrough.

10. Means as defined in claim **9** wherein said restraining means is rotatably coupled to said support member, and said first surface of said restraining means comprises a plurality of teeth arranged to engage the adjacent surface of a generally flattened, resilient elongate article disposed between said restraining means and said deflecting surface first portion.

11. Means as defined in claim **10** wherein said guide means slot extends outwardly towards and communicates with the outer peripheral surface of said guide means.

12. Means as defined in claim **1** wherein said body member further comprises an elongate member extending generally longitudinally from said first end thereof towards said support member, and said support member further comprises a longitudinally extending recessed portion slidably coupled to said elongate member.

13. Means as defined in claim **12** wherein said deflecting surface first portion is generally planar and at least said second portion and said further portion thereof are generally curvilinear.

14. Means as defined in claim **12** wherein said deflecting surface is generally planar and at least said second portion thereof is generally concave.

15. Means as defined in claim **12** wherein said deflecting surface first portion is generally planar and said further portion is at least partially concave and at least partially convex.

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