

Aug. 7, 1962

H. C. LINGLE
STRAPPING DEVICE

3,048,204

Filed June 20, 1958

4 Sheets-Sheet 1

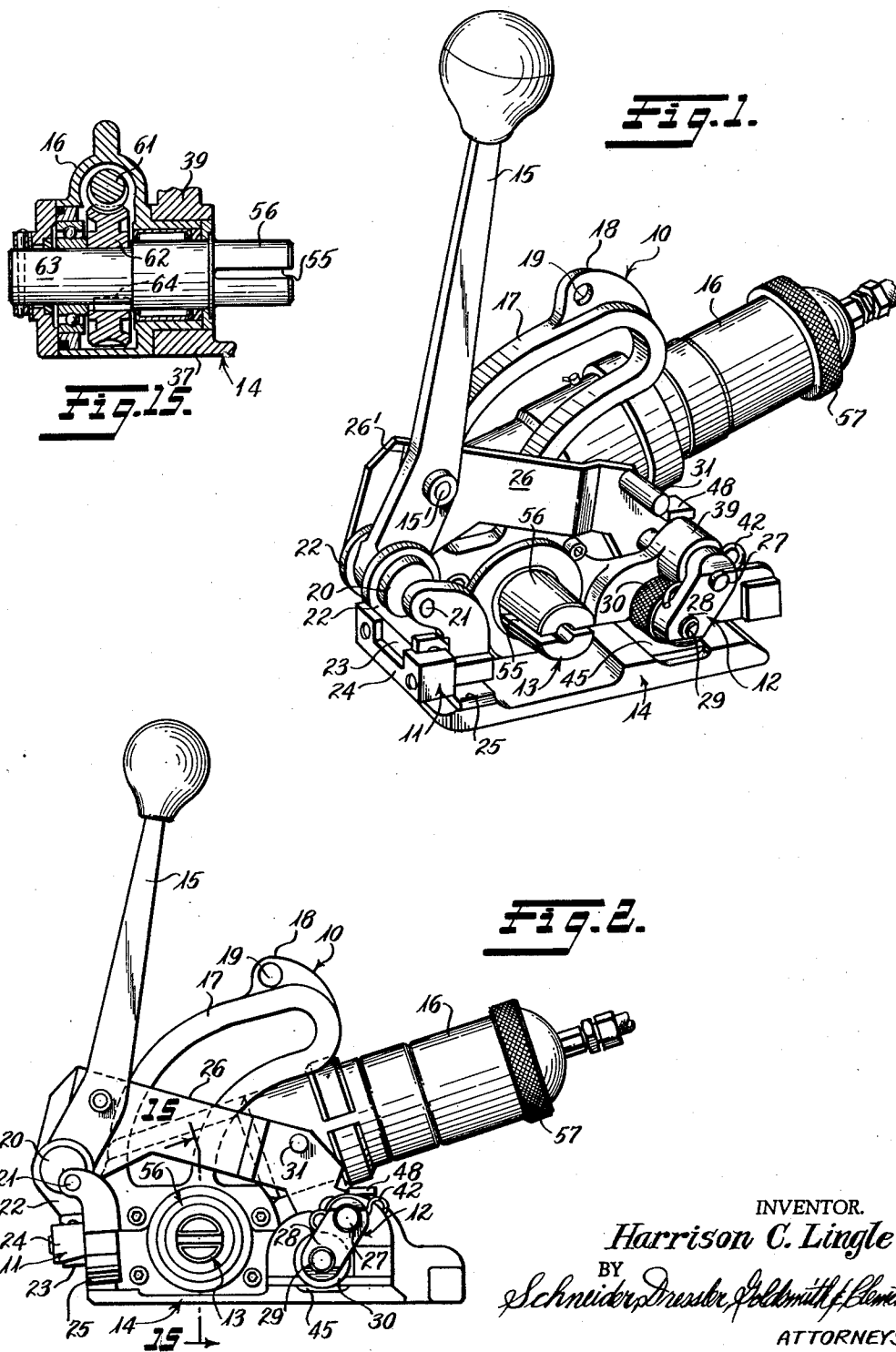


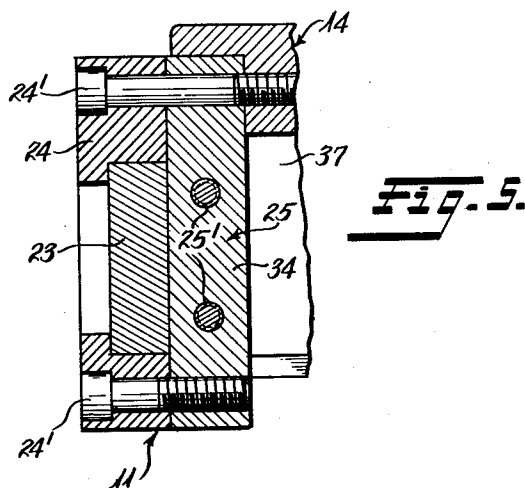
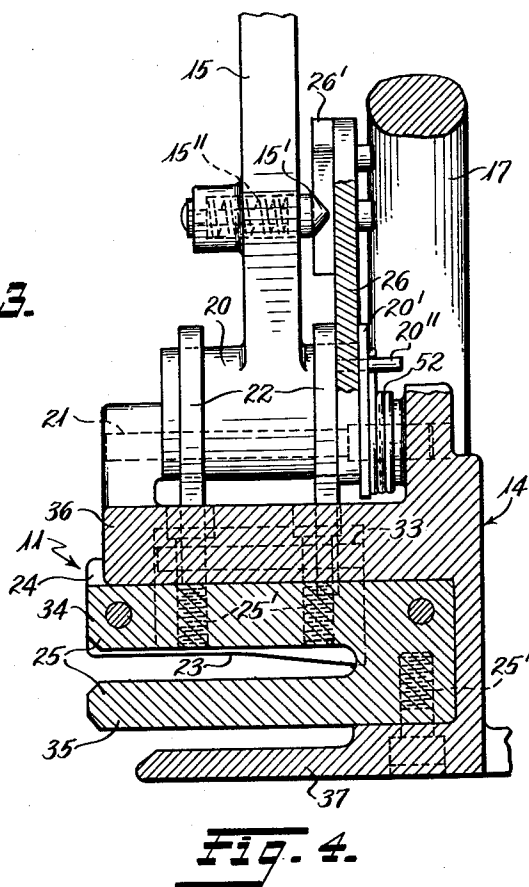
Fig. 2.

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4 Sheets-Sheet 2



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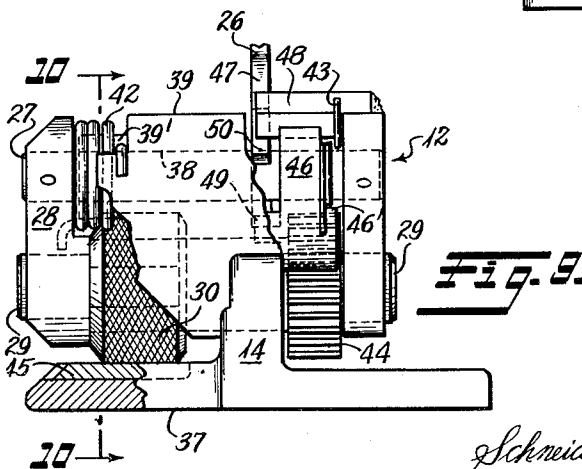
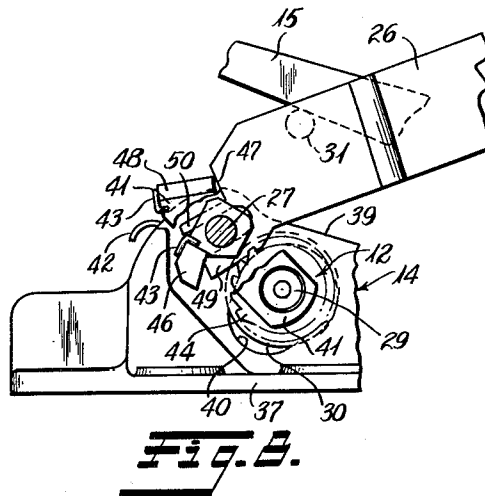
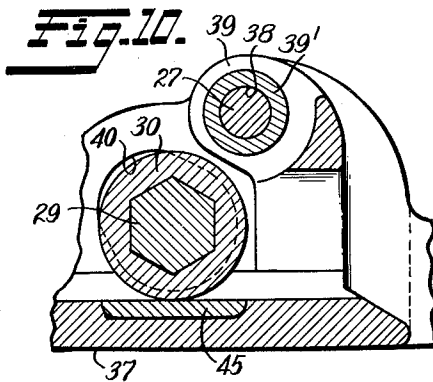
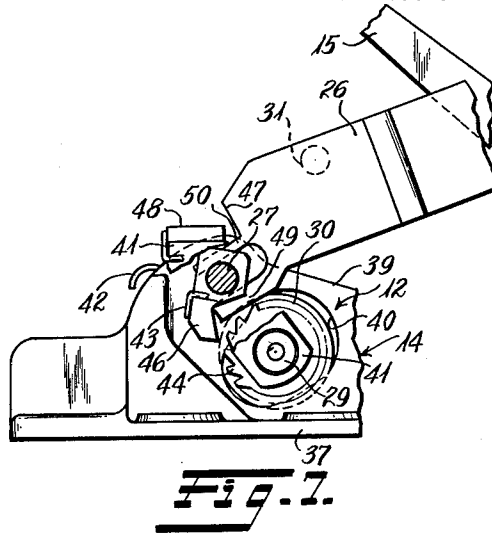
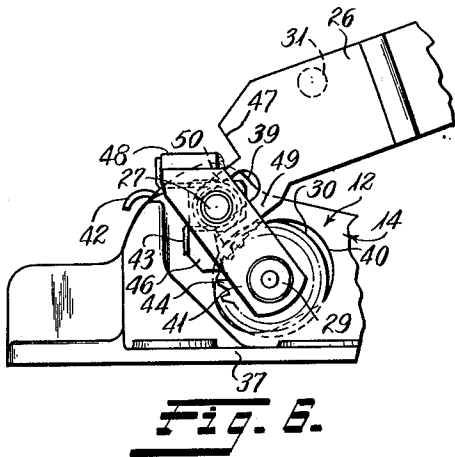
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4 Sheets-Sheet 3



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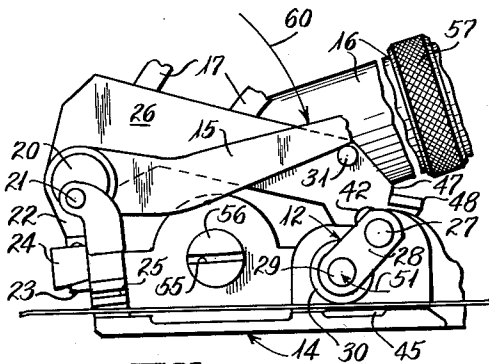


Fig. 11.

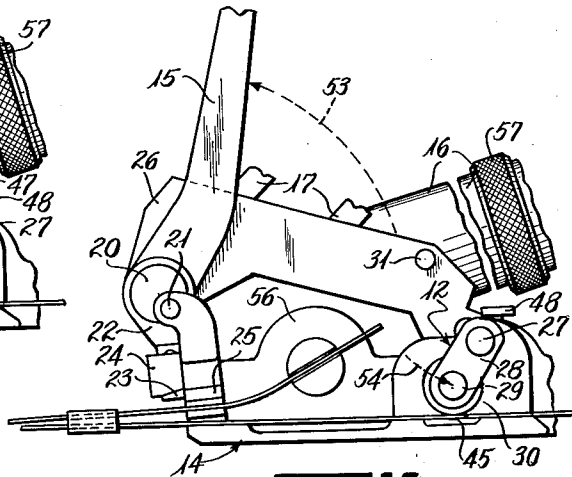


Fig. 12.

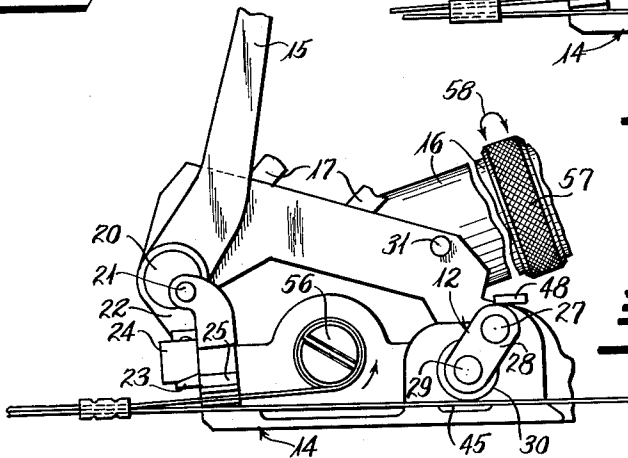


Fig. 13.

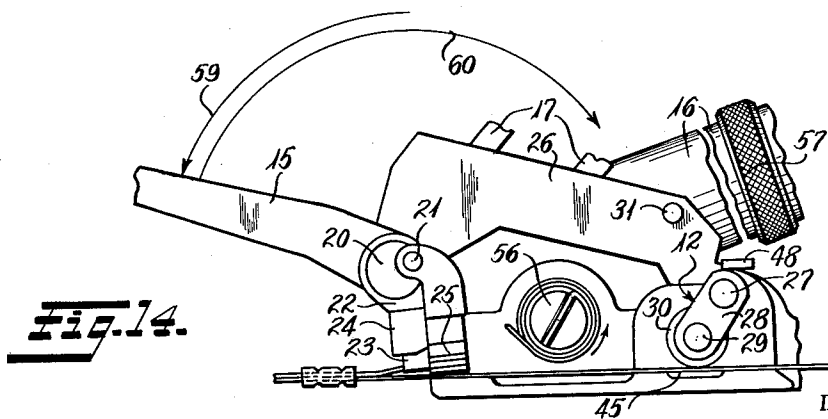


Fig. 14.

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3,048,204

STRAPPING DEVICE

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Filed June 20, 1958, Ser. No. 743,448

19 Claims. (Cl. 140—123.6)

The present invention relates to strapping devices and more particularly to hand tools for stretching strap about an object and severing the free end of the strap after other means have been employed to secure or seal the overlapped portions of the stretched strap.

The invention is particularly directed to the provision of simply operated hand tools for strapping packages such as containers, bales, crates, etc. in which power, such as pneumatic or electric power, is preferably employed to operate the stretching equipment with the remaining operations for positioning, gripping and cutting the strap being effected manually. By simplifying operation of such hand tools, operator training and fatigue are maintained at a minimum and operator performance is improved.

The invention is further directed to the provision of hand tools of the above character possessing improved durability, particularly from the standpoint of the structure employed to grip the strap while the same is being tensioned.

In conventional hand strapping devices, the strap gripping surface becomes badly worn through use and requires frequent replacement. In many instances the gripping element must be replaced within two or three days. Wear of the strap gripping surface in the present invention is distributed in a manner which greatly extends the useful life thereof. This result is achieved without complicating the operation of the strapping tool or reducing the strap gripping effectiveness of the gripper.

In accordance with the present invention, a single handle is provided for operating the gripper as well as the strap cutting means. This handle is effective, in its forward position, to complete the strap severing function and, in its rearward position, to complete the strap gripping and releasing functions.

It is merely necessary to move the single operating handle to one end of its arc to release the strap gripping means so that the bottom end of the strap may be appropriately inserted beneath the gripper of the strapping device. After insertion of the strap, the handle is released and the strap is gripped. The operator is then free to complete the tasks of threading the strap into the stretcher, stretching or tensioning the strap and sealing the overlapped portion of strap. The strap is sealed by conventional means not part of the hand tool under consideration.

The stretched and sealed strap is severed by pivoting the single handle to the other end of its arc. The gripper is then released by returning the handle to the first end of its arc. The strapping operation is completed in this simple manner and the strapping tool may be removed while the single handle is in its gripper releasing position.

The use of a single handle for operating the gripper and the cutter together with power stretching which eliminates the largest single physical burden from the strapping operation, is particularly advantageous since additional handles are eliminated together with the possibility that the operator will manipulate the wrong handle either through ignorance or carelessness. As will be evident, physical manipulation of hand tools adapted for stretching and cutting strap has been substantially simplified.

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Strap stretching in accordance with the invention is achieved preferably using an air powered windlass. Other powering means, such as an electric motor-clutch combination, or even hand power may be substituted for the preferred air-operated motor. Even with such substitution, however, many of the advantages of the invention are retained.

The use of a windlass or wind-up device is best performed with pre-cut strap, but the invention is not limited to wind-up stretching. The structure of the invention may be modified to use continuous strap stretching means such as a knurled feed wheel to permit operation using a supply of strap in coil form.

An important feature of the invention is the employment of a rotatable gripper wheel which is automatically prevented from rotating when forced into gripping engagement with the strap and automatically released when moved away from the strap to free the same for rotation when the strapping operation is completed, and thereby presents a different gripping surface to the next strap to be gripped, thus distributing wear. Of particular importance is the release of the gripper wheel for rotation before the gripper wheel is moved away from the strap to free the same. In present structures, a fixed gripper swings in the direction of strap tension and imbeds itself into the strap. In order to release the gripper the reverse action takes place causing the strap to be gouged by the gripper teeth as these teeth move away from gripping engagement. At the same time as the strap is being damaged, the gripping teeth are worn.

In accordance with the present invention the gripper wheel rollingly engages the strap until the releasable stop means associated with the wheel prevents further rotation. It then firmly and securely grips the strap during the successive operations performed to tension, seal and cut the strap. When the strap is to be released, the gripper wheel is first freed for rotation permitting the gripper wheel to be rolling and disengaged from the strap without gouging the strap or wearing the teeth on the wheel.

The gripper wheel, in a preferred embodiment of this invention, is mounted for pivotal movement toward and away from the strap so that as it moves with respect to the strap the rolling engagement with the strap will cause the wheel to present a new gripping surface to the strap. As a result, an action normally producing strap damage and excessive wear is converted to the useful purpose of rotating the gripper wheel to bring a fresh gripping surface into gripping position.

The invention will be more fully understood and its objectives and advantages appreciated from the description which follows taken in conjunction with the accompanying drawings showing an illustrative embodiment of the invention and in which:

FIGURE 1 is a perspective view illustrating a hand tool for stretching and severing strap, and constructed in accordance with the invention, this hand tool constituting the presently preferred form of the invention;

FIGURE 2 is a front elevation of the hand tool pictured in FIGURE 1;

FIGURE 3 is a partial front view in section showing the mounting of the operating handle and the cutter unit;

FIGURE 4 is a sectional view taken substantially along the line 4—4 of FIGURE 3;

FIGURE 5 is a sectional view taken substantially along the line 5—5 of FIGURE 3;

FIGURE 6 is a partial rear elevational view showing the gripper unit in gripping position with the operating handle in its upstanding or neutral position;

FIGURE 7 is a view similar to FIGURE 6 with the operating handle pivoted part way toward the gripper unit and showing release of the gripper wheel prior to

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movement of the gripper wheel away from its strap gripping position;

FIGURE 8 is a further view similar to FIGURE 6 and showing the operating handle in its fully pivoted position with the gripper wheel being elevated into strap-freeing position;

FIGURE 9 is a rear view of the gripper unit with parts broken away and in section for purposes of clarity in illustrating the gripper unit construction;

FIGURE 10 is a sectional view taken substantially along the lines 10—10 of FIGURE 9 and illustrating the mounting of the gripper wheel and the gripper support pin;

FIGURE 11 is a simplified, partial front elevation illustrating the rearward pivoting of the operating handle to enable insertion of the bottom strap for the strapping operation;

FIGURE 12 is a view similar to FIGURE 11 and illustrating the strap gripping action which takes place when the operating handle is released;

FIGURE 13 is a further view similar to FIGURE 11 and illustrating operation of the air motor for the purpose of tensioning the strap;

FIGURE 14 is still another view similar to FIGURE 11 and illustrating the severing of the top strap and the release of the gripper to complete the strapping operation; and

FIGURE 15 is a sectional view taken substantially along the line 15—15 of FIGURE 2 and illustrating the interconnection between the air motor-operated worm gear and the stretching windlass.

Referring to FIGURES 1 and 2, the numeral 10 generically identifies a strap stretching and severing tool which comprises a cutting unit 11, a gripping unit 12 spaced from the cutting unit 11 along the length of the tool and a strap stretching unit 13 which is preferably positioned as shown intermediate the cutting unit 11 and the gripping unit 12. The cutting unit 11, the gripping unit 12 and the stretching unit 13 are all mounted upon a common support which is the tool body 14.

A single handle 15 (which may be termed an operating lever) constitutes the sole mechanism for operating the cutting unit 11 and the gripping unit 12. Separate means, preferably an air motor 16, is provided for operating the stretching unit 13. A carrier 17 is provided to facilitate movement of the tool. The carrier is preferably formed with an upstanding flange 18 provided with an opening 19 therein to facilitate support by an overhead support device terminating in a hook which passes through the opening 19.

The handle 15 has formed integral therewith or secured thereto a shaft or cam 20 which is eccentrically mounted with respect to the pivot 21 which is the pivotal axis of the handle 15 and which permits the handle 15 to be pivoted. When the handle 15 is pivoted to the left as viewed in FIGURES 1 and 2, the eccentricity of the shaft 20 is such that it is lowered and the cutter links 22 which encircle the shaft 20 are also lowered. As will later more fully appear, lowering of the cutter links 22 depresses the cutter blade 23 in the cutter housing 24 to sever the top strap against the cutter block 25.

Also supported upon the shaft 20 is a release link 26. When the handle 15 is pivoted to the right as viewed in FIGURES 1 and 2 the eccentric mounting of the shaft 20 is such that the release link 26 is moved to the right. Movement of the release link 26 to the right functions to release the gripping unit 12 as will later more fully appear.

The gripper unit 12 includes a support pin 27 and a front link 28 which is pivotable about the axis of the support pin 27. The front link 28 carries a gripper shaft 29 which supports various parts including the gripper wheel 30, the outer surface of which is knurled as illustrated in FIGURE 1.

The release link 26 carries a stop member 31 which limits movement of the handle 15 when said handle is

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pivoted to the right as viewed in FIGURES 1 and 2. Pivotal movement of handle 15 in the opposite direction (during the cutting action) is limited, in the form illustrated, by abutment of the release link 26 against the cutter housing 24.

Referring to the cutting unit 11, best seen in FIGURES 3, 4 and 5, the cutter blade 23 is slidably mounted for vertical movement within a cutter housing 24 with the inner surface of the cutter blade 23 sliding against the forward surface of the cutter block 25. Reciprocation of the cutter blade 23 is effected by the pivotal movement of handle 15 which lowers the shaft 20 as a result of the eccentric mounting of shaft 20 on pin 21. As the shaft 20 descends, the cutter links 22 are forced downwardly, the shaft 20 being rotatable within the openings 32 formed in the upper ends of the cutter links 22. The cutter links 22 are pivotally connected to the upper end of the cutter blade as indicated at 33.

The cutter block 25 is preferably U-shaped having upper and lower legs 34 and 35, and is secured to the tool body 14 and a side extension 36 of the tool body 14. The cutter block 25 is elevated with respect to the base 37 to permit passage of the bottom strap between the bottom of the cutter block 25 and the upper surface of the tool base 37. The space between the legs 34 and 35 of the cutter block 25 is intended to receive the free end or upper portion of the strap (the top strap). It is this top strap which is severed by the cutter blade 23 after the strap is tensioned and sealed. The bolts securing the cutter block 25 to the tool body 14 and the extension 36 are identified by the numeral 25' and the bolts securing the cutter housing 24 to the tool body 14 are identified by the numeral 24'.

The release link 26 encircles the shaft 20 in the same manner as the cutter links 22, as seen in FIGURES 3 and 4. Thus, the release link 26 moves with the shaft 20, the shaft 20 being free to rotate within an opening in the lower forward end of the release link 26, said opening being coincident in FIGURE 3 with the opening 32 in the cutter links 22. The shaft 20 is formed with an inner flange 20' from which a pin 20'' projects. The inner flange 20' retains the release link 26 on the shaft 20. The tool body 14 is formed with a cylindrical extension about which a spring 52 is mounted. The spring 52 engages the pin 20'' and also the tool body 14 so that when handle 15 is pivoted to the right in FIGURES 1, 2 and 3, the spring 52 will be tensioned and function to return the handle 15 to its upstanding or neutral position when the handle 15 is released.

In the preferred construction illustrated, a detent pad 26' having tapered side edges is bolted to the release link 26 as is illustrated in FIGURES 3 and 4. The handle 15 carries a detent 15' which is spring biased to engage the detent pad 26' by means of spring 15''. The rear of the detent 15' is enlarged to limit the forward movement of the detent 15'. Thus, when the handle 15 is released, it is prevented from swinging to an extent sufficient to operate the cutter blade 23.

Referring more particularly to the gripper unit 12, the gripper support pin 27 is mounted in bore 38 (see FIGURE 9) in an upstanding portion 39 formed in the tool body 14 at the rear thereof. Gripper shaft 29 is rotatably mounted at the lower end of front link 28 (see FIGURES 2 and 9) and extends to the rear of the tool through an opening 40 in the tool body. The support pin 27 and the gripper shaft 29 are linked together at the back of the tool by a rear link 41. A spring 42, mounted to engage the front link 28, pivotally biases the same in a downward direction toward the tool base 37. The gripper wheel 30 is keyed to gripper shaft 29 for rotation therewith and is positioned between the front link 28 and the upstanding portion 39 at the front of the tool (see FIGURE 9). At the back of the tool, the gripper shaft 29 carries a ratchet wheel 44. The ratchet wheel 44 and the gripper shaft 29 may be formed as a single piece or the ratchet wheel

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may be secured to the shaft 29 as desired. By this construction gripper wheel 30 is free to rotate only when the ratchet wheel 44 is also free to rotate. Similarly, when ratchet wheel 44 is prevented from rotating, at least in the direction of strap tension, the gripper wheel 30 is also prevented from rotating and can function to hold the strap against longitudinal movement.

FIGURE 6 shows the gripper unit 12 when the handle 15 extends upwardly as shown in FIGURE 2. In this position, the gripper wheel 30 bears against the wear or pressure pad 45 as can be seen in FIGURES 2 and 9. The strap is normally gripped between the wheel 30 and the pad 45. A pawl 46 pivotally mounted on support pin 27 is biased into engagement with the teeth of ratchet wheel 44 by means of spring 43 and prevents the gripper wheel 30 from being rotated by the tension applied to the strap.

The release link 26, as seen in FIG. 6, is not operative to release the gripper when the handle 15 is in its upstanding position since the shoulder 47 is free of the lateral flange 48 and since the finger 49 is free of the pawl 46. It will be observed that the forward end of finger 49 is closer to the pawl 46 than is the shoulder 47 to the flange 48. As will be more fully understood in connection with FIGURES 7 and 8, this spacing enables the ratchet wheel 44, and hence the gripper wheel 30, to be released for rotation before the shoulder 47 can act to move the gripper wheel 30 away from the wear pad 45 to release the strap. Guide finger 50 cooperates with finger 49 by encircling the support pin 27 to maintain the free end of the release link 26 in its correct position.

As viewed in FIGURE 7, the operating handle 15 has been partially pivoted toward the stop 31. It will be observed that the finger 49 has engaged the pawl 46 and pushed the same to cause the pawl to pivot about the support pin 27 until the pawl is clear of the teeth of the ratchet wheel 44. When the mechanism is in this position, the ratchet wheel 44 and the gripper wheel 30 are freed for rotation. It will also be observed that the shoulder 47 has not yet engaged the flange 48 so that no pivoting force has been applied to the gripper unit 12.

Various other means may be substituted for the releasable pawl and ratchet arrangement shown and described above, within the scope of the present invention. The important feature to be kept in mind is that releasable means is to be provided to hold the gripper wheel against rotation when the mechanism is tensioning the strap and to release the gripper wheel for rotation when it is being brought into and taken out of gripping engagement with the strap by relative movement toward and away from the pressure pad 45. By releasing the wheel 30 for rotation in this manner, relative movement of the strap with respect to the wheel will cause the wheel to rotate thereby positioning the wheel for presentation of a new gripping surface to the next strap to be gripped and preventing the teeth on the wheel from wearing and from gouging the strap.

As examples of the various modifications that can be made in the releasable wheel-holding means, the ratchet wheel could be milled into the gripper wheel or secured to an end face thereof. A pawl may be arranged to engage the teeth on the gripper wheel or teeth in a recessed ratchet milled into the circumferential face of the gripper wheel. Also, the gripper wheel may be cooperatively arranged with friction brake, self-energizing or otherwise as desired, which may engage a brake drum secured for co-rotation with the wheel, or which may engage an end face or the periphery of the gripper wheel or both. The important thing is that the gripper wheel should be held against rotation when the strap is being tensioned, and released for free rotation at other times.

As viewed in FIGURE 8, the operating handle is in its fully pivoted position against the stop 31. In this position of the handle, the shoulder 47 has engaged the flange 48 and pushed the flange 48 rearwardly to pivot the rear

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link 41 against the pressure of spring 42 to raise the gripper wheel 30 and release the bottom strap. When the operator releases the handle 15, the handle is returned to its upstanding position shown in FIGURES 1, 2, 3 and 4, by spring 52.

Upon the return of the handle 15 to its upstanding inactive position, the spring 42 becomes effective to automatically return gripper wheel 30 to its strap holding position against the wear pad 45 and the spring 43 automatically returns the pawl 46 into gripper wheel holding position interengaging with the teeth of the ratchet wheel 44.

The preferred construction of the gripper unit 12 is shown in FIGURE 9 in which the positioning of the springs 42 and 43 is clearly indicated. The spring 42 encircles a cylindrical extension 39' and bears downwardly upon the front link 28. One end of the spring 43 extends around and bears downwardly upon a shoulder 46' on the pawl 46 and the other end of the spring 43 engages the rear surface of the flange 48 to urge the pawl 46 into engagement with the ratched wheel 44.

The keying of the gripper shaft 29 to the gripper wheel 30 is clearly seen in FIGURE 10 wherein it is shown that the interior of gripper wheel 30 is hexagonal and the gripper wheel is positioned upon a portion of the gripper shaft 29 which has a hexagonal exterior. FIGURE 10 also shows the relationship between the gripper wheel 30 and the wear plate 45 as well as the structure of the upstanding portion 39 of the tool body with its cylindrical extension 39' receiving the support pin 27. The opening 40 in the upstanding portion of the tool body can be seen with particular clarity in FIGURE 10.

The operation of the strap stretching and severing tool is shown in FIGURES 11-14, inclusive, in which the illustration of the tool is simplified in order to emphasize the operational features thereof.

The first step in the strapping of a package is shown in FIGURE 11 in which the insertion of the bottom strap beneath the gripper wheel 30 at the rear of the tool body is illustrated. The handle 15 is pivoted rearwardly of the tool against the stop 31 so that the shoulder 47 of release link 26 abuts the flange 48 to pivot the front link 28 and thereby elevate the gripper wheel 30 away from the wear pad 45. With the handle 15 in its rearward position against the stop 31, the gripper wheel 30 remains elevated to facilitate insertion of the bottom strap therebeneath. The first movement of the handle 16 is illustrated by arrow 60 and the action upon the gripper wheel 30 is illustrated by arrow 51. The handle 15 is then released by the operator whereupon spring 52 elevates the handle into the position shown in FIGURE 12 (also see FIGURES 3 and 4) and spring 42 lowers the gripper wheel 30 into engagement with the bottom strap as shown in FIGURE 12 and FIGURES 6-9, inclusive.

As the gripper wheel 30 pivotally descends, it rollingly engages the strap and rotates to present a new gripping surface to the strap. When the gripping wheel has fully descended, the pawl 46 is biased by spring 43 into engagement with the teeth of ratchet wheel 44 to prevent rotation of gripper wheel 30. However, due to rotation of the wheel 30 by engagement thereof with the strap, the pawl 46 may not be seated completely against a tooth on the ratchet wheel 44. This permits slight further rotation of the wheel 30 for presentation of a new gripping surface when tension is initially applied to the strap.

The automatic elevation of handle 15 is indicated by dotted arrow 53 and the automatic engagement of gripper wheel 30 with the bottom strap is indicated by dotted arrow 54. Arrows 53 and 54 are dotted to indicate that this movement is an automatic movement which occurs without operator manipulation.

The top strap, with a seal threaded thereon, is then inserted through the cutter block 25 and into the slot 55 of the windlass 56. As will be understood, there are

various types of seals such as thread-on and snap-on types which may be employed by the operator in the conventional manner.

After the strap has been threaded in the windlass 56, as is shown in FIGURE 12, and the seal has been properly positioned, the valve ring 57 of the air motor 16 is rotated so that air under pressure can operate the motor 16 to turn the windlass 56 and tension the strap. The strap tension is controlled by adjusting the air pressure which is supplied to the motor. With a given air pressure, the tension which is imposed upon successive straps will be uniform as long as the operator permits the motor to come to a complete stop with the motor turned on before crimping the seals. FIGURE 13 illustrates the operation of the air motor valve ring 57 (double-ended arrow 58) and shows the strap in its tensioned condition with the seal crimped.

It is now necessary to sever the top strap. This operation is illustrated in FIGURE 14 in which arrow 59 illustrates the forward pivoting of handle 15 so that the cutter blade 23 severs the top strap close to the seal. The air motor 16, which is still being supplied with air under pressure causes the windlass 56 to wind up the excess material from the top strap about the windlass 56 as shown in FIGURE 14 and as described in detail below.

When the strapping operation is complete the air motor is de-energized and the only task which remains to be performed is the act of removing the tool. To achieve this result, the handle 15 is pivoted rearwardly against the stop 31, as indicated by arrow 60 in FIGURE 14. This action, which returns the tool to the position shown in FIGURE 11, elevates the gripper wheel 30 which is freed for rotation by release pawl 46 from ratchet wheel 44 prior to elevation of the gripper wheel 30 upon a single motion of the handle 15. With the gripper wheel 30 elevated, the tool is grasped by the carrier 17 and pivoted about the heel thereof in order to disengage the tool from the tensioned and sealed strap.

As tension is applied to the strap by operation of the windlass 56, the interengagement of the strap and the gripper wheel will cause rotation of the gripper wheel until the pawl 46 completely seats against a tooth in the ratchet wheel 44. Thereafter, the gripper wheel 30 is prevented from rotating. Continued operation of the windlass 56 increases the tension in the strap and causes the teeth on the wheel 30 to bite into the strap to firmly grip the strap between the wheel 30 and the pad 45. This also causes slight further pivotal movement of the strap, which movement is used to advantage as explained below.

At the completion of the strapping operation, the pawl 46 is released from the ratchet wheel 44 and then the gripper wheel 30 is moved pivotally upwards. Since the gripper is free, it will rotate and be rollingly disengaged from the strap. The increased pivotal movement of the gripper wheel for biting engagement with the strap upon tensioning the strap results in increased rotational movement of the gripper wheel upon release of the strap thereby further insuring presentation of a new gripping surface to the next strap to be gripped.

In brief, manipulation of the hand tool of the invention involves the following operations:

(1) Pivot handle 15 rearwardly to the stop 31 and insert bottom strap;

(2) Release handle 15 and thread the top strap into the windlass 56 (the seal is positioned in a manner depending upon the structure of the seal);

(3) Turn on air motor 16 to stretch strap (the seal is crimped manually when the motor stops);

(4) Pivot handle 15 forwardly away from gripper unit 12 to cut the top strap;

(5) Turn off air motor 16; and

(6) Pivot handle 15 rearwardly to the stop 31 to release the bottom strap and remove the tool.

Since step 2 is automatic when the operator reaches for

the top strap, the entire strapping operation requires only three manipulations of handle 15 and all of these involve only the pivoting of the handle directly to the positions at the ends of its arc or swing. In steps 4 and 6, the operator simply swings handle 15 away from him as far as it will go and then swings it back to him as far as it will go. These two movements, though separate, are easily combined in the mind of the operator into the single manipulation of moving one operating lever back and forth.

The simple manipulation required in the invention may be compared with the manipulation of commercially available hand-operated strap stretching and severing tools. Conventional strap stretching and severing tools possess three handles; one for the cutter assembly, a stretcher handle for the windlass, and a gripper release lever. Even when the stretcher handle engages with and operates the gripper release lever, the structure is still complex and its operation difficult. Thus, care must be taken when operating the stretcher handle to prevent accidental release of the gripper and the stretcher handle must be positively moved from gripper releasing position to a point where a strap stretching function can be achieved. Care must also be taken to avoid operating the wrong handle which will result in premature strap severing or release. As will be apparent, the present invention presents a new and substantially simplified combination strapping tool irrespective of the presence or absence of power operation of the stretcher unit and irrespective of the use of the improved gripper unit of the invention.

It will be observed that the air motor 16 extends away from the cutter unit toward the gripper unit at an acute angle to the horizontal. This provides balance for the cutting operation as indicated by arrow 59 in FIGURE 14 and also enables the handle 15 to be held in gripper releasing position as shown in FIGURE 11 while the tool is being moved to remove the tool from the tensioned, sealed and severed strap to another object to be severed and also while the operator inserts the bottom strap beneath the elevated gripper wheel. More particularly, the operator may employ his left hand to manipulate the bottom strap beneath the gripper wheel and to grasp the carrier 17 while the right hand is positioned on the air motor 16 with the thumb of the right hand holding the operating handle 15 in its gripper releasing position shown in FIGURE 11.

Manipulation of hand tools constructed in accordance with the invention has been simplified to the point where operator training is greatly reduced and where the opportunity for improper tool utilization is largely eliminated. With the air motor 16 supplying the power for strap stretching, and with the remaining physical manipulations being greatly simplified, operator fatigue is reduced and productivity increased.

The air motor is operated whenever it is necessary to position the slot in the windlass either to receive the top strap as seen in FIGURE 12 or to facilitate removal of waste strap from the windlass at the completion of the strapping operation as seen in FIGURE 14.

The interconnection between the air motor 16 and the windlass 56 is shown in FIGURE 15. The forward end of the air motor 16 is provided with a worm 61 which meshes with a gear 62. The gear 62 is keyed to a reduced portion 63 at the back end of the windlass 56 by means of the key 64.

The air motor 16 may be of various constructions, a preferred air motor structure being disclosed in the United States patent to Ernest H. Shaff, No. 2,099,280, dated November 16, 1937.

It will be understood that numerous modifications and variations may be made from the illustrative embodiment of the invention described above and shown in the accompanying drawings, without departing from the concepts and novel principles of the invention.

I claim:

1. In a hand tool for stretching and severing strap disposed about an article and having overlapping upper and lower portions, comprising gripper means movable into and away from gripping position for holding the lower portion of a strap, stretching means for tensioning the upper portion of said strap and cutting means for severing the upper portion of said strap, the improvement comprising a pivotally mounted handle, means actuated by said handle for operating said cutting means to cut said strap when said handle is pivoted toward one end of its arc, and a lost motion linkage operable when said handle is pivoted to the opposite end of its arc for holding said gripper means away from gripping position.

2. The improvement recited in claim 1 in which said gripper means and said cutting means are spaced apart along the length of said hand tool and said stretching means is positioned intermediate said gripper means and said cutting means.

3. The improvement recited in claim 2 in which said gripper means comprises a rotatable wheel that is pivotally mounted and spring biased into gripping position.

4. The improvement recited in claim 1 in which said means for operating said cutting means comprises a shaft connected to said handle, said shaft being eccentrically mounted to permit pivotal movement of said handle combined with movement of said shaft about said eccentric mounting, and a cutter blade operatively coupled to said shaft for operation thereby.

5. In a hand tool for stretching and severing strap disposed about an article and having upper and lower overlapping portions, comprising gripper means biased into gripping position and mounted for movement away from gripping position, said gripper means being adapted to hold the lower portion of a strap, stretching means for tensioning the upper portion of said strap and cutting means for severing the upper portion of said strap, said gripper means and said cutting means being spaced apart along the length of said hand tool with said stretching means positioned therebetween, the improvement comprising a pivotally mounted handle, means movable with said handle for operating said cutting means when said handle is pivoted toward one end of its arc of movement and a last motion release link pivotally mounted with respect to said handle and movable with said handle to move said gripper means away from gripping position and to hold said gripper means away from gripping position when said handle is pivoted to the opposite end of its arc of movement.

6. In a hand tool for stretching strap, the improvement comprising a support, stretching means mounted on said support, a gripper wheel rotatably mounted on said support and releasable means cooperatively arranged with said gripper wheel to prevent rotation of said gripper wheel when said tool is stretching strap and to release said gripper wheel for rotation thereof at other times.

7. In a hand tool for stretching strap, the improvement comprising a support, stretching means mounted on said support, a gripper wheel rotatably mounted on said support, releasable means cooperatively arranged with said gripper wheel to prevent rotation of said gripper wheel when said tool is stretching strap and to release said gripper wheel for rotation thereof at other times, and strap pressure backing means arranged on said support opposite to said gripper wheel, said gripper wheel being relatively movable with respect to said backing means for insertion and removal of strap therebetween.

8. In a hand tool for stretching strap, the improvement comprising a support, stretching means mounted on said support, a gripper wheel rotatably mounted on said support, releasable means cooperatively arranged with said gripper wheel to prevent rotation of said gripper wheel when said tool is stretching strap and to release said gripper wheel for rotation thereof at other times,

and strap pressure backing means arranged on said support opposite to said gripper wheel, said gripper wheel being pivotally movable with respect to said backing means for insertion and removal of strap therebetween.

9. A hand tool as recited in claim 6 in which said gripper wheel is mounted together with a ratchet wheel upon a gripper shaft mounted for movement toward and away from the strap, said gripper wheel and said ratchet wheel each being non-rotatably mounted on said gripper shaft, and said releasable means comprising pawl means engageable with the teeth of said ratchet wheel to prevent rotation of said gripper wheel and removable from the teeth on said ratchet wheel to permit rotation of said gripper wheel.

10. A hand tool as recited in claim 6 in which said gripper wheel is mounted together with a ratchet wheel upon a gripper shaft, a support pin pivotally supporting a pair of spaced-apart links, said gripper shaft being mounted between said links, said gripper wheel and said ratchet wheel each being non-rotatably mounted on said gripper shaft and said releasable means comprising pawl means engageable with the teeth of said ratchet wheel to prevent rotation of said shaft and said gripper wheel and removable from said teeth to permit rotation of said gripper wheel.

11. The improvement recited in claim 10 in which said pawl is pivotally mounted upon said support pin and spring biased into engagement with the teeth of said ratchet wheel.

12. The improvement recited in claim 10 in which said links are spring biased to move said gripper wheel downwardly into strap holding position.

13. The improvement recited in claim 10 in which said tool includes a handle mounted for pivotal movement, said handle carrying means operative upon a single movement of said handle to a position at one end of its arc to remove said pawl means from engagement with the teeth of said ratchet wheel and thereafter to pivot said links to move said gripper wheel away from strap holding position.

14. The improvement recited in claim 10 in which a release link is mounted upon said hand tool at a distance from said gripper unit for movement toward and away from said gripper unit, said release link being operative upon movement thereof to engage and pivot said links and said pawl means from engagement with the teeth of said ratchet wheel to free said gripper wheel for rotation.

15. The improvement recited in claim 14 in which said release link is formed with a finger and a shoulder, said finger being closer to said pawl means than said shoulder to said links whereby movement of said release link toward said gripper causes said finger to disengage said pawl means from the teeth of said ratchet wheel before said shoulder can engage said links to pivot the same and thereby move said gripper wheel away from strap holding position.

16. In a hand tool for stretching and severing strap disposed about an article and having upper and lower overlapping portions, comprising gripper means biased into gripping position and mounted for movement away from gripping position, said gripper means being adapted to hold the lower portion of a strap stretching means for tensioning the upper portion of said strap and cutting means for severing the upper portion of said strap, said gripper means and said cutting means being spaced apart along the length of said hand tool with said stretching means positioned therebetween, the improvement comprising a pivotally mounted handle, a shaft connected to said handle, said shaft being eccentrically mounted with respect to the pivotal axis of said handle to permit pivotal movement of said handle combined with eccentric movement of said shaft about said axis, a release link and cutter links pivotally coupled to said shaft for movement therewith, and a cutter blade connected to said cutter

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links for cutting operation thereby when said handle is pivoted toward one end of its arc of movement, and a lost motion connection between said release link and said gripper means whereby said gripper means is moved away from gripping position by said release link when said handle is pivoted to the opposite end of its arc of movement.

17. A hand tool as recited in claim 16 in which said release link includes stop means to limit pivotal movement of said handle toward said gripper means.

18. In a hand tool for stretching and severing strap disposed about an article and having upper and lower overlapping portions, comprising a gripper wheel biased into gripping position and mounted for movement away from gripping position, said gripper wheel being adapted to frictionally engage the lower portion of a strap, stretching means for tensioning the upper portion of said strap and cutting means for severing the upper portion of said strap, said gripper wheel and said cutting means being spaced apart along the length of said hand tool with said stretching means positioned therebetween, the improvement comprising a pivotally mounted handle, means movable with said handle for operating said cutting means when said handle is pivoted toward one end of its arc of movement, a lost motion release link pivotally mounted with respect to said handle and movable with said handle to move said gripper wheel away from gripping position when said handle is pivoted to the opposite end of its arc of movement, and pawl means operative to hold said gripper wheel against rotation by said strap, said release link including means for maintaining said pawl disengaged from said gripper wheel for rotation when said gripper wheel is moved away from gripping position.

19. In a hand tool for stretching and severing strap disposed about an article and having upper and lower

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overlapping portions, comprising a gripper wheel biased into gripping position and mounted for movement away from gripping position, pawl means operative to hold said gripper wheel against rotation by said strap, said gripper wheel being adapted to hold the lower portion of a strap, stretching means for tensioning the upper portion of said strap and cutting means for severing the upper portion of said strap, said gripper wheel and said cutting means being spaced apart along the length of said hand tool with said stretching means positioned therebetween, the improvement comprising a pivotally mounted handle, means movable with said handle for operating said cutting means when said handle is pivoted toward one end of its arc of movement and a lost motion release link pivotally mounted with respect to said handle and movable with said handle to move said gripper means away from gripping position when said handle is pivoted to the opposite end of its arc of movement, said link being configured to disengage said pawl means from said gripper wheel before said gripper wheel is moved away from gripping position.

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