PATENT SPECIFICATION (11) 1 577 958

1 577 958

(21) Application No. 29174/79 (22) Filed 9 Feb. 1977

(62) Divided out of No. 1577957

(31) Convention Application No. 656489 (32) Filed 9 Feb. 1976 in

(33) United States of America (US)

(44) Complete Specification Published 29 Oct. 1980

(51) INT. CL.[3] B25B 25/00

(52) Index at Acceptance F2G G1 G4

(19)

(54) TENSIONING AND SEVERING TOOLS

(71) We, DENNISON MANUFACTURING CO. LIMITED, a Company registered under the laws of England, of Colonial Way, Watford, Hertfordshire, do

hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

This invention relates to a tensioning and severing tool and more particularly but not exclusively to a tool for the installation of fasteners such as cable ties.

Cable tie fasteners are commonly installed by wrapping their straps around groups of articles and then threading the straps through locking heads. The installation is completed by pulling on the free end of the strap until the articles are securely bundled and then severing the free end of the strap in the vicinity of the head.

According to the present invention, a tensioning and severing tool comprises a housing, a gripper slidable in the housing between a forward position and a rearward position to tension an elongate article gripped by the gripper, a sever mechanism operable to sever the article at a location spaced forwardly of the said rearward position, and an ejector spring located between the forward and rearward positions and operative on a portion of the article drawn by the gripper past the forward position to the rearward position to bias the said portion in a direction generally perpendicular to the length of the said portion and out of the tool.

The tool may include means for releasing the grip of the gripper when the gripper reaches the rearward position.

The ejector tool may comprise a leaf having a rearward end biased into the path of the gripper and movable out of the path by movement of the gripper from its forward to its rearward position.

The invention may be carried into practice in various ways but one tensioning and severing tool embodying the invention will now be described by way of example with reference to the accompanying drawings, in which:-

Figure 1 is a perspective view of the tool being used in the installation of a cable tie;

Figure 2A is a perspective view of the tensioning and sever mechanisms in the installation tool of Figure 1;

Figure 2B is a schematic representation of the tensioning and severing mechanisms of Figure 2A during tensioning;

Figure 2C is a schematic representation of the tensioning and severing mechanism of Figure 2A during severing;

Figure 3A is a perspective view of a compression spring cage for the adjustment of tension applied by the tool;

Figure 3B is a perspective view of the interior of the cage of Figure 3A;

Figure 4A is a view of the installation tool of Figure 1 with portions broken away to show the placement of constituents pictured in Figures 2A to 3B;

Figure 4B is an end view of the tool of Figure 4A; and

Figure 4C is a top view of the tool of Figure 4A.

Turning to the drawings, there is shown a tensioning and severing tool 10 formed by a split-cover housing 10*h* containing a tensioning assemblage 11 and a pivoted cut-off lever 12, which is visible through a viewing aperture of a cutter guard 12*g* and mounts a cutter blade 12*b*.

As illustrated in Figure 1, the tool 10 can be used to complete the installation of an item such as a cable tie 20. The strap portion 21 of the tie 20 is wrapped around articles that are to be bundled, for example the individual wires W of a cable C. A free end 22 of the tie 20 is inserted through the head 23 of the strap into the mouth of the tool 10

between gripper constituents 11*p* and 11*a* of the tensioning assemblage 11.

When force F_t is applied to a trigger 13 of the tool 10, it is transmitted through levers and linkages (not visible in Figure 1) to the tensioning assemblage 11, causing the assemblage to be drawn towards the rear of the gun. This frees a pivoted and spring-loaded pawl 11*p* which rotates against the portion 22 of the strap and grips it with respect to a stud 11*a*.

The initial rearward motion of the tensioning assemblage 11 caused by the force F_t tightens the portion 21 of the strap around the wires W of the cable C, with the head 23 of the cable tie 20 in close abutment with the tool 10. Further movement of the tensioning assemblage 11 increases the tension applied to the gripped portion 22 of the tie 20 until a predetermined tension level is reached. At that point, as explained below, the force transmitted to the tensioning assemblage 11 from the trigger 13 causes a collapse of the intervening linkage which acts upon the cutoff lever 12 and pivots it upwardly, bringing the blade 12*b* into sever position with respect to the gripped end portion 22 of the cable tie 20.

In the operation of a typical tensioning and severing tool previously available, the sever action produces a significant shock impact. However, this impact is significantly reduced in the tool being described because of the particular way in which the cutoff lever 12 is operated, as explained in conjunction with Figures 2A to 2C.

A perspective view showing the relationship between the tensioning assemblage 11 and the cutoff lever 12 is given in Figure 2A. The tensioning assemblage 11 is maintained in a normally forward position in the tool 10 by a compression spring 11*c*. The tensioning assemblage is connected to the trigger 13 through a set of actuator linkages including toggle linkages 14 and an internal actuator lever 15.

When the trigger force F_t is applied, it is transmitted through a trigger link 13*t* to the actuator lever 15 which is pivotally mounted within the handle 16 of the tool 10. The upper portion of the actuator lever 15 is pivotally connected to the toggle linkages 14, which are, in turn, pivotally connected to the bar 11*b* of the tensioning assemblage 11. To maintain the toggle linkages 14 in position to transmit the trigger force F_t, a countervailing force F_c is applied to the midpoint 14*m* of the toggle through a toggle arm 14*a*. The toggle is never completely straight; there is always a slight angular inclination, in the rest position, towards the force F_c. When the tensioning force applied from the trigger 13 exceeds the countervailing force F_c, the toggle collapses by pivoting with respect to both the actuator lever 15 and the tensioning bar 11*b* and engages a cam surface 12*c* of the cutoff lever 12. Since the operation of the cutoff lever takes place while the actuator lever is moving to the rear, there is, in effect, a cushioned impact of the collapsed toggle linkages 14 against the cutoff lever 12. It is believed that this cushioning limits the shock loading that is produced when the strap 22 is severed.

In addition, an ejector spring 17, in the form of a leaf 17*f* with a curved end portion 17*c* extending into the mouth of the tool, is included to reduce any tendency for the severed end of the strap to be propelled toward the user.

As the tensioning bar 11*b* is drawn towards the rear of the gun 10, the curved portion 17*c* of the ejector spring 17 tends to be flattened against the adjoining housing wall. When the pawl 11*p* reaches a cam surface 11*c* (shown in Figures 1 and 2A), with the strap 22 under tension, the cam acts upon the pawl and partially releases it. In addition, as noted in Figure 1, the housing 10*h* has a shield 10*s* that extends at the top of the gun to the vicinity of the ejector spring 17. Consequently when the strap is under tension, with pawl 11*p* partially released and the spring 17 partially deflected, and the cutter blade 12*b* is operated to sever the strap, the severed portion tends to be propelled laterally out of the housing instead of towards the user. The desired lateral propulsion is promoted by contributions from the shield 10*s*, the partial pawl release provided by the cam 11*c* and the ejector spring 17.

A schematic representation of the tensioning and sever operation is illustrated in Figures 2B and 2C. Initially as shown in Figure 2B the individual links of the toggle assemblage 14 are almost in alignment but with a slight inclination downwards. For simplicity the toggle assemblage 14 in Figure 2B is shown formed by the first link 14-1 that is pivotally connected to the tensioning bar 11*b* and a second link 14-2 that is pivotally connected to the actuator lever 15. The actuator and sever links 14-1 and 14-2 are in turn pivotally joined. It is at this point of joinder 14*m* that the countervailing force F_c is applied. To keep the countervailing force from driving the links 14-1 and 14-2 of the toggle assemblage out of alignment, the tensioning bar 11*b* includes an integral stop 11*t* shown in Figure 2B. A possible alternative is shown in Figure 4A where the upward motion of the linkages is limited by a slot 11*s* in the draw bar 11*b*. The various ways of applying the countervailing force F_c to the toggle assemblage 14 are discussed below.

When the tension applied to the strap by the bar 11*b* exceeds the value of the countervailing force F_c applied at the pivot centre 14*m* of the toggle assemblage 14, the

toggle collapses as shown in Figure 2C. This collapse brings the bearing surface 14*b* of the toggle into engagement with the cam surface 12*c* at the rear of the cutoff lever 12. Since the toggle assemblage 14 is formed by pivotally connected members, the force transmitted to the cutoff lever is composed of both horizontal and vertical components, by which a cushioned impact is applied to the cutoff lever 12, instead of a direct impact, so that impact shock loading is avoided.

In addition, as is evident from Figure 2B, the use of the trigger 13 in conjunction with the actuator lever 15 provides a mechanical advantage so that the amount of operator force applied to the toggle is considerably less than that needed with conventional installation tools. The use of the actuator lever 15 also permits the desired tensioning force to be applied by movement over a relatively small arc of operation of the trigger 13.

The desired countervailing force F_c is provided by a compression spring 32*s* in a cage 30 shown in Figures 3A and 3B. As indicated in Figure 3A the end of the toggle linkage 14*a* is connected by a pivot pin 31*p* to the lower end of a cover part 31 of the cage 30, which is slideably movable with respect to a housing part 32 of the cage within which the spring 32*s* is located. One end of the spring abuts the bottom wall of the housing while the top end abuts a lug 31*p* which projects from the upper end of the cover part 31 into the housing part 32. A possible alternative to the compression spring 32*s* and cage 30 is a tension spring one end of which is hooked to the end of the link 14*a* and the other end of which is hooked to the body of the tool near the top of the link 14*a* but such a spring tends to be mechanically unreliable.

To adjust the tension applied through the toggle arm 14*a* an adjusting member 32*a* is threaded into the bottom portion 32 of the cage 30 as shown in Figure 3B by rotation of a tension control knob 33. This moves the lower portion 32 of the cage 30 of Figure 3A upwardly with respect to the upper portion 31 and carries with it the indicator 32*r* that moves within a slot 31*s* of the cover portion 31 and simultaneously causes compression of the tension control spring 32*s*. This arrangement achieves precise control over tension and a high degrees of mechanical stability.

A partial sectional view of the entire installation tool of Figure 1 is shown in Figures 4A to 4C to indicate the relative positioning of the internal constituents of the tool, as well as the interrelations among those constituents.

Thus in the tool 10 as shown in Figures 4A and 4B the toggle assemblage 14 is formed by four links (Figure 4C) 14-1 to 14-4. The link 14-1 is seated on a hub 11*h* of the tensioning bar 11*b*. The link 14-1 is in turn pivotally connected to the arm 14*a* that extends to the compression cage 30. The arm 14*a* is connected to the lever 15 by the link 14-2, as well as by the further link 14-3. There is also pivotal connection between the hub 11*h* of the tensioning bar 11*b* and the arm 14*a* by the link 14-4. It is the latter link that limits the upward movement of the toggle assemblage due to the application of the compression force F_c through the arm 14*a*. This is because the fourth linkage 14-4 rides in the slot 11*s* of the tensioning bar 11*b*. Initially with the full compression force F_c applied to the arm 14*a* the individual links of the toggle assemblage are almost in alignment and the link 14-4 is seated in the upper part of the ecess 11*s*. When the tension applied to the strap exceeds the countervailing force F_c the toggle assemblage collapses as described previously and the link 14-4 moves out of the slot 11*s* to contact the cam surface 12*c* and operate the sever lever 12.

Also indicated in Figures 4A and 4B is the placement of the cam 11*c* that provides partial release of the pawl 11*p* before sever.

Details of the compression cage 30 are illustrated in Figures 4A and 4C.

Attention is directed to our copending Patent Application No. 5343/77 (Serial No. 1577957) from which the present application has been divided and which claims a tensioning and severing tool comprising a gripper for an article to be tensioned, a drive member, a transmission between the drive member and the gripper including a toggle linkage arranged so that the linkage is in compression during tensioning, a spring holding the linkage in an almost straight condition until a predetermined tensioning force is applied by the drive member through the toggle linkage to the gripper, and a sever mechanism operable by collapse of the toggle linkage to sever the article.

WHAT WE CLAIM IS:

1. A tensioning and severing tool comprising a housing, a gripper slidable in the housing between a forward position and a rearward position to tension an elongate article gripped by the gripper, a sever mechanism operable to sever the article at a location spaced forwardly of the said rearward position, and an ejector spring located between the forward and rearward positions and operative on a portion of the article drawn by the gripper past the forward position to the rearward position to bias the said portion in a direction generally perpendicular to the length of the said portion and out of the tool.

2. A tool as claimed in Claim 1 which includes means for releasing the grip of the

gripper when the gripper reaches the rearward position.

3. A tool as claimed in Claim 1 or Claim 2 in which the ejector spring comprises a leaf having a rearward end biased into the path of the gripper and movable out of the path by movement of the gripper from its forward to its rearward position.

KILBURN & STRODE.
Chartered Patent Agents.
Agents for the Applicants.

Printed for Her Majesty's Stationery Office,
by Croydon Printing Company Limited, Croydon, Surrey, 1980.
Published by The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.

1577958 COMPLETE SPECIFICATION

3 SHEETS This drawing is a reproduction of the Original on a reduced scale

Sheet 1

FIG. 1.

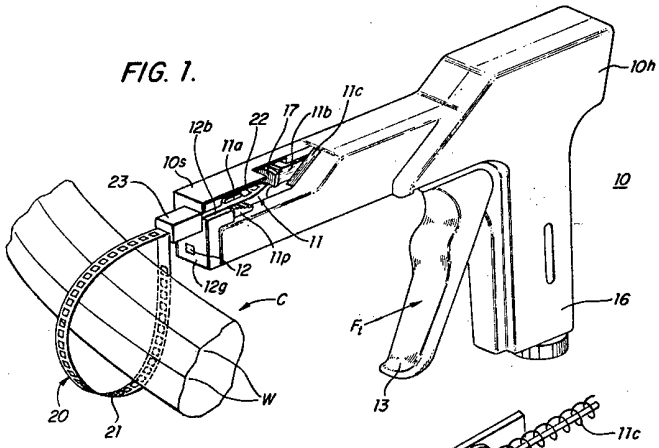
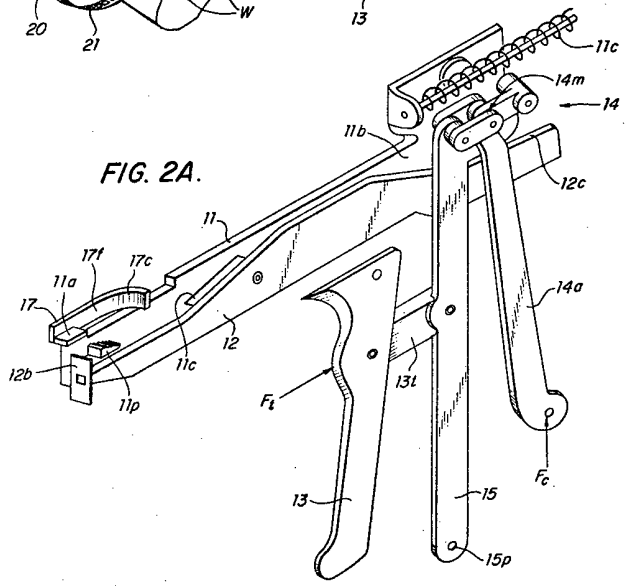


FIG. 2A.



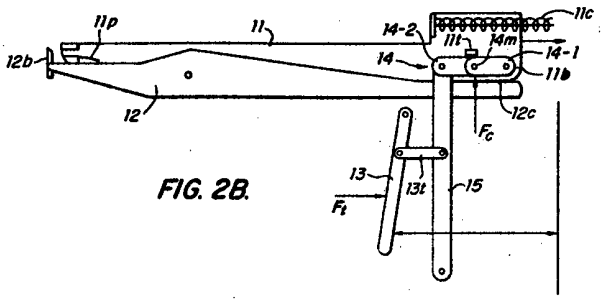


FIG. 2B.

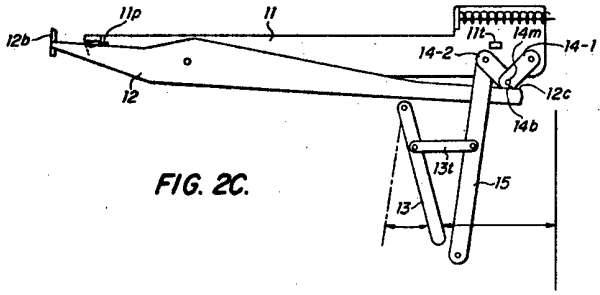


FIG. 2C.

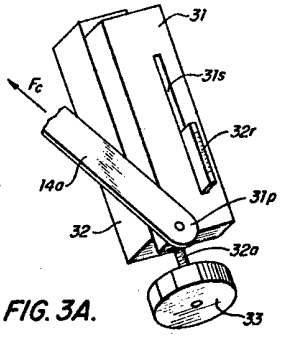


FIG. 3A.

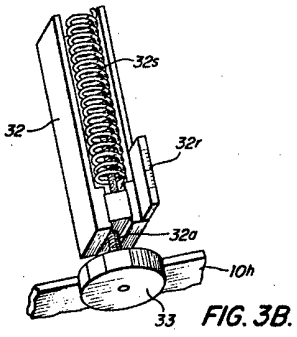


FIG. 3B.

1577958 COMPLETE SPECIFICATION
3 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 3

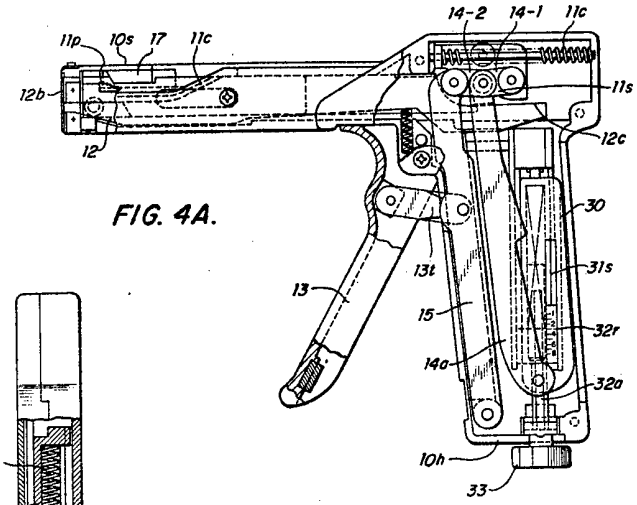


FIG. 4A.

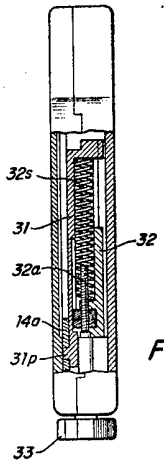


FIG. 4B.

FIG. 4C.