United States Patent

Farkas et al.

[15] **3,648,738**

[45] **Mar. 14, 1972**

[54] STRAP APPLYING TOOL

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

[22] Filed: **Sept. 25, 1970**

[21] Appl. No.: **75,483**

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

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

[58] Field of Search ..... 140/93.2, 123.6, 149; 100/33 PB

[56] **References Cited**

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3,254,680	6/1966	Caveney et al.	140/123.6
3,433,275	3/1969	Eppler	140/123.6
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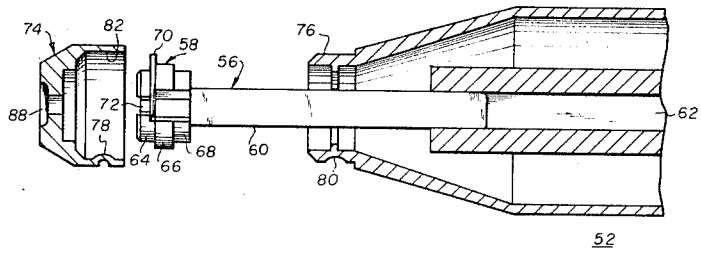
Primary Examiner—Lowell A. Larson

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[57] **ABSTRACT**

The invention is directed to an improved strap tensioning and cutoff tool provided with selectively interchangeable strap receiving and cutoff assemblies releasably securable adjacent the extending nose portion thereof, each assembly being preferably arranged to accept a particular type of bundling strap, wherein a single tool may be advantageously cooperably employed with a variety of different bundling straps. Each selectively interchangeable assembly comprises a removable, slotted-head strap twisting member having suitable shear means therein and a releasable, matingly cooperable, cuplike slotted cover member encompassing the head portion of the strap twisting member, and coaxial therewith.

15 Claims, 14 Drawing Figures



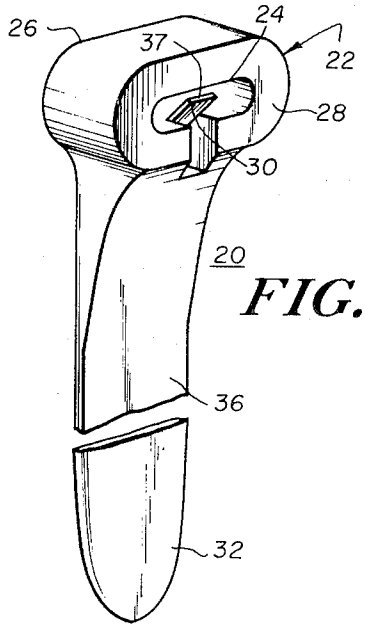


FIG. 1

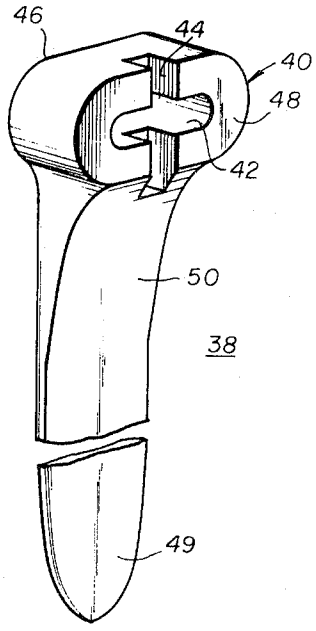


FIG. 2

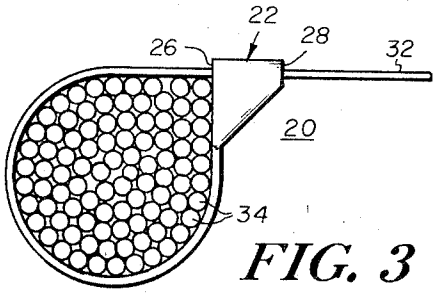


FIG. 3

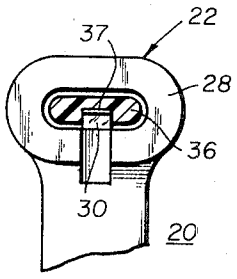


FIG. 4

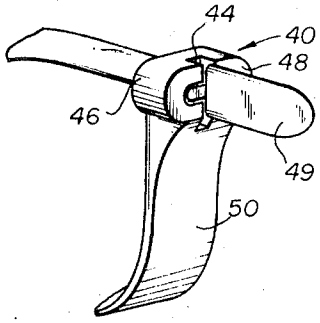


FIG. 5

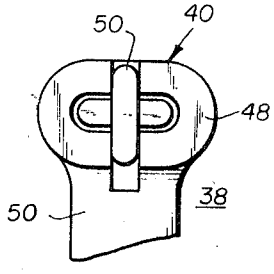


FIG. 6

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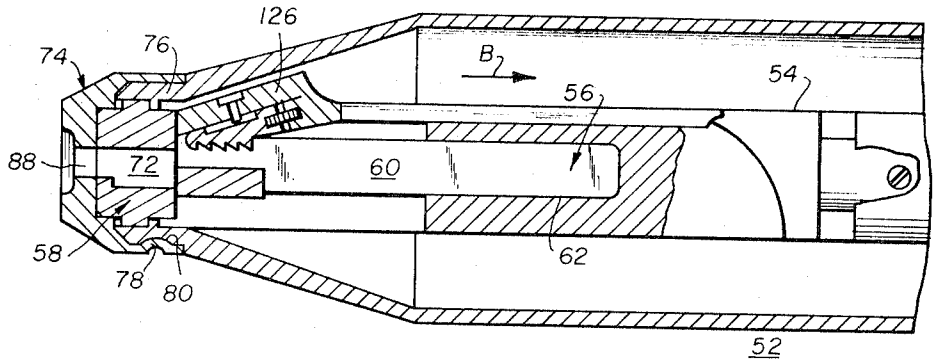


FIG. 7

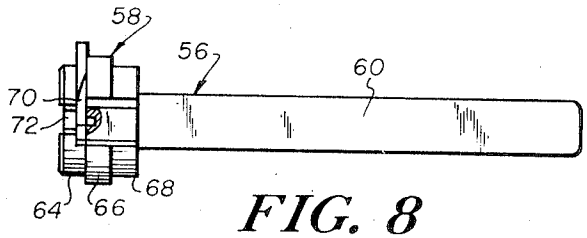


FIG. 8

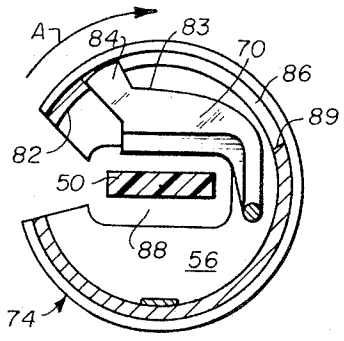


FIG. 10

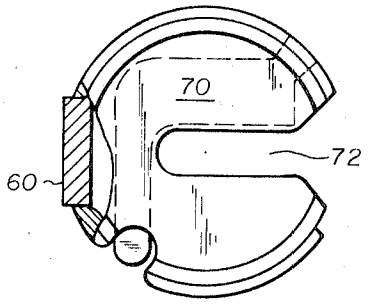


FIG. 9

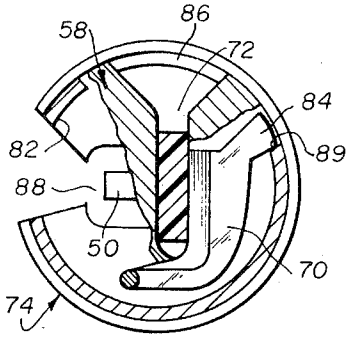


FIG. 11

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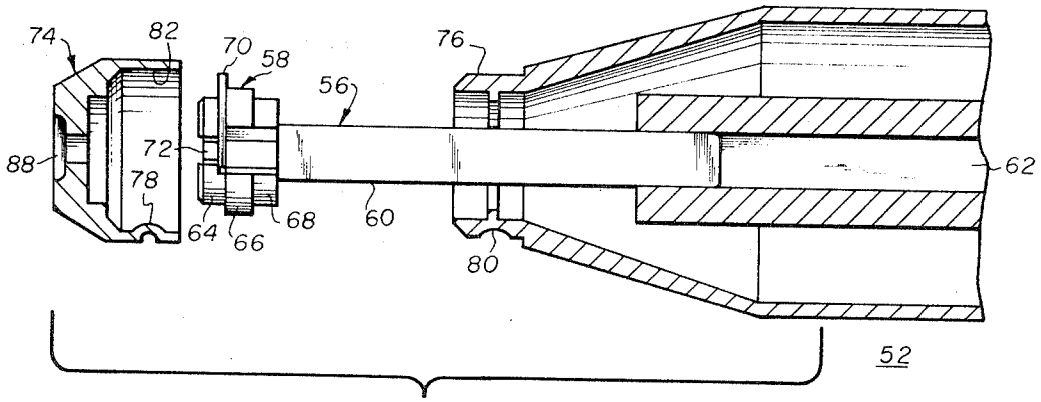


FIG. 12

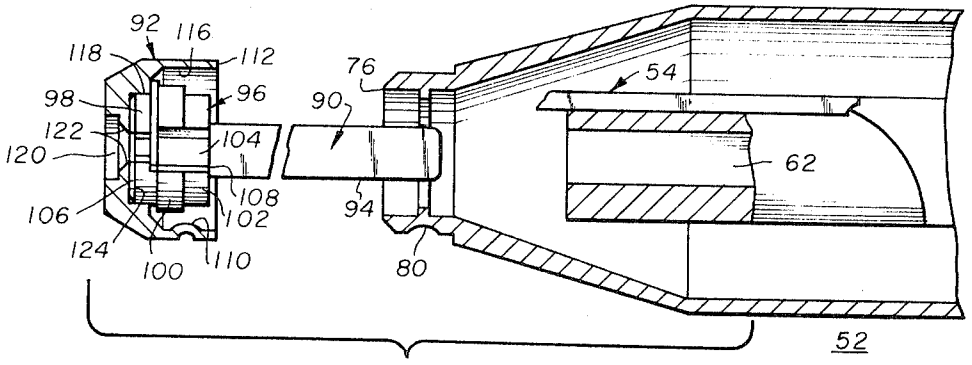


FIG. 13

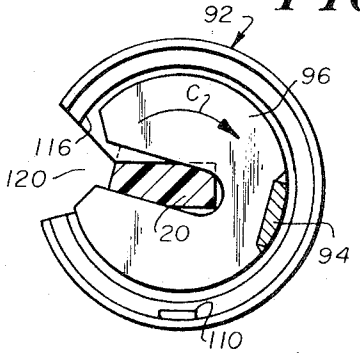


FIG. 14

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STRAP APPLYING TOOL

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention is directed to the field of tools and principally to a strap tensioning and cutoff tool for use in conjunction with an article bundling strap or similar device.

2. Description of the Prior Art

Strap tensioning and cutoff tools according to the prior art generally comprised a unitary device limitingly adapted for use with only one particular type of bundling strap, wherein the strap is disposed around a bundle of wires or the like, drawn into the tool to a predetermined tension, and the excess strap selectively severed in a cutoff operation. In one form, as exemplified in U.S. Pat. No. 3,332,454, for a Tool, issued July 24, 1967, to G. R. Lawson et al. and assigned to the assignee of the instant invention, the tool featured a noninterchangeable strap receiving portion limitingly arranged to accept, tension, and cut off a twist-type bundling strap. In another form, as exemplified in U.S. Pat. No. 3,433,275, for a Strap Applying Tool, issued Mar. 18, 1969, to D. Eppler and assigned to the assignee of the instant invention, the tool featured a replaceable and interchangeable twister plate and registration plate for use with straps of varying dimensions, but was adaptable only to a twist-type strap, severely restricting the versatility thereof.

SUMMARY OF THE INVENTION

The invention is directed to an improved strap tensioning and cutoff tool which overcomes the limitations noted above with respect to prior art devices by providing a conveniently interchangeable strap receiving and cutoff assembly releasably engageable with an extending nose portion of the tool, permitting the use of a single tool in conjunction with a selective variation of different commonly employed bundling straps. A first selective strap twisting member having a generally cylindrically contoured radially slotted head portion is releasably slidably coupled to an axially and rotatably movable operating member disposed within the nose portion of the tool. A second selective radially slotted cuplike cover member is releasably coupled to the nose portion adjacent the free end thereof and is appropriately recessed to accept therewithin in rotatable cooperative engagement the radially slotted head portion of the first selective member. In one embodiment of the invention, shear means having cam engaging means coupled thereto may be operatively coupled to the first selective member head portion adjacent the slotted portion thereof. A selectively recessed cam portion within the second selective member may be provided for cooperable engagement with said cam engaging means permitting a predetermined angular displacement of the shear means, wherein a predetermined twist may be applied to a strap disposed within the slot in the head portion prior to the shearing operation. In another embodiment, the second selective member is provided with a dimensionally restrictive slotted portion having inwardly converging tapered walls terminating in a shearing edge. The head portion of a matingly cooperable first selective member is disposed directly adjacent the second selective member shearing edge wherein a strap inserted within the respective slotted portions of the first and the second selective members is subjected to a shearing force immediately upon the radial axial displacement of the head portion of the first selective member. Means are provided for interchanging the assemblies comprising each embodiment, permitting the use of the tool with a variety of different types and sizes of bundling straps. It is therefore an object of this invention to provide an improved strap tensioning and cutoff tool.

It is another object of this invention to provide an improved strap tensioning and cutoff tool adaptable for use with a variety of different types and sizes of bundling straps.

It is a further object of this invention to provide an improved selectively adaptable strap tensioning and cutoff tool for tensioning and severing twist-type and locking barb-type bundling straps.

It is still another object of this invention to provide an improved, selectively adaptable strap tensioning and cutoff tool having cooperable, interchangeable strap tensioning and severing assemblies.

It is yet another object of this invention to provide an improved, selectively adaptable strap tensioning and cutoff tool having cooperable, interchangeable strap tensioning and severing assemblies for use with a variety of different sizes and types of bundling straps.

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 principle of the invention and the best mode which has been contemplated for carrying it out.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings.

FIG. 1 is a fragmentary view, in perspective, of the head portion of a locking-barb type bundling strap.

FIG. 2 is a fragmentary view, in perspective, of the head portion of a twist-type bundling strap.

FIG. 3 is a side view of a bundling strap secured about a plurality of conductors or the like.

FIG. 4 is a front elevational view of the head portion of the strap of FIG. 1 showing the body portion, in section, lockingly engaged therewithin.

FIG. 5 is a perspective view of the strap of FIG. 2 showing the manner in which the body portion is twisted to prevent its removal from the apertured head portion.

FIG. 6 is a front elevational view of the head portion of the strap of FIG. 5.

FIG. 7 is a fragmentary side elevational view, partly in section, of the nose portion of an improved strap tensioning and cutoff tool constructed in accordance with the concepts of the invention.

FIG. 8 is a side elevational view of a first selective member of the tool of FIG. 1, constructed in accordance with the concepts of the invention.

FIG. 9 is a front elevational view, partly in section, of the first selective member of FIG. 8.

FIG. 10 is a rear elevational view, partly in section, of the head portion of the first selective member of FIG. 8 rotatably engaged within a second selective member according to the concepts of the invention.

FIG. 11 is a rear elevational view, partly in section, of the assembly of FIG. 10 showing the first selective member head portion rotatably displaced from its position in FIG. 10.

FIG. 12 is a side elevational view, partly in section, of the nose portion of FIG. 7 in partial disassembly according to the concepts of the invention.

FIG. 13 is an exploded side elevational view of another embodiment of the nose portion of an improved strap tensioning and cutoff tool constructed in accordance with the concepts of the invention.

FIG. 14 is a rear elevational view, partly in section, of the head portion of the first selective member of the assembly of FIG. 13 rotatably disposed within the second selective member thereof.

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

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning now to FIG. 1, there is shown the head portion 22 of one type of commonly employed bundling strap 20 as further described in U.S. Pat. No. 3,186,047 for a Self-Clinching Bundling Strap, issued June 1, 1965, to D. P. Schwester et al. and assigned to the assignee of the instant invention, and usable in conjunction with the instant invention. Head portion 22 of strap 20 has a transverse selectively dimensioned aperture 24 therethrough extending from a rear surface 26 to a front surface 28. Extending partially into aperture 24 is a locking means 30 disposed in oblique angular relationship with the axis thereof and inclined generally towards

front surface 28. In use, as is more clearly seen in FIG. 3, the body portion 36 of strap 20 is wrapped about a plurality of items such as conductors 34 or the like, and the tail portion 32 inserted within aperture 24 in head portion 22 and drawn through to a predetermined tightness, thereby securing conductors 34 in bundle-like fashion, as shown in FIG. 3. Upon the advance of body portion 36 within aperture 24, the protruding edge 37 of locking means 30 is caused to bear against a portion of the surface of strap 20 directly adjacent thereto, permitting the insertion of body portion 36 within aperture 24 in a first or forward direction, from surface 26 to surface 28 as shown, but lockingly engages the adjacent surface of strap 20 upon the attempted removal of body portion 36 from aperture 24 in a second or rearward direction. The excess portion of strap 20 extending beyond surface 28 of head portion 22 may be removed as by severing or the like, presenting a finished appearance generally as shown in FIG. 4. Various modifications of strap 20 may be employed to effect a similar result, as, for example, forming locking means 30 integral with head portion 22, or varying the position thereof within aperture 24.

Referring now to FIG. 2, there is shown another embodiment of a bundling strap 38 as further described in U.S. Pat. No. 3,022,557 for a Cable Bundling and Supporting Strap, issued Feb. 27, 1962, to M. C. Logan and assigned to the assignee of the instant invention, and usable in conjunction with the instant invention. Head portion 40 of strap 38 has a first transverse aperture 42 therethrough, extending between the rear surface 46 and the front surface 48 thereof. A second transverse aperture 44 in normal axial alignment with aperture 42 extends only partially into head portion 40, communicating with the front surface 48 thereof, as shown.

In use, strap 38 is employed in a manner similar to that described above with respect to strap 20, wherein body portion 50 of strap 38 is wrapped about a plurality of conductors 34 or the like, tail portion 49 of strap 38 being advanced through aperture 42 to provide a convenient grasping means for tightening body portion 50 about articles 34. To prevent the removal of body portion 50 of strap 38 from aperture 42 of head portion 40, the portion of strap 38 adjacent surface 48 and extending therefrom is selectively rotated approximately 90° about its longitudinal axis in a twisting manner, as is more clearly shown in FIG. 5, causing the rotated portion of strap 38 to engage and be confined within aperture 44 upon release of tail portion 49. The excess portion of strap 38 extending beyond surface 48 may then be severed by suitable cutting means, wherein the resulting configuration is substantially as shown in FIG. 6.

Turning now to FIGS. 7, 8, 9, 10, 11 and 12, there is shown an extending nose portion 52 of an improved strap tensioning and cutoff tool constructed in accordance with the concepts of the invention. The remaining portion of the tool to which nose portion 52 is attached may take any one of several convenient forms which comprise no part of this invention and which may include suitable mechanisms for displacing and rotating operating member 54, such as those described, for example, in U.S. Pat. No. 3,332,454 for a Tool issued July 25, 1967, to G. R. Lawson et al. and assigned to the assignee of the instant invention; U.S. Pat. No. 3,433,275 for a Strap Applying Tool issued Mar. 18, 1969, to D. Eppler and assigned to the assignee of the instant invention; and U.S. Pat. No. 3,438,406 for a Strap Tensioning and Locking Tool issued Apr. 15, 1969, to W. J. Rozmus. Releasably slidably coupled to an elongated operating member 54 longitudinally disposed within nose portion 52 and axially and rotatably movable therewithin, by means such as described in the aforementioned patents, is a first selective twister member 56 having a generally cylindrical slotted head portion 58 and a tail portion 60 extending axially from said head portion 58. The tail portion 60 of first selective member 56 is disposed within a preferably close-fitting longitudinally aligned recessed portion 62 in operating member 54, said recessed portion 62 selectively proportioned for sliding engagement and retention with tail portion 60. Head portion 58 of member 56 comprises, in longitudinal axial order, as better seen in FIG. 8, a first cylindrical portion 64, a second cylindrical portion 66 preferably diametrically larger than first portion 64, and a third cylindrical portion 68, forming a preferably integral unit. As is more clearly shown in FIG. 8, a shearing means such as knife 70 is pivotally coupled to head portion 58 generally intermediate the first and the second cylindrical portions 64, 66, respectively, and is movable towards and away from a selectively contoured generally transverse strap receiving aperture 72 extending axially through head portion 58 from the first cylindrical portion 64 to the third cylindrical portion 68. An appropriately recessed, radially slotted, preferably cuplike second selective member 74 is operatively disposed generally circumjacent the head portion 58 of first selective member 56, and is releasably secured to nose portion 52 adjacent the open end 76 thereof. A portion of the periphery of second selective member 74 is deformed radially inwardly as at 78 to releasably matingly engage a complementary recessed portion 80 adjacent the open end 76 of nose portion 52 permitting second selective member 74 to be conveniently coupled to and uncoupled from said open end 76. It should be understood that although only one means for releasably securing second selective member 74 to nose portion 52 is shown, other suitable arrangements may be provided without departing from the spirit of the invention, as, for example, a ball and detent coupling, latch means, or mating threaded means, such arrangements being illustrative only and not intended to be exhaustive of the means adaptable herewith. A generally transverse radial slot 88, dimensioned to permit the unrestricted axial rotation of the body portion 50 of a strap such as 38 therewithin, extends axially through second selective member 74 and is longitudinally aligned with aperture 72 in head portion 58 of first selective member 56, thereby defining a substantially continuous strap receiving aperture, as is more clearly shown in FIG. 7. The inner surface 82 of second selective member 74 is appropriately recessed to provide a rotatable bearing for the first and second cylindrical portions 64, 66 respectively of head portion 58, permitting said head portion 58 to rotate freely therewithin. Extending from the outer periphery 83 of knife 70 is a cam engaging means such as projection 84 (see FIG. 10) operatively movable within a generally arcuate, angularly limited recessed portion 86 adjacent the inner surface 82 of second selective member 74. Thus, as may be more clearly seen in FIG. 10, as head portion 58 is rotatably displaced within second selective member 74, protrusion 84 is caused to freely arcuately traverse recess 86 through a predetermined angle, in the direction indicated by arrow A in FIG. 10, whereupon protrusion 84 is urged against stop 89 defining one end of recess 86, thus restricting any further angular movement of knife 70, as head portion 58 is further rotated in said direction A. For a more complete description of the manner in which a knife such as 70 and a head portion such as 58 coact to selectively twist and shear a selective portion of a strap such as 38 interposed therebetween, reference is herein made to U.S. Pat. No. 3,332,454 for a Tool, issued July 25, 1967, to G. R. Lawson et al. and assigned to the assignee of the instant invention. Thus, as described, first selective portion 58 and second selective portion 74 serve to provide a cooperative, conveniently replaceable assembly usable with bundling straps such as 38 or the like.

Turning now to FIGS. 13 and 14, there is shown another embodiment of a first selective member 90 and a second selective member 92 constructed in accordance with the concepts of the invention. Tail portion 94 of first selective member 90 is dimensionally equivalent to tail portion 60 of first selective member 56 (see FIGS. 7 and 8) and is adapted to be similarly releasably slidably engaged within recess 62 in operating member 54. The head portion 96 of first selective member 90 is somewhat similar to head portion 58 of first selective member 56, being comprised of a first cylindrical portion 98, a second, preferably enlarged cylindrical portion 100, and a third cylindrical portion 102, said portions 98, 100, and 102

forming a preferably integral structure substantially as shown. A restrictively contoured radial slot 104 extends longitudinally through head portion 96 from a front surface 106 to a rear surface 108 thereof, defining a strap receiving passage for the receipt therein of the body portion 36 of a bundling strap such as 20 (see FIG. 1) or the like. The second selective member 92 is disposed circumjacent first selective member 90 in a manner similar to that described above with respect to member 74 of FIG. 7. An inwardly deformed portion 110 adjacent the open end 112 of member 92 is arranged to engage a mating complementary recessed portion 80 adjacent open end 76 of nose portion 52, providing a releasable coupling therebetween as described above with respect to the embodiment illustrated in FIG. 12. Other suitable means for releasably coupling second selective member 92 to nose portion 52, examples of which were described above, will be apparent to those skilled in the art, and may readily be employed without departing from the spirit of the invention. The inner surface 116 of second selective member 92 is appropriately recessed, as at 118, in a manner similar to that described above with respect to member 74, to provide a bearing in which head portion 96 is free to rotate. A generally transverse, restrictively dimensioned radial slot 120 is provided in second selective member 92, to permit the passage therethrough of the free end of a strap such as 20 (see FIG. 1) as said free end is drawn into the strap tensioning and cutoff tool nose portion 52. Slot 120 is initially disposed in longitudinal, adjacent axial alignment with opening 104 in head portion 96 of first selective member 90. The walls 122 defining slot 120 in second selective member 92 taper generally inwardly as shown, towards inner surface 124, terminating in a sharp edge formed by the communication of walls 122 with surface 124, the purpose of which is described below. In operation, the free end of a bundling strap such as 20 is wrapped about an article or articles to be secured and progressively inserted through slot 120 and opening 104. A pawl means such as 126 (see FIG. 7), operatively coupled to operating member 54 and reciprocatingly movable in nose portion 52, is caused to engage said free end of strap 20 and is retracted into nose portion 52, as directionally indicated by arrow B, in response to the axial movement of operating member 54. Upon the attainment of a selectively predetermined tension value in strap 20, operating member 54 is caused to rotate, and first selective member 90 being coupled thereto through tail portion 94 is rotationally displaced in response to the movement of operating member 54. As is more clearly seen in FIG. 14, wherein head portion 96 of first selective member 90 is shown angularly displaced from its initial position, the portion of strap 20 engaged within opening 104 is subjected to a twisting force in the direction indicated by arrow C, causing the portion of strap 20 immediately adjacent slot 120 in second selective member 92 to be urged against the previously described sharp edges adjacent slot 120, thus severing from the body portion 36 thereof that portion of strap 20 extending into nose portion 52 beyond slot 120. It should be noted that both slot 120 and opening 104 are restrictively dimensioned to provide a close fit about the body portion 36 of a bundling strap such as 20, thereby necessitating only a slight angular displacement of first selective member head portion 96 to accomplish the severing operation, without subjecting strap 20 to any appreciable twist. It should be understood that although a first selective member such as 56 has been described in combination with a second selective member such as 74, member 56 may be employed with equal effectiveness in combination with a second selective member such as 92, where it is desired to accomplish the shearing action by means of knife 70 rather than by utilization of the cutting edges adjacent slot 120 in member 92. In such event, cam recess 86 may be appropriately modified by reducing the length thereof to provide a relatively small aperture sufficient to restrictively receive cam engaging means 84 therein, wherein upon the rotation of head portion 58, knife 70 is immediately subject to an inwardly directed camming action, causing it to contact the adjacent portion of a bundling strap such as 20 interposed within slot 72, to effect the severing thereof. Similarly, where advantageous or desirable, second selective member 74 may be effectively utilized in combination with first selective member 90 by tapering the walls defining slot 88 in member 74 in a manner similar to that described with reference to slot 120 in member 92 to provide an appropriately contoured shearing edge thereon. It should be evident that a similar shearing edge may be provided at the juncture formed by the communication of the walls defining slot 104 and the outer surface of first cylindrical member 98 of first selective member 90. Other variations and combinations of the first and second selective members herein described will be apparent to those skilled in the art, and may be readily adapted to effect the purposes set forth above without departing from the spirit of the invention. Further, it should be obvious to those skilled in the art that although the embodiment of the invention has been disclosed as particularly applicable to a strap tensioning and cutoff tool, its use is not intended to be restricted thereby.

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

1. In an article tensioning and cutoff tool of the type having a generally elongated extending nose portion open at a first end, and a generally elongated operating member longitudinally disposed in said extending nose portion and axially and rotatably movable therewithin, the improvement comprising: a first selective member having a slotted head portion disposed generally adjacent said open end of said nose portion and a tail portion extending into said nose portion; first coupling means for releasably slidably coupling said tail portion of said first selective member to said operating member; a slotted second selective cover member disposed circumjacent said head portion of said first selective member; said head portion of said first selective member contoured to permit the rotation thereof within said second selective member; and second coupling means for releasably coupling said second selective member to said first end of said nose portion; said first selective member and said second selective member thereby forming a predetermined selective assembly.

2. The improvement as defined in claim 1 further comprising means responsive to the rotational movement of said operating member for shearing an article disposed in said slot in said first selective member head portion.

3. The improvement as defined in claim 2 wherein said slot in said second selective member is so proportioned as to permit the predetermined longitudinal axial rotation of an article inserted therethrough.

4. The improvement as defined in claim 3 wherein said shearing means comprises a blade member operatively coupled to said head portion of said first selective member.

5. The improvement as defined in claim 4 further comprising cam engaging means coupled to said shearing means; and cam means in said second selective member cooperable with said cam engaging means for selectively restraining said shearing means after the rotation of said first selective member through a predetermined angle, whereby said shearing means is caused to contact and shear said article disposed in said slot in said second selective member, upon the further angular displacement of said second selective member.

6. The improvement as defined in claim 5 wherein said first coupling means is a generally longitudinally extending recessed portion in said operating member dimensioned to slidingly receive and engage said tail portion of said first selective member.

7. The improvement as defined in claim 6 wherein said second coupling means comprises a selectively contoured recessed portion adjacent said first end of said nose portion and a mating, complementarily contoured raised portion of said second selective member adjacent said recessed portion and engageable therewith.

8. The improvement as defined in claim 2 wherein said slot in said second selective member is so proportioned as to provide a relatively close fit about an article inserted therethrough.

9. The improvement as defined in claim 8 further comprising a cutting edge adjacent the juncture of the walls defining said slot in said second selective member and the adjoining inner surface of said second selective member.

10. The improvement as defined in claim 9 wherein said first coupling means is a generally longitudinally extending recessed portion in said operating member dimensioned to slidingly receive and engage said tail portion of said first selective member.

11. The improvement as defined in claim 10 wherein said second coupling means comprises a selectively contoured recessed portion adjacent said first end of said nose portion and a mating, complementarily contoured raised portion on said second selective member adjacent said recessed portion and engageable therewith.

12. The improvement as defined in claim 8 wherein said shearing means comprises a blade member operatively coupled to said head portion of said first selective member.

13. The improvement as defined in claim 12 further comprising cam engaging means coupled to said shearing means; and cam means in said second selective member cooperable with said cam engaging means for preventing the movement of said shearing means upon the rotation of said first selective member, whereby upon the rotation of said first selective member said shearing means contacts and shears an article disposed in said slot.

14. The improvement as defined in claim 13 wherein said first coupling means is a generally longitudinally extending recessed portion in said operating member dimensioned to slidingly receive and engage said tail portion of said first selective member.

15. The improvement as defined in claim 14 wherein said second coupling means comprises a selectively contoured recessed portion adjacent said first end of said nose portion and a mating, complementarily contoured raised portion on said second selective member adjacent said recessed portion and engageable therewith.

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