

[54] **POWERED STRAP TENSIONING AND SEVERING TOOL**

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[51] Int. Cl. **B21f 9/00**

[58] Field of Search. **140/93 A, 123.6, 93.2**

[56] **References Cited**

UNITED STATES PATENTS

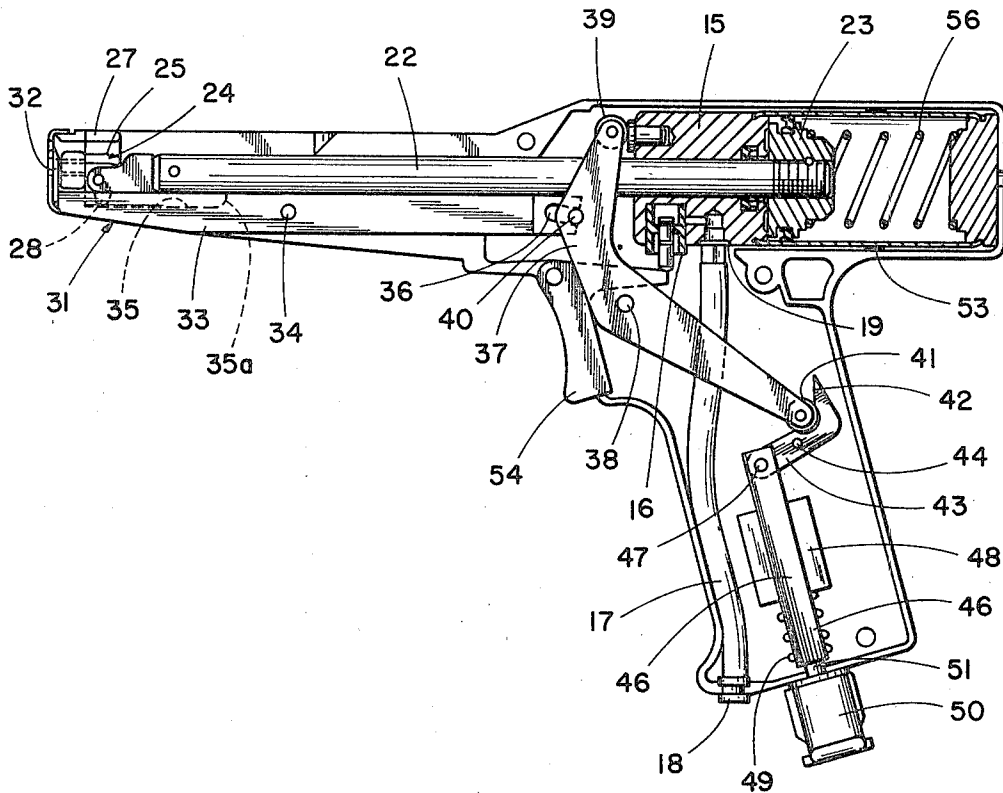
3,254,680	6/1966	Caveney et al.	140/123.6
3,438,406	4/1969	Rozmus	140/123.6
3,661,187	5/1972	Caveney et al.	140/123.6

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[57] **ABSTRACT**

A power-operated tool for tensioning and severing a binder strap is provided comprising a housing, movable strap gripping means for gripping a strap whereby the strap may be tensioned about a bundle of wires or the like, strap cutting means for cutting the free end after tensioning, motor means for driving the strap gripping means and actuating the strap cutting means, biasing means for restraining actuation of the cutting means until a predetermined tension has been produced in the strap. The motor means is mounted in the housing for relative movement therein, whereby movement of the motor means upon the predetermined tension being developed in the strap actuates the strap cutting means.

20 Claims, 7 Drawing Figures



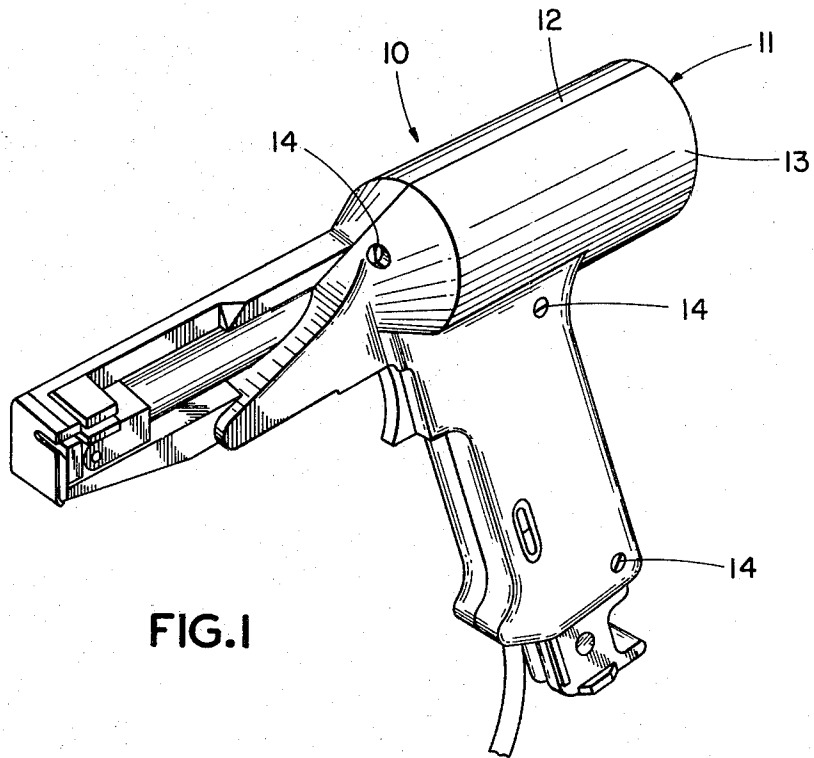


FIG. 1

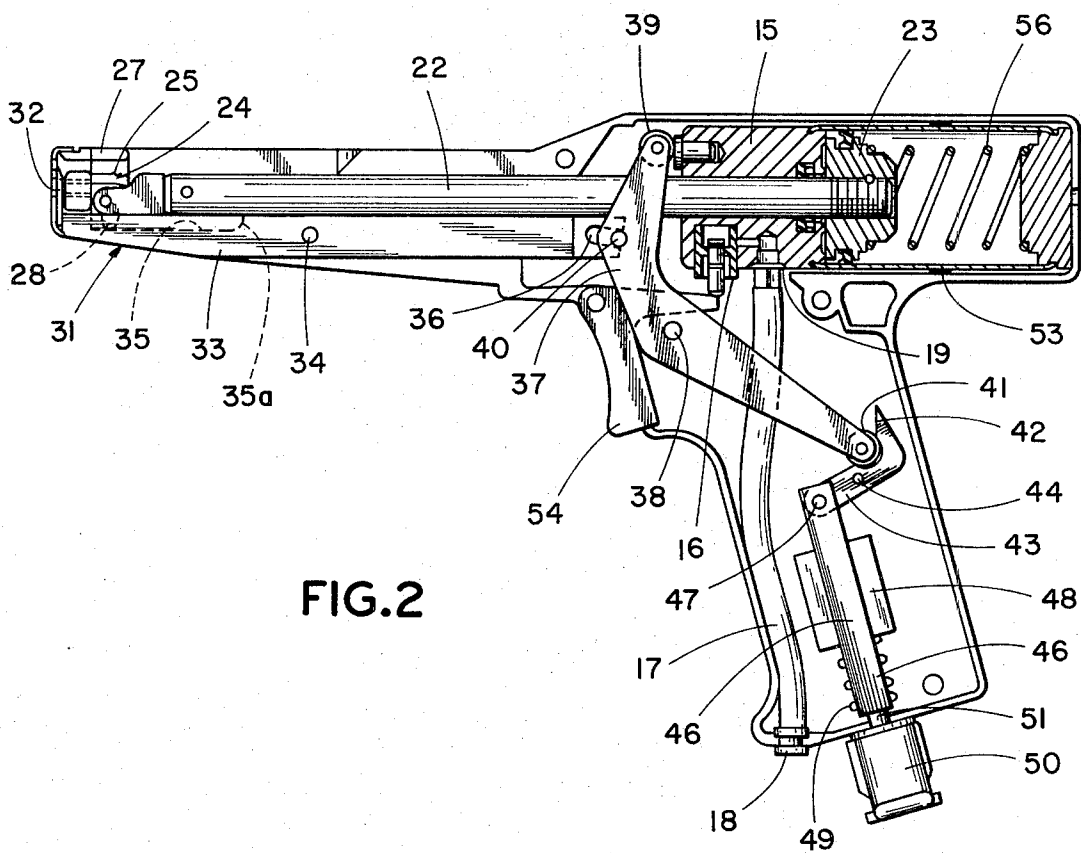


FIG. 2

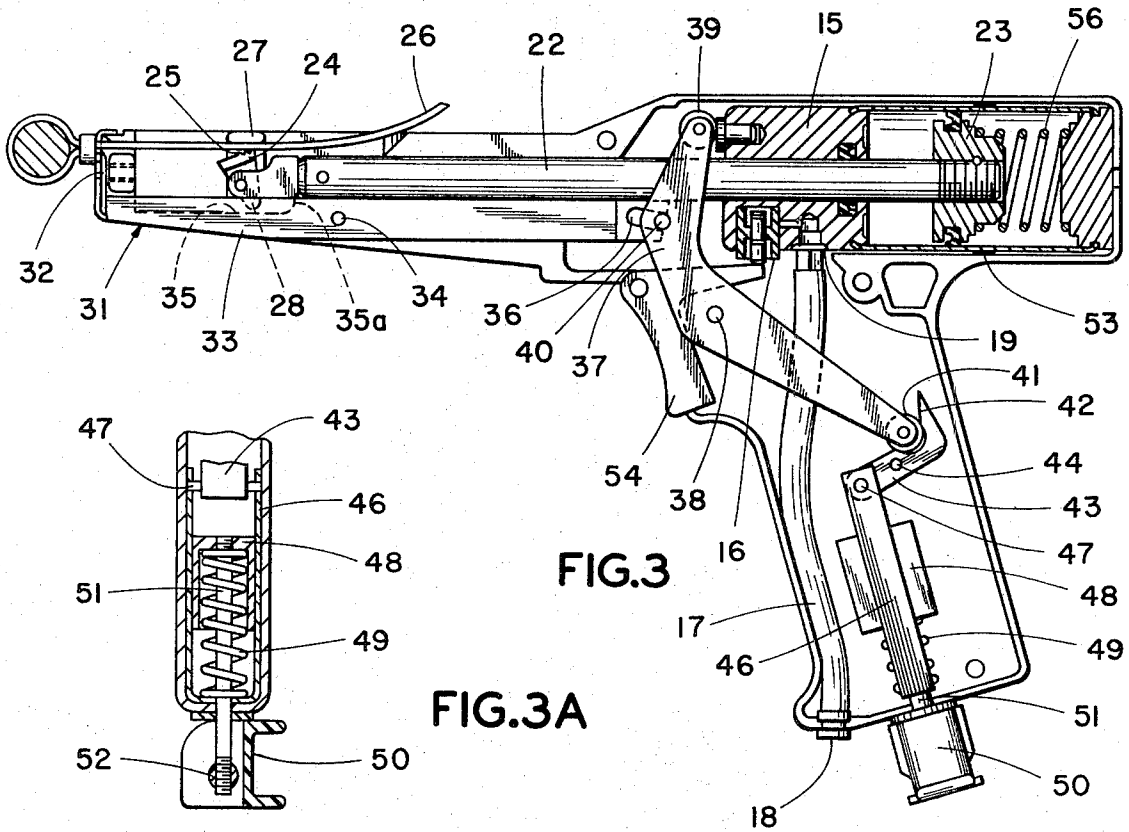


FIG. 3

FIG. 3A

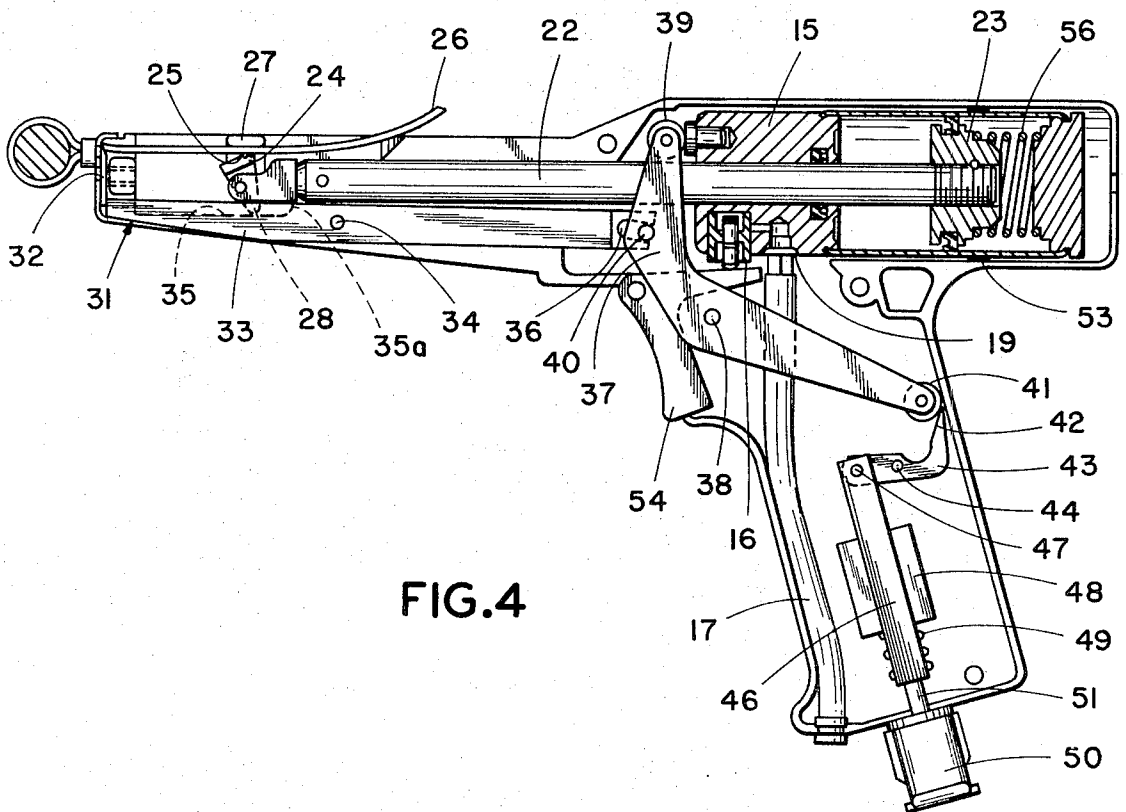
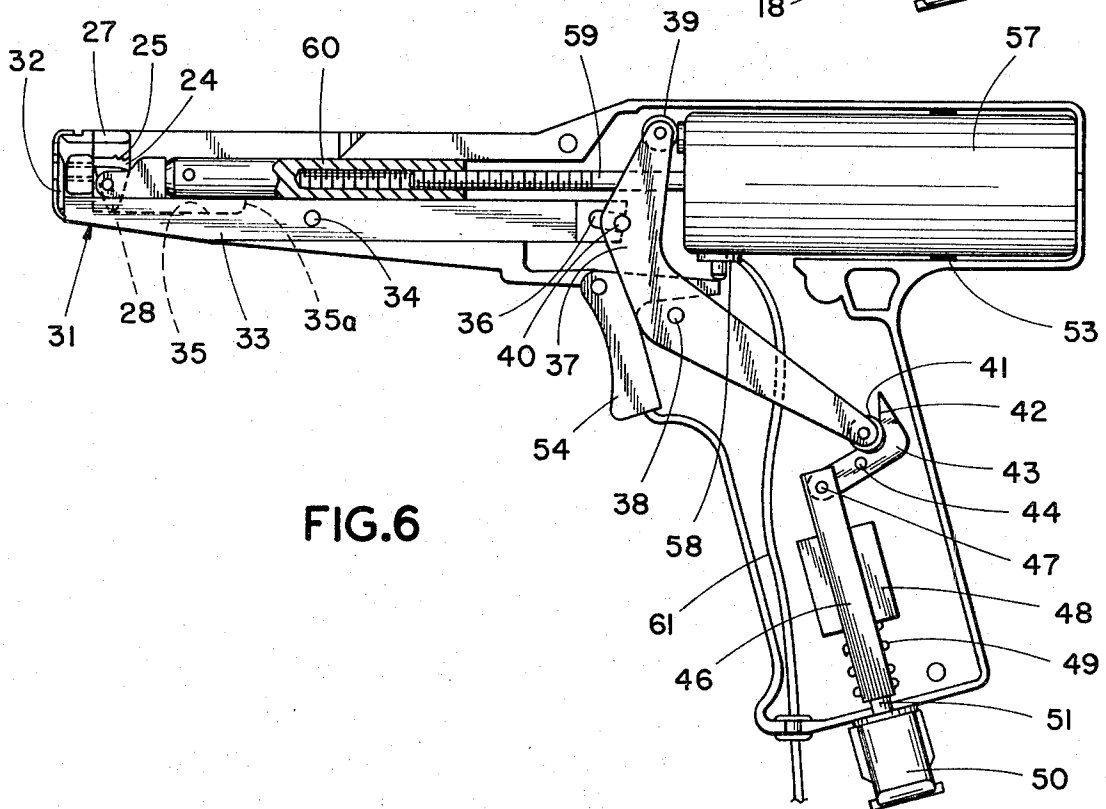
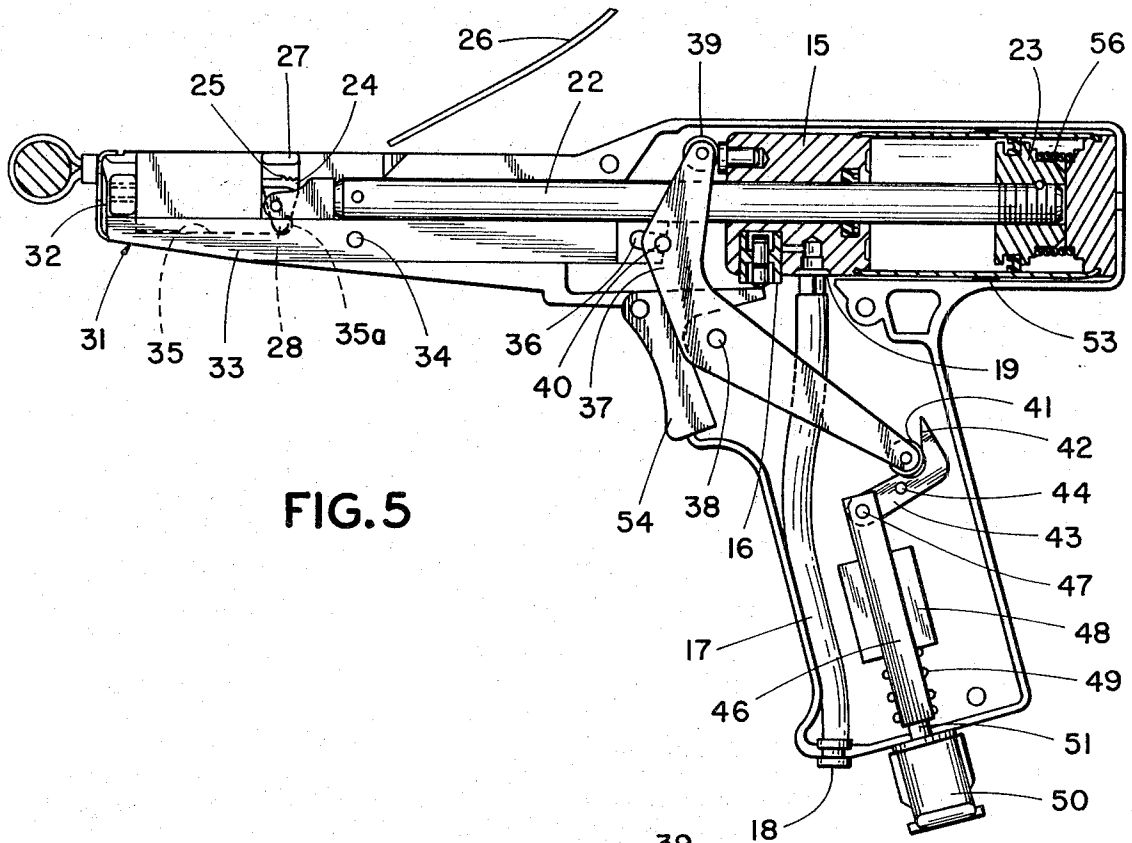


FIG. 4



POWERED STRAP TENSIONING AND SEVERING TOOL

The present invention relates to the art of strap tensioning and severing tools and particularly to an improved power-operated tool for tensioning a binder strap around a bundle of wires or the like and thereafter cutting the excess off the free end of the strap.

In the past, power-operated tools have required complex mechanical linkage between the strap severing means and the power source to cut the strap end once the strap has been tensioned around a bundle of wires or the like. Accordingly, it would be desirable to provide a power-operated tool that provides a simple connecting means between the power source and the strap cutting means.

One prior art powered tool utilized a rotating rod to effect strap cut off. Such a construction poses a potential safety hazard as an operator grabbing a strap tip having only a small amount of the tip exposed could have his hand pulled into the tool upon rotation of the rod. It would therefore be desirable to provide a power-operated tool wherein safety hazards inherent in using a rotating rod to effect strap cut off are minimized.

Prior art power-operated tools have utilized a double acting air cylinder wherein once the free end of the strap has been severed the strap gripper is returned to its original position by air pressure. In utilizing such a structure it is possible for an operator to pinch a finger between the strap gripper and the nose of the tool due to the air return force being applied to the gripper. It would therefore be desirable to provide a tool that minimizes potential harm to the operator caused by rapid return of the gripper once the strap has been severed.

Accordingly, it is an object of the present invention to provide a power-operated tool for quickly and economically applying straps around bundles of wires or the like and thereafter severing the free or loose end of the strap. Another object of the present invention is to provide a strap tensioning and severing tool that minimizes safety hazards inherent in using a rotating rod to effect strap cut off. Still another object of the present invention is to minimize the potential harm to an operator caused by rapid return of the strap gripper under air pressure. Yet another object of the present invention is to provide a strap tensioning and severing tool that uniformly tensions successively applied straps about a bundle of wires or the like that is independent of the potential of the energy source for the motor means. Another object of the present invention is to provide a relatively simple yet highly improved mechanism for tensioning and severing the straps. Further objectives and advantages of the present invention will become apparent as the following description proceeds and the features of novelty characterizing the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

Briefly the preferred embodiment of the present invention comprises a housing, movable strap gripping means for gripping a strap whereby the strap may be tensioned about a bundle of wires or the like, strap cutting means for cutting the free end of the strap after tensioning, motor means for driving the strap gripping means and actuating the strap cutting means, biasing means for restraining the cutting means until a predetermined tension has been produced in the strap, and means for mounting the motor means in the housing for relative movement between the motor means and the

housing whereby movement of the motor means upon reaching a predetermined tension in the strap actuates the strap cutting means.

For a better understanding of the present invention reference may be had to the accompanying drawings showing a preferred embodiment wherein the same reference numerals have been applied to like parts and wherein:

FIG. 1 is an isometric view of a power tool built in accord with the present invention.

FIG. 2 is a cross-sectional view of a power tool built in accord with the present invention.

FIG. 3 is a cross-sectional view similar to FIG. 2 showing the parts of the tool after the tool has been actuated to tension the strap and showing the position of the parts of the tool prior to severing of the free end of the strap.

FIG. 3A is a side cross-sectional view of the lower portion of the handle shown in FIG. 3 showing a biasing means to selectively preset the tension in the strap at which cut off will take place.

FIG. 4 is a view similar to FIG. 3 showing the parts of the tool in the position which they occupy at the instant the cutter blade severs the strap.

FIG. 5 is a view similar to FIG. 4 showing the parts of the tool in the position which they occupy after the cutter blade has severed the strap.

FIG. 6 is a cross-sectional view of a power tool similar to that shown in FIG. 2 showing an alternative embodiment.

Referring now to the drawings there is disclosed a power-operated tool for tensioning and cutting a strap generally indicated at 10 comprising a gun-shaped housing 11 having a housing half 12 and a cover half 13 suitably formed as for example by casting aluminum or the like and suitably secured together as for example by screws 14.

As best shown in FIG. 2, the housing half 12 contains motor means in the form of a fluid or an air cylinder 15 having an actuator valve 16 and a hose 17 for interconnecting the air cylinder and an external supply of air through a lower fitting 18 and upper fitting 19. Movable strap gripping means in the form of a tensioning rod 22 has one end thereof secured to the air cylinder plunger 23 and is mounted for substantially rectilinear movement. The other end of the tensioning rod 22 is secured to a gripper 24 having teeth 25 formed on its upper side for engaging the underside of the free end of a strap 26. Above the gripper 24 a laterally projecting lug 27 is positioned to support the upper side of the free end of the strap 26 when the teeth 25 of the gripper 24 are resiliently biased into engagement with the underside of the free end of the strap 26. The gripper 24 is biased into the position as shown in FIGS. 3 and 4 by a not-shown spring continuously urging the gripper 24 in a counterclockwise direction from the position as shown in FIGS. 3 and 4. In FIGS. 1 and 2 the forward portion of the housing half 12 forces the gripper 24 to a position against the bias of the spring so as to permit insertion and/or release of a strap. A dog 28 extends downwardly from the gripper 24 in order to cooperate with a camming surface to return the gripper to its open position and release the end of the strap 26 as will be more fully explained hereafter.

Cutter means 31 for severing the free end of the strap 26 once the strap is tensioned is positioned in the housing half 12 and comprises a cutter blade 23 secured to

a lever arm 33 pivoted about a pivot pin 34 suitably supported by the housing half 12 and the cover half 13. A channel 35 is provided in the lever arm 33 and is positioned in such a manner that the dog 28 of the gripper 24 is keyed to travel therein during tensioning of the strap 26. Upon movement of the dog 28 to the rearmost wall 35a of the channel 35, the strap gripper 24 is pivoted in a clockwise manner from the position shown in FIG. 3 such that the free end of the strap 26 is released from engagement with the teeth 25 of the gripper 24 as shown in FIG. 5.

The end of the lever arm 33 opposite the cutter blade 32 is provided with a rearwardly-opening slot 36. Linkage means in the form of a link plate 37 is pivotally supported about link plate pivot pin 38 suitably supported by the housing half 12 and cover half 13. At the upper portion of the link plate 37 as shown in FIGS. 2, 3 and 4, a cam follower 39 comprising a first cam roller is disposed adjacent the forwardmost part of the air cylinder. A hardened pin may be disposed in the air cylinder to prevent wear of the air cylinder 15. Intermediate the cam follower 39 and the link plate pivot pin 38, actuator means in the form of an actuator pin 40 is secured to the link plate 37 and disposed in the rearwardly-opening slot 36. The lowermost part of the link plate 37 is provided with a second cam roller 41 disposed against a cam surface 42 on a pivotal arm 43 pivotally supported in the housing by a cam pivot pin 44. The cam surface 42 is biased into the position shown in FIGS. 2 and 3 by any suitably adjustable biasing means connected to the pivotal arm 43 at a point on the other side of the cam pivot pin 44 from the cam surface 42.

As best shown in FIG. 3A, one suitable biasing means urging the cam surface 42 to the position as shown in FIG. 3 comprises a yoke 46 secured at one end to the cam pivot arm 43 by a cam securing pin 47. A movable block 48 is positioned for slideable movement within the yoke 46 having a spring 49 disposed between the bottom of the block 48 and the bottom of the yoke 46. A tension setting knob 50 is disposed outwardly of the housing 11 and is secured to the movable block 48 by means of a screw threaded tension setting rod 51 positioned for rotation relative to the movable block 48 and threaded through a hinge pin 52 secured to the tension setting knob 50. The hinge pin 52 is disposed eccentrically in the tension setting knob 50 so that as the knob 50 is rotated about the hinge pin 52, the end of the tension setting rod 51 is moved outwardly from the housing 11 a distance varying with the amount of knob material between the pin and the housing 11.

Additionally, the tension setting knob 50 and the tension setting rod 51 secured thereto may be rotated relative to the movable block 48 to bring about rectilinear movement of the movable block 48 in a direction to compress or elongate the spring 49 depending upon whether the tension setting knob 50 is rotated clockwise or counterclockwise. Thus it will be appreciated the greater the spring 49 is compressed between the movable block 48 and the yoke 46, the greater the force required to pivot the cam surface 42 clockwise from the position in FIG. 3 about the cam pivot pin 44. U.S. Pat. No. 3,661,187 assigned to the same assignee as the present invention discloses additional biasing means and is incorporated herein by reference for the disclosure of the biasing means contained therein.

Suitable bearing means in the form of a plastic bearing strip 53 disposed radially about the circumference of the air cylinder 15 enables the air cylinder to move rectilinearly within the housing 11. A trigger 54 is pivotally mounted in the housing half 12 and a cover half 13 and is adapted to actuate the air cylinder valve 16.

During operation of the tool the end of a strap 26, as shown in FIG. 3, is positioned adjacent the gripper 24 and the trigger 54 is depressed to actuate the air cylinder valve 16 such that the force of the air under pressure forces the plunger 23 and its connected tensioning rod 22 to the right in FIG. 3 thereby tensioning the strap 26 about the bundle of wires or the like. Upon reaching the desired predetermined tension as set by adjusting the bias on the cam surface 42 the air cylinder 15 will move towards the left from its position in FIG. 3 to that shown in FIG. 4 based upon Newton's law, "to every action there is always an equal and opposite reaction." It will be readily appreciated that the force applied by air under pressure in the air cylinder to move the plunger 23 to the right against the developing tension in the strap 26 is also applied in an opposite direction to urge the air cylinder 15 to move to the left. When the moment about the link plate pivot pin 37 produced by the force against the cam follower 39 exceeds the moment produced by the bias force against second cam roller 41 the air cylinder 15 will begin to move to the left in FIG. 3. Upon movement of the air cylinder 15, the link plate 37 pivots about link plate pivot pin 38 forcing the actuator pin 40 to move counterclockwise about the pivot pin 38 against the bottom camming surface of the rearwardly-opening slot 36 such that the cutter blade 32 is urged upwardly to sever the strap 26 as best shown in FIG. 4. It will be appreciated that the length of travel of the cutter blade 32 may be varied by changing the slope of the bottom camming surface of the rearwardly-opening slot 36.

Once the strap 26 is severed resulting from the tension, the force of the strap restraining movement of the tensioning rod 22 to the right as shown in FIG. 3 will be eliminated whereupon the plunger 23 moves to the rearmost position in the air cylinder 15 as shown in FIG. 5. It will be appreciated that in FIG. 4, a line perpendicular to the cam surface 42 at the point of tangency between the roller 41 and cam surface 42 will pass below the link plate pivot pin 38 such that a return force is exerted upon the link plate 37 to return the link plate 37 to the position as shown in FIGS. 2, 3, and 5. Accordingly, as shown in FIG. 5, once the free end of the strap 26 is severed by the cutter blade 32, the link plate 37 returns to its original position. As long as the trigger 54 is depressed, the tensioning rod 22 will remain in the position as shown in FIG. 5 whereupon the dog 28 is positioned against the rearmost wall 35a of the channel 35 such that the teeth 25 on the gripper 24 are disengaged from the strap 26 and the strap 26 may be removed from the tool.

When the trigger 54 is released the valve 16 returns to its original position and air is slowly forced out of the air cylinder 15 around the valve 16 as the plunger 23 is urged to the left in FIG. 4 by a return spring 56. It will be appreciated that the speed of return of the gripper 24 may be regulated thus eliminating any possibility of an operator having his finger pinched between the gripper 24 and the nose of the tool.

In FIG. 6, an alternative embodiment of the present invention is disclosed wherein the air cylinder 15 of

FIGS. 1 through 5 is replaced by an electric motor 57 having a suitable gear box. The air cylinder valve 16 of FIGS. 1 through 5 is replaced by a reversing switch 58 and the tensioning rod 22 is replaced by a motor driven screw 59 and a threaded tensioning sleeve 60 secured to the gripper 24. A suitable electric cord 61 is secured to the electric motor 57 through the reversing switch 58 in order to provide the requisite current from a suitable source of electric power. The dog 27 keyed in the channel 35 absorbs the driving torque tending to rotate the tensioning sleeve 60. In order to maximize absorption of the driving torque, the tensioning sleeve 60 could be provided with a non-circular cross-section for travel in a non-circular groove in the housing 11. The motor housing for the electric motor 57 also incorporates suitable means preventing rotation of the motor housing. Not-shown limit switches may be provided to prevent motor stall at the ends of travel of the motor driven screw 59 during operation of this embodiment. As shown in FIG. 6, movement of the housing for the electric motor 57, once the moment about the link plate pivot pin 38 produced by the force against the cam roller 39 exceeds the moment produced by the bias force against the roller 41, will pivot link plate 37 about link plate pivot pin 38 forcing the actuator pin 40 to move counterclockwise about the pivot pin 38 such that the cutter blade 32 is urged upwardly to sever the strap 26. It will be readily appreciated that other suitable motor means may be provided to replace the air cylinder 15 or the electric motor 57 as shown and described in the present application.

While there has been described what is at present considered to be the preferred embodiment and a modification of the present invention, it will be appreciated that numerous changes or modifications are likely to occur to those skilled in the art and it is intended in the appended claims to cover all such modifications as fall within the true spirit and scope of the present invention.

What is claimed is:

1. A power-operated tool for tensioning and cutting a strap or the like comprising a housing, movable strap gripping means for gripping a strap and tensioning said strap about a bundle of wires or the like, strap cutting means for cutting said strap, motor means for driving said strap gripping means, biasing means for restraining movement of said strap cutting means until a predetermined tension has been produced in said strap, means mounting said motor means in said housing for relative movement between said motor means and said housing, whereby movement of said motor means once the predetermined tension is reached in said strap actuates said strap cutting means.

2. The power-operated tool of claim 1 wherein link means is disposed between the motor means and the biasing means whereby as the strap is tensioned the motor means is urged against said link means, said link means restraining movement of said motor means until the moment produced by the force thereagainst exceeds the moment produced by the force of said biasing means against said link means.

3. The power-operated tool of claim 2 wherein said motor means comprises an air cylinder.

4. The power-operated tool of claim 3 wherein said strap gripping means comprises a tensioning rod secured at one end thereof to a plunger in said air cylinder,

the other end of said tensioning rod being secured to a gripper biased to a position for locking engagement with said strap.

5. The power-operated tool of claim 2 wherein said link means is mounted for pivotal movement in said housing and is provided with an actuator, said cutter means comprising a pivotal lever arm having a cutter blade secured to one end and a camming surface disposed on the other end, said actuation being positioned for movement against the camming surface to actuate movement of said cutter blade.

6. The power-operated tool of claim 2 wherein said motor means comprises an electric motor.

7. The power-operated tool of claim 6 wherein said strap gripping means comprises a tensioning arm secured at one end thereof to a screw, said screw being secured to said electric motor for rotational movement thereof, said tensioning arm comprising an internally threaded sleeve at one end thereof disposed for rectilinear movement upon rotation of said screw, the other end of said tensioning arm being secured to a gripper biased to a position for locking engagement with said strap.

8. The power-operated tool of claim 7 wherein link means is disposed between the electric motor and the biasing means whereby as the strap is tensioned the electric motor is urged against said link means, said link means restraining movement of said motor until the moment produced by the force exerted by said motor against said link means exceeds the moment produced by the force of said biasing means against said link means.

9. The power-operated tool of claim 8 wherein said link means is mounted for pivotal movement in said housing and is provided with an actuator, said cutter means comprising a pivotal lever arm having a cutter blade secured to one end and a camming surface disposed on the other end, said actuator being positioned for movement against the camming surface to actuate movement of said cutter blade.

10. The power-operated tool of claim 1 wherein said biasing means returns said strap cutting means to its original position once the strap cutting means cuts said strap.

11. A power-operated tool for tensioning and cutting a strap or the like comprising a housing, motor means disposed in said housing, means mounting said motor means for relative movement between said motor means and said housing, movable strap gripping means for gripping said strap and tensioning said strap about a bundle of wires or the like, said motor means being connected to said strap gripping means, strap cutting means for cutting said strap, said motor means being positioned to actuate said cutting means upon movement of said motor means relative to said housing, and biasing means for restraining movement of said strap cutting means until a predetermined tension has been produced in said strap.

12. The power-operated tool of claim 11 wherein link means interconnects said motor means and said biasing means and said strap cutting means.

13. The power-operated tool of claim 12 wherein said link means comprises a link having a first cam follower disposed adjacent said motor means and a second cam follower disposed adjacent said biasing means, said link being pivotally mounted in said housing about a pin intermediate said first and second cam followers,

said cutting means having a camming surface disposed thereon, said link plate being provided with an actuator positioned for movement relative to said camming surface.

14. The power-operated tool of claim 11 wherein said motor means comprises a fluid-operated cylinder.

15. A power-operated tool for tensioning and cutting a strap or the like comprising a housing, movable strap gripping means for gripping a strap and tensioning said strap about a bundle of wires or the like, strap cutting means for cutting said strap, a single acting fluid cylinder for driving said strap gripping means from a first position to a second position, means mounting said cylinder in said housing for relative movement from a cylinder first position to a cylinder second position, biasing means for restraining movement of said cylinder from said cylinder first position to said cylinder second position until a predetermined tension has been produced in said strap, whereby movement of said cylinder from said cylinder first position to said cylinder second position actuates said strap cutting means.

16. The power-operated tool of claim 15 including means for biasing said strap gripping means to said first position.

17. The power-operated tool of claim 15 wherein link means is disposed between the cylinder and the biasing means whereby as the strap is tensioned the cylinder is urged against said link means, said link means restraining movement of said cylinder until the moment produced by the force thereagainst exceeds the moment produced by the force of said biasing means against said link means.

18. A power-operated tool for tensioning and cutting a strap or the like comprising a housing, movable strap gripping means for gripping a strap and tensioning said

strap about a bundle of wires or the like, means for biasing said strap gripping means to a first position, strap cutting means for cutting said strap, motor means for driving said strap gripping means to a second position, means mounting said motor means in said housing for relative movement between said motor means and said housing, biasing means for restraining movement of said motor means until a predetermined tension has been produced in said strap, whereby movement of said motor means once the predetermined tension is reached in said strap actuates said strap cutting means.

19. The power-operated tool of claim 18 wherein said means for biasing said strap gripping means to a first position is contained within said motor means.

20. A power-operated tool for tensioning and cutting a strap or the like comprising a housing, movable strap gripping means for gripping a strap and tensioning said strap about a bundle of wires or the like, strap cutting means for cutting said strap, motor means for driving said strap gripping means, means mounting said motor means in said housing for relative movement from a first position to a second position, biasing means for restraining movement of said motor means from said first position to said second position until a predetermined tension has been produced in said strap, and link means disposed between the motor means and the biasing means whereby as the strap is tensioned the motor means is urged against said link means, said link means restraining movement of said motor means until the moment produced by the force thereagainst exceeds the moment produced by the force of said biasing means against said link means, whereby movement of said motor means from said first position to said second position actuates said strap cutting means.

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