Aug. 22, 1961 W. A. MEIER 2,996,939

CRIMPING MECHANISM

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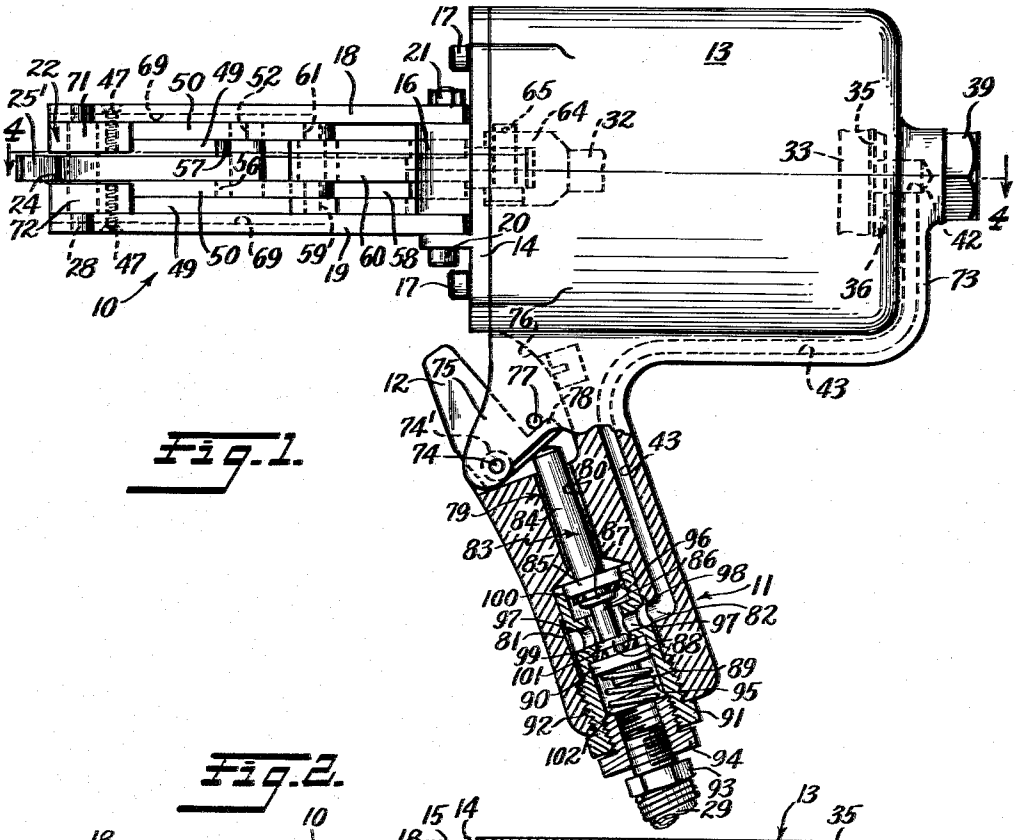


Fig. 1.

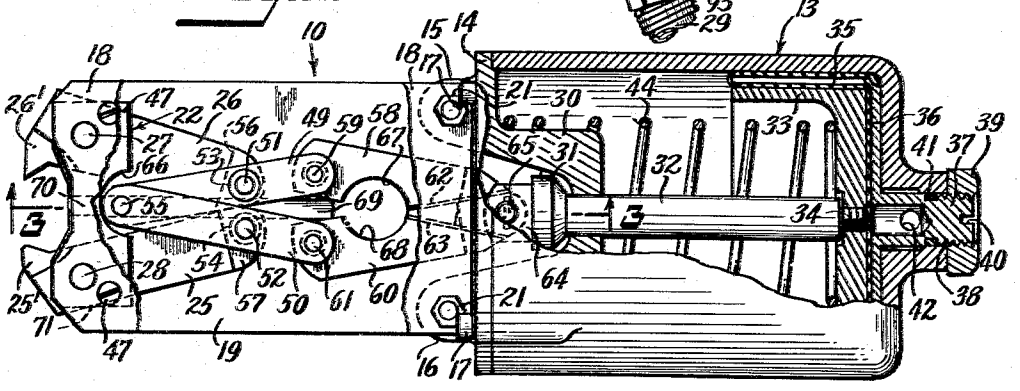


Fig. 2.

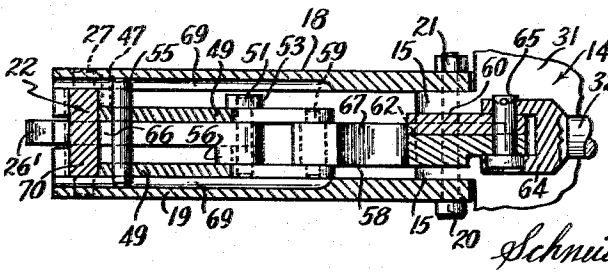


Fig. 3.

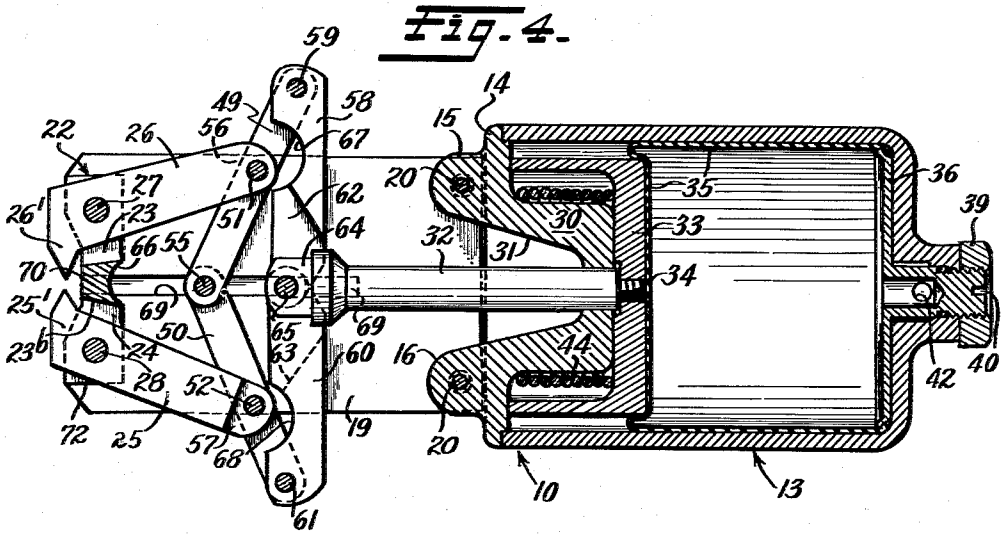
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CRIMPING MECHANISM

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Fig. 4.



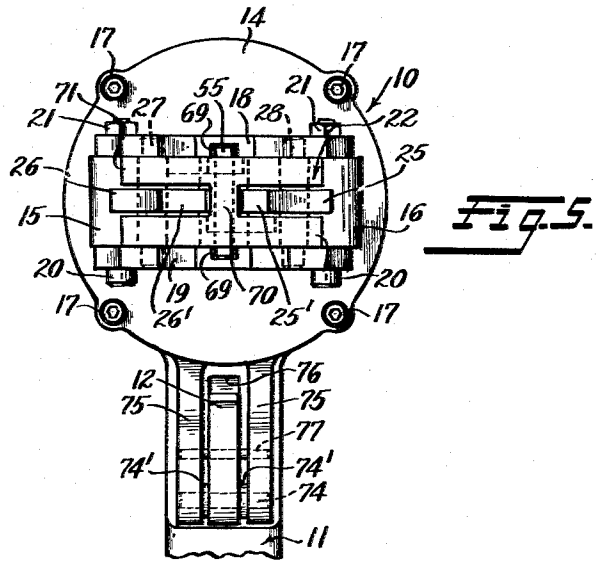


Fig. 5.

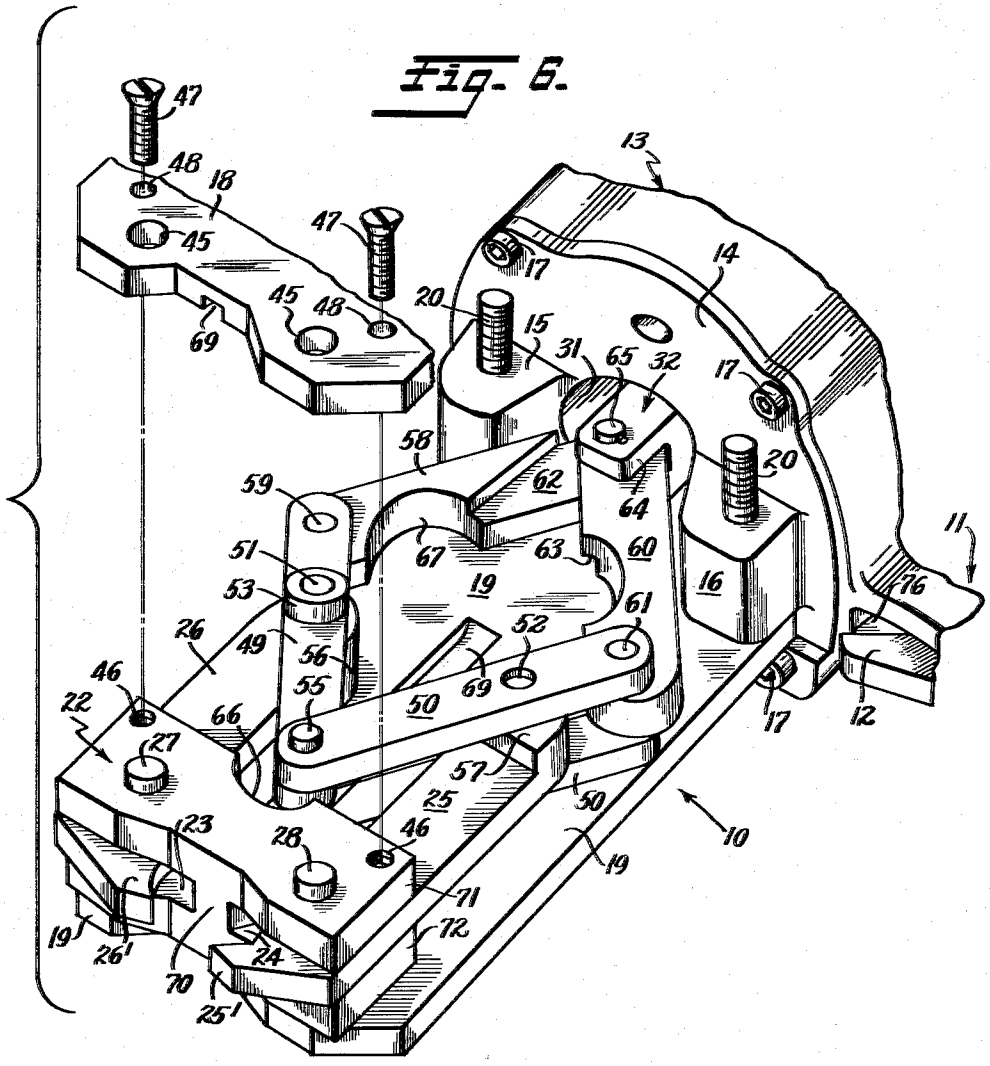
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Fig. 6.



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CRIMPING MECHANISM

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2 Claims. (Cl. 81—9.1)

The present invention relates to tools for crimping a seal about overlapped strap ends and more particularly to power-operated hand tools and to a new linkage for operating crimping jaws upon the longitudinal or translational movement of a power source mechanism toward and away from the crimping jaws.

In accordance with the present invention, the tool has a pair of crimping jaws formed at the ends of a pair of jaw links which are pivotally mounted in spaced opposed relation in an H-shaped crimping block or notcher. The jaw links are pivotally secured at the rearward ends thereof to a pair or first pair of operating links, respectively. The term "lower links" is used herein to designate this first pair of operating links. A second pair of operating links employed in the instant mechanism is herein described as "upper links."

The rear ends of the jaw links are pivotally connected to the lower links, respectively, at intermediate points along the length of the lower links and the lower links are pivotally connected together at the forward end thereof.

A pair of upper or rearward links are connected to be responsive to the longitudinal movement of a power-driven operating rod for the purpose of spreading the rearward ends of the lower links to spread the points of connection between the lower links and the crimping jaws or jaw links apart to operate the jaws with an increasing mechanical advantage as the operating rod approaches the end of its stroke completing the crimping or sealing operation. The rearward ends of the upper links are pivotally connected to the forward end of the operating rod, and the forward ends of the upper links are pivotally connected to the lower links at the rearward ends thereof, respectively. Thus, the interconnection between the power source and the crimping jaws is a three or triple-link connection arranged to provide an increasing mechanical advantage as the jaws are moved toward each other.

The invention provides a simple, hand-operable, power-operated pistol-type crimper which facilitates effective crimping of a seal about overlapped strap ends with minimum effort. The increase in mechanical advantage which is achieved minimizes the power requirement to permit the completed tool to be operable with generally available and safe power supplies such as hydraulic or pneumatic pressures, or an electric drive, and to be of such size and weight as to facilitate convenient hand manipulation while at the same time providing a durable tool of high crimping power.

The invention will be more fully described and its advantages will become more fully apparent from the following description of an illustrative embodiment of the invention taken in conjunction with the accompanying drawing in which:

FIGURE 1 is a side elevation with parts broken away for clarity;

FIGURE 2 is a top plan view with parts broken away for clarity;

FIGURE 3 is a fragmentary vertical sectional view taken substantially along the line 3—3 of FIGURE 2;

FIGURE 4 is a horizontal sectional view taken substantially along the line 4—4 of FIGURE 1 but showing the tool in crimping position;

FIGURE 5 is a fragmentary front elevational view; and

FIGURE 6 is a fragmentary perspective view illustrating the linkage and including a part of one of the side plates exploded away from the linkage to illustrate the assembly of the linkage between the side plates.

There is shown in FIGURE 1 an illustrative embodiment of the invention in the form of an air-operated pistol-type crimping tool identified generally by the numeral 10. The crimping tool 10 comprises a hand grip 11, having a trigger 12, and supporting an air cylinder 13. The forward end of the cylinder 13 is closed by a mounting plate 14 which is provided with a pair of forwardly extending mounting lugs 15 and 16. The mounting plate 14 is secured to the cylinder 13 by means of screws 17.

A pair of side plates 18 and 19 are secured to the mounting lugs 15 and 16 by means of bolts 20 which extend through the side plates 18 and 19 and through the mounting lugs 15 and 16, the bolts 20 being received in nuts 21. The side plates 18 and 19, mounted as indicated above, extend forwardly of the mounting plate 15 in spaced apart parallel relation. At the forward end of the side plates 18 and 19 and mounted therebetween is an H-shaped crimping block or notcher 22. The notcher 22 is formed to define a pair of side recesses 23 and 24 within which the jaw links 25 and 26 having crimping jaws 25' and 26' formed at the forward end thereof, are mounted for pivotal movement by means of notcher pins 27 and 28 positioned adjacent to the crimping jaws 25' and 26'.

The central portion of the mounting plate 14 is formed with an inwardly extending spring mount 30 which is externally recessed as indicated at 31 for the purpose of receiving the enlarged forward end of a piston rod 32 that extends axially of the air cylinder 13. The rear of the piston rod 32 is secured to a piston 33 by a threaded interconnection indicated by the numeral 34. The rear of the piston 33 abuts a flexible diaphragm 35 which is secured at the rear of the air cylinder 13 by a retainer plate 36 formed with an externally projecting portion 37 having threads 38. The threaded projection 37 and the retainer plate 36 are held in position at the rear of the air cylinder 13 by means of the jam nut 39. The projection 37 terminates in a slot 40 enabling rotation of the retainer plate 36 for adjustment purposes. A seal 41 surrounds the inner end of the projection 37 to render the joint air-tight.

The center of the retainer plate 36 is bored to provide a port 42 which communicates with an air passage 43 running along the underside of the air cylinder 13 and into the hand grip 11. An air hose 29, extending from a source of air pressure is connected to the pistol grip 11. The passage 43 communicates with a valve mechanism operated by the trigger 12 to permit air to flow from the hose 29 into the mechanism.

When air enters the port 42 (see FIGURE 2) it acts against the diaphragm 35 and propels the piston 33 along the air cylinder 13 into the position shown in FIGURE 4 compressing a spring 44 surrounding the spring mount 30. When the air pressure behind the flexible diaphragm 35 is removed as by venting to the atmosphere, the spring 44 will propel the piston 33 rearwardly along the air cylinder 13 to the position shown in FIGURE 2. The piston rod 32 connected to the piston 33 is moved axially with the piston; the forward axial movement of the piston rod 32 being effected under air pressure to constitute a power-crimping stroke and the rearward axial movement of piston rod 32 being effected by the spring 44 for the purpose of opening the crimping jaws 25' and 26' so that the tool may be removed from the work.

The linkage which enables the longitudinal reciprocation of the piston rod 32 to be transformed into an effective opening and closing movement of the crimping jaws 25' and 26' is shown most clearly in the perspective illustration in FIGURE 6. In FIGURE 6 the crimp-

ing jaws 25' and 26' are shown partially closed and the piston rod 32 is moved partially forward in its power crimping stroke. FIGURES 1, 2, 3 and 5 show the crimping jaw actuating linkage with the crimping jaws in open work-receiving position. FIGURE 4 illustrates the linkage with the crimping jaws 25' and 26' in their closed or sealing position.

Referring more particularly to the perspective view of FIGURE 6, it will be seeen that the jaw links 25 and 26 on which the crimping jaws 25' and 26' are formed, are mounted for pivotal movement in the notcher 22 by means of notcher pins 27 and 28 which extend across the recesses 23 and 24 and through the jaw links 25 and 26 close to the jaws 25' and 26'. The notcher pins 27 and 28 also extend into the side plates 18 and 19 and, more particularly, into the openings 45 therein. The notcher 22 is further provided with threaded openings 46 which receive screws 47 which extend through openings 48 in the side plates 18 and 19. The screws 47 do not extend into the side recesses 23 and 24 and are employed to bolster the securement of the notcher 22 to the side plates 18 and 19.

The trailing ends of the jaw links 25 and 26 are secured to lower links 49 and 50, the preferred construction utilizing a pair of lower links for each of the jaw links 25 and 26. The jaw links 25 and 26 are pivotally secured to the lower links 49 and 50, respectively, at points intermediate the length of the lower links by jaw link pins 51 and 52 extending through the lower links 49 and 50 and the jaw links 25 and 26.

A washer 53 is positioned adjacent one of the lower links 49 and a washer 54 is positioned adjacent another of the lower links 50 to fill the space between the links 49 and 50 and the interior surfaces of the side plates 18 and 19. This space occurs due to the staggered offset arrangement of the links as discussed below.

The lower links 49 are staggered with respect to the lower links 50 due to the fact that lower links 49 and lower links 50 are all pivotally interconnected by a common pin 55 at the forward end of the links. In view of the staggered position of the links 49 with respect to the links 50, the jaw link 26 is provided with an offset 56 at the rearward end thereof, whereas the jaw link 25 is provided with a similar offset 57 which faces in a direction opposite to the direction in which the offset 56 extends.

The rearward ends of the lower links 49 embrace the forward end of upper link 58 and are pivotally connected to the upper link 58 by means of the pin 59. Similarly, the rearward ends of the lower links 50 are pivotally connected to the forward end of upper link 60 by means of pin 61. The rearward ends of the upper links 58 and 60 are recessed as indicated at 62 and 63 to permit these upper links to mesh together. The rearward ends of the upper links are pivotally connected together in the yoke-shaped forward extremity 64 of the piston rod 32 by means of the pin 65.

When the piston rod 32 is fully retracted, the forward extremities of the lower links 49 and 50 are adjacent to the notcher 22 and the notcher is provided with a cutout portion 66 to receive the forward ends of the lower links 49 and 50. Similarly, when the piston rod 32 is fully projected, as illustrated in FIGURE 4, the trailing ends of the jaw links 25 and 26 are adjacent to the upper links 58 and 60 and the upper links 58 and 60 are provided with cutout portions 67 and 68.

The pin 55 which interconnects the forward ends of the lower links 49 and 50 extends beyond these links and into a central longitudinally extending channel 69 in each of the side plates 18 and 19 so that movement of the pin 55 is confined to a longitudinal movement within the opposed channels 69. This insures that the projection and retraction of the piston rod 32 will produce a smooth opening and closing movement of the crimping jaws 25' and 26'. The manner in which the guide pin 55 is limited to movement along the longitudinal channel 69 is illustrated in FIGURES 2, 3 and 4.

One of the important aspects of the invention lies in the linkage arrangement by which at the beginning of the stroke as shown in FIGURE 2, the mechanical advantage obtained by the piston rod 32 is limited, whereas toward the end of the stroke as shown in FIGURE 4, the mechanical advantage achieved is very large since the lower links 49 and 50 and the upper links 58 and 60 are almost perpendicular to the piston rod 32. Since the mechanical advantage increases as the links 49, 50, 58 and 60 become further and further removed from the position shown in FIGURE 2, in which these links are substantially in alignment with the piston rod 32, it will be apparent that the mechanical advantage progressively increases as the crimping jaws 25' and 26' are closed. Thus, the greatest mechanical advantage is achieved at the end of the stroke when the full resistance of the seal to the crimping action takes place and when the momentum of the forward movement of the piston rod 32 can be of assistance to the completion of the sealing operation. As can be seen in FIGURE 4, the guide pin 55 moves rearwardly along the channel 69 toward the yoke 64 during the power crimping or sealing stroke.

The notcher 22 is desirably formed as a single piece in which the side recesses 23 and 24 are separated by an intermediate section 70 which is integral with the wings 71 and 72, the wings 71 and 72 and the intermediate portion 70 together defining the recesses 23 and 24.

In the form of the invention which has been illustrated, the jaw links 25 and 26 and the jaws 25' and 26' move in a plane which is perpendicular to the plane of the hand grip 11. It will be appreciated that the screws 17 securing the mounting plate 14 to the air cylinder 13, may be removed and the operating end of the tool rotated 90° in either direction so that the crimping jaws 25' and 26' will operate in the plane of the hand grip 11. After pivoting of the mounting plate 14 with its associated structure, the screws 17 are replaced. Thus, the crimping tool may be adjusted so that the crimping jaws will move either in the plane of the hand grip 11 or in a plane at right angles to the plane of the hand grip 11.

The air passage 43, as illustrated in FIGURE 1, extends from its connection with the port 42 downwardly through a web 73 to the rear of and beneath the air cylinder 13 and into the hand grip 11. The valve mechanism which controls the flow of air from the supply hose 29 to the passage 43 is operated by a trigger 12 at the upper front portion of the pistol grip 11. The trigger 12 is pivotally connected to the upper end of the hand grip 11 by means of the pin 74 which extends between a pair of ears 75 (see FIGURES 1 and 5) defining a trigger-receiving recess 76. Washers 74' mounted on pivot pin 74 are employed to centrally position the trigger 12 in the recess 76 and to reduce friction. Movement of the trigger 12 which is normally biased to a closed (counterclockwise, as viewed in FIGURE 1) position, is limited by the stop pin 77 which engages a rearwardly extending abutment 78 at the lower rearward end of the trigger.

The lower end of the hand grip 11 is bored to define a valve receiving bore 79 which comprises an upper valve stem-receiving bore 80 communicating with the trigger-receiving recess 76 and a lower larger diameter bore 81 within which the valve mechanism is mounted. The bore 81 communicates with the air passage 43 as indicated at 82.

The valve mechanism includes a valve stem cap 83 which is slidingly received within the bores 80 and 81 and comprises an upper rod portion and a polygonal (in this instance, triangular) flange 85 on the lower end of the upper portion 84. A valve stem 86 having an upper flange 87 and a lower flange 88, is coaxially secured to the underside of the flange 85 as by a threaded connection. A valve extension 89 having a polygonal

(in this instance, triangular) flange **90** at the upper end thereof is coaxially secured to the valve stem **86** below the flange **88** by a threaded connection.

Threadingly received within the bore **81** is a valve housing **91**, secured in place by the threaded connection **92**. The air hose **29** is secured to the valve housing **91** by means of connector **93** and the reducing bushing **94**. The valve housing **91** is formed with a lowermost portion defining a recess **95**. The lowermost portion of the housing **91** is secured to the bore **81** by the threaded connection **92**. The valve housing **91** further includes an uppermost portion defining a recess **96** within which the flange **85** of the valve stem cap **83** is slidingly received. Between the upper and lower portions, the valve housing **91** is radially bored to provide ports **97** which communicate with the air passage **43**.

The ports **97** are bored in an intermediate portion of the valve housing, which portion is provided with upper and lower flange faces that operate as air outlet and air inlet valve seats **98** and **99**, respectively. These seats **98** and **99** are cooperatively arranged with valve gaskets or washers **100** and **101** which are formed of a resilient material and which, when pressed against the valve seats **98** and **99**, respectively, provide effective seals therewith. The air outlet washer **100** is retained between flange **85** on the stem cap **83**, and the upper flange **87** on the valve stem **86**. The air inlet washer **101** is retained between the flange **90** on the valve extension **89**, and the lower flange **88** on the valve stem **86**. A spring **102** disposed between the flange **90** and the bushing **94** and within the lower recess **95** in the valve housing **91** normally biases the valve toward a closed position with the washer **101** sealingly engaging the seat **99**.

The valve mechanism described above is operated by manipulation of the trigger **12**. When the trigger is moved in a clockwise direction about the pivot pin **74**, as viewed in FIGURE 1, the lower rearward end portion **78** thereof pushes against the upper end of the valve stem cap **83** causing the cap, stem and extension of the valve to move downwardly against the force of the biasing spring **102**. This unseats the washer **101** from the seat **99** thereby permitting air to flow from the hose **29** through the connector **93**, past the sides of the flange **90** and through the passages **97**, **82** and **43** to the piston in the body of the tool to cause operation of the tool in the manner described above. At the same time that the inlet valve comprised of the washer **101** and the seat **99**, is opened, the outlet valve, comprised of the washer **100** and the seat **98**, is closed.

After the operation of the tool has been completed to crimp a seal disposed about a pair of overlapped strap ends, the trigger **12** is released. This permits the spring **102** to move the valve cap, stem and extension upwardly to open the outlet valve and to reclose the inlet valve. When the outlet valve is open, air escapes from the piston and cylinder by passing through the ports **97**, past the cap flange **85** and past the cap rod **84** to exhaust through the bore **80**. The spring **44** is effective to drive the piston rearwardly of the body of the sealer mechanism to drive the air in the cylinder out of the cylinder through the port **42**.

From the foregoing it will be readily observed that numerous variations and modifications may be effected without departing from the spirit and scope of the novel concepts and principles of this invention. It will be appreciated that the above description and the accompanying illustration of an illustrative embodiment of this invention is for the purpose of providing a complete description of the invention and that no specific limitations on the invention are intended thereby.

I claim:

1. An air-powered hand tool for crimping a seal about overlapped strap ends comprising a hand grip including a trigger, an air cylinder mounted atop said hand grip and terminating in a mounting plate, a valve operated by said trigger and communicating with said air cylinder at

the rear thereof, a pair of spaced apart parallel side plates secured to said mounting plate and extending forwardly therefrom, a notcher comprising wings separated by an intermediate section defining a pair of side recesses, said notcher being secured between the forward ends of said side plates by securing means extending between said side plates and said wings, a pair of jaw links having crimping jaws thereon, said jaw links being received within the side recesses of said notcher and pivotally secured between the wings thereof adjacent to the crimping jaws for opening and closing movement between said side plates in a plane parallel to the plane thereof, a pair of lower links pivotally interconnected to each other at the forward end thereof by means of a pin extending beyond said lower links, the interior surfaces of said side plates each being formed with a longitudinal channel receiving said pin to permit said pin and the forward ends of said lower links to move toward and away from said notcher in a laterally confined longitudinal path, said lower links being pivotally connected with the rearward ends of said jaw links at points intermediate the length of said lower links, a pair of upper links pivotally interconnected at the rearward ends thereof and with the forward ends of said upper links being pivotally connected to one of said lower links at the rearward ends thereof, a piston rod extending through said air cylinder and into the space between said side plates and secured to said upper links at the rearward ends thereof, said piston rod being secured to a piston slidable within said air cylinder so that said piston may be propelled by air pressure upon operation of said trigger to move said piston rod axially toward said notcher to close said jaws with an increasing mechanical advantage, and spring means mounted between said mounting plate and said piston for retracting said piston and to open said jaws, the rear of said notcher being cut out to receive the forward ends of said lower links when said piston rod is retracted.

2. An air-powered hand tool for crimping a seal about overlapped strap ends comprising a hand grip including a trigger, an air cylinder mounted atop said hand grip and terminating in a mounting plate, a valve operated by said trigger and communicating with said air cylinder at the rear thereof, a pair of spaced apart paralled side plates secured to said mounting plate and extending forwardly therefrom, a notcher comprising wings separated by an intermediate section defining a pair of side recesses, said notcher being secured between the forward ends of said side plates by securing means extending between said side plates and said wings, a pair of jaw links having crimping jaws thereon, said jaw links being received within the side recesses of said notcher and pivotally secured between the wings thereof adjacent to the crimping jaws for opening and closing movement between said side plates in a plane parallel to the plane thereof, a pair of lower links pivotally interconnected to each other at the forward end thereof by means of a pin extending beyond said lower links, the interior surfaces of said side plates each being formed with a longitudinal channel receiving said pin to permit said pin and the forward ends of said lower links to move toward and away from said notcher in a laterally confined longitudinal path, said lower links being pivotally connected with the rearward ends of said jaw links at points intermediate the length of said lower links, a pair of upper links pivotally interconnected at the rearward ends thereof and with the forward ends of said upper links being pivotally connected to one of said lower links at the rearward ends thereof, a piston rod extending through said air cylinder and into the space between said side plates and secured to said upper links at the rearward ends thereof, said piston rod being secured to a piston slidable within said air cylinder so that said piston may be propelled by air pressure upon operation of said trigger to move said piston rod axially toward said notcher to close said jaws with an increasing mechanical advantage, and spring means mounted between

said mounting plate and said piston for retracting said piston and to open said jaws, the inner faces of said upper links being cut out to receive the rearward ends of said crimping jaws when said piston rod is projected.

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