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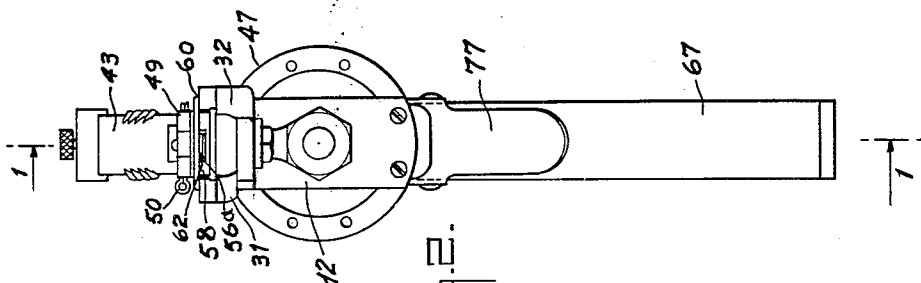
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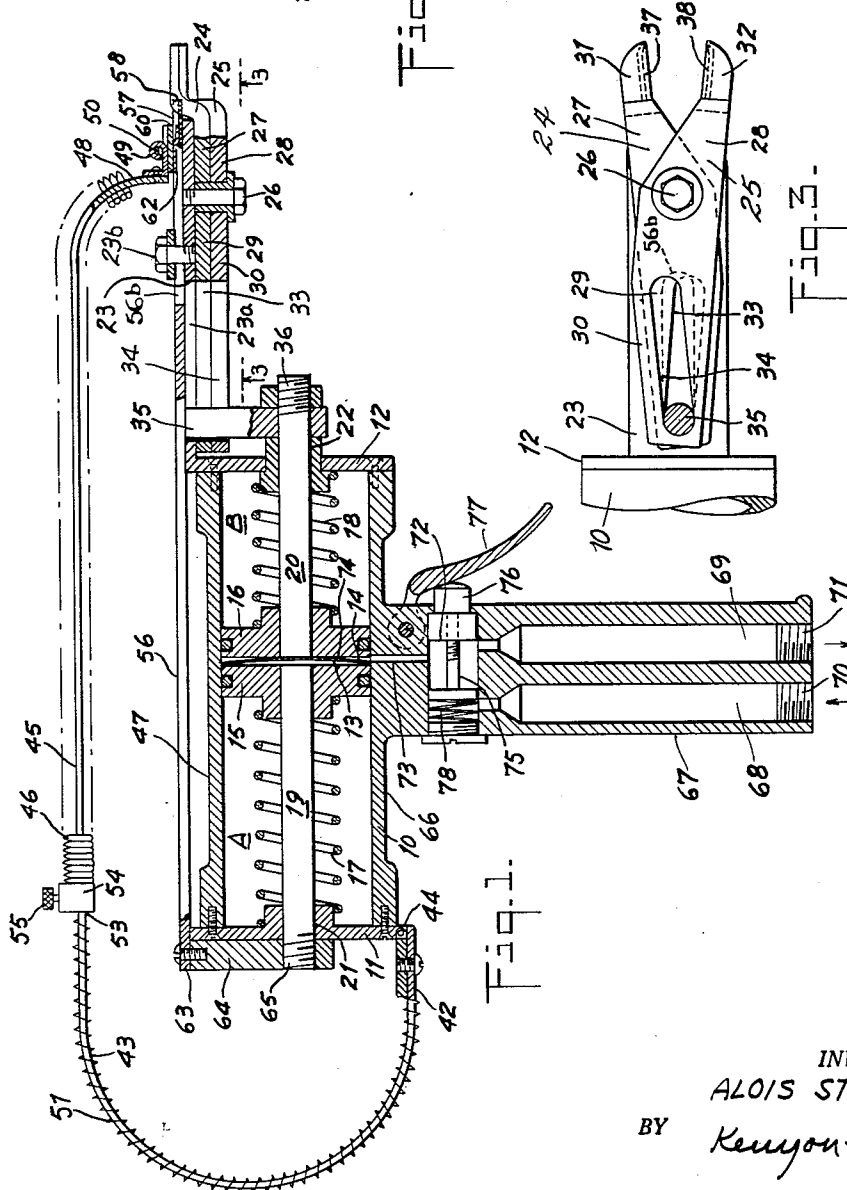
STAPLE CLINCHING TOOL

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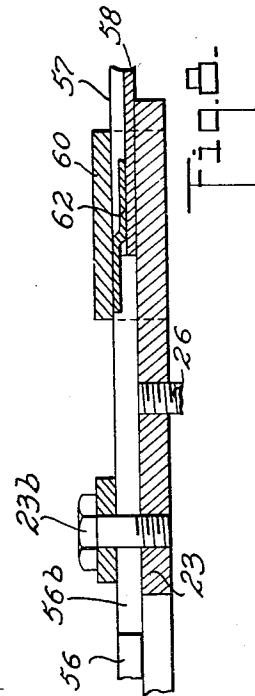
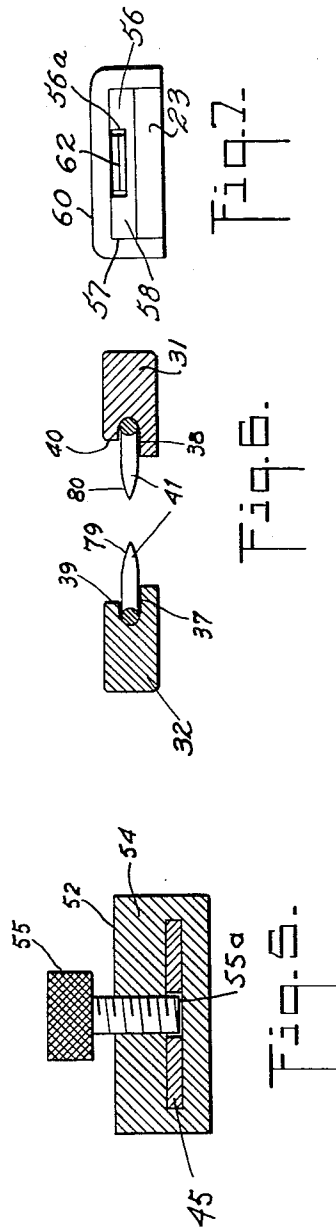
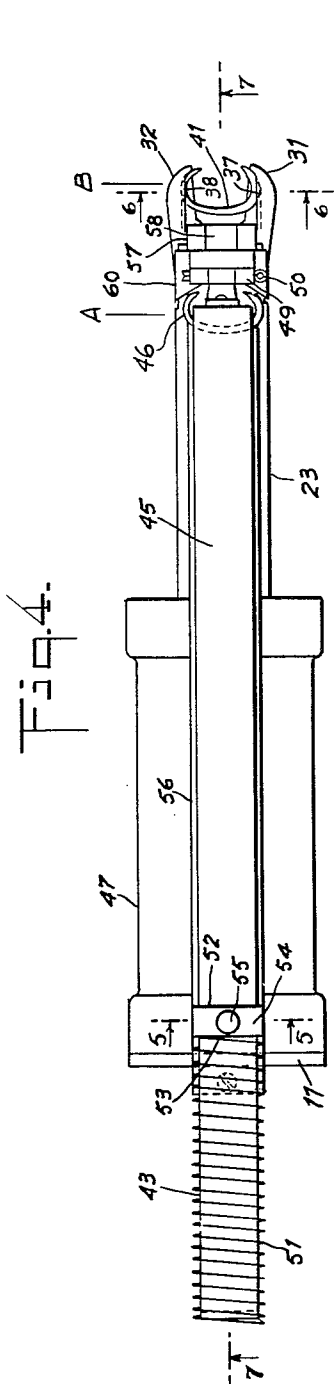
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STAPLE CLINCHING TOOL

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2 Sheets-Sheet 2



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STAPLE CLINCHING TOOL

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10 Claims. (Cl. 1—187)

This invention relates to an improved hand tool for automatically clamping or clinching wire staples and the like around a rod, bar, or other work piece, and is particularly useful in upholstering operations where it is desired to secure fabric edges to a supporting frame.

More particularly, this invention relates to a staple clinching tool in which wire staples are magazine-fed one at a time to a pair of plier-like jaws, said staples being held firmly by the latter with the staple ends protruding slightly beyond the jaws for easy insertion into the fabric to be secured around the supporting frame, the said jaws when actuated by a manually controlled pneumatic system moving together and thereby closing the said staple ends around said frame.

A primary object of this invention is to provide a light-weight pneumatic hand tool of a compact unitary design which is free from operational vibrations, easy to manipulate and of great utility as a production tool.

Another object is to provide a staple clinching tool having a staple magazine lying close to the body of the tool to provide a more versatile clinching tool which can be used in structurally congested areas.

Another object of this invention is to provide a tool in which the staple is guided from the magazine to the jaws and is firmly held after delivery thereto so that one end of the staple can be hooked into upholstering material being attached to a supporting frame and a tightening or pulling force be exerted therewith to gather and stretch the material over the supporting frame before clinching the staple around said frame to hold the material in place.

Another object is to provide a pneumatically operated staple-clinching tool having a handle which is adjustable to three distinct operating positions, namely right-hand, left-hand, and neutral.

An additional object is to provide a staple-clinching tool in which each staple is clearly visible to the operator as it is being held by said jaws ready for clinching so that the staple may be observed for any defects before it is used, thus further insuring proper operation of the tool.

Still another object of this invention is to provide a pneumatically actuated hand tool in which the feeding mechanism for delivering staples to the clamping jaws, and the actuating mechanism for opening and closing said jaws is operated by two oppositely acting pistons in one pneumatic cylinder, said pistons separated by an orifice plate or separator to thereby delay the movement of the feeding mechanism-actuating piston with respect to the jaw-actuating piston, such construction providing a compact and smoothly operating hand tool in which the staple is held firmly from the time of feeding up to the time of clamping, and the jaws are fully opened before the next staple is fed forward to the jaws.

Other objects and features of this invention will become apparent from the following description and drawings.

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In reference to the drawings:

Fig. 1 is a partially sectionalized side elevation of said tool;

Fig. 2 is an end elevation of the jaw end of said tool;

Fig. 3 is a bottom plan view of the jaws;

Fig. 4 is a top plan view of the tool;

Fig. 5 is a sectionalized elevation of the magazine spring locking device, taken along line 5—5 of Fig. 4;

Fig. 6 is a sectionalized elevation of the jaws, taken along line 6—6 of Fig. 4;

Fig. 7 is an end view of the ring feeding mechanism, taken from right to left in Fig. 4;

Fig. 8 is an enlarged fragmentary view of the ring feeding mechanism at the right in Fig. 1, the feeding member 56 being shown partially advanced.

As shown in Fig. 1, the tool is comprised of a hollow cylinder 10 having end plates 11 and 12 which can be fastened at its ends in any one of three different radial positions by any conventional means. The inside of said cylinder 10 is divided into two compartments forming opposed cylinders A and B by a transverse partition or separator 13 having a small hole or orifice 14 therein establishing communication between said cylinders. The separator 13 may be constructed with a concave-convex surface configuration, the convex surface facing the compartment B, as shown in Fig. 1. The cylinders A and B are connected in parallel to a common source of fluid pressure under the control of a manually operated valve means, to be described. The orifice 14 in the separator 13 constitutes, in effect, a throttling means interposed in that branch of the fluid conducting passage leading to cylinder A, giving the branch passage an effective area less than that leading to cylinder B, whereby piston 15 acts in a time-delayed relationship with respect to piston 16 when both pistons are subjected to fluid pressure.

On opposite sides of said separator 13 are pistons 15 and 16 which are biased toward said separator by coil springs 17 and 18 respectively. Piston rods 19 and 20 are connected to their respective pistons and extend through holes 21 and 22 in end plates 11 and 12 respectively. The said pistons are movable from normal at rest positions adjacent said separator as shown in Fig. 1, toward said end plates under the influence of fluid pressure in a manner to be described.

Attached to end plate 12 or formed integrally therewith is a base plate portion 23 extending outwardly and perpendicular to the surface of said plate from the periphery thereof. A pair of superimposed levers 24 and 25 is rotatably attached to said base plate by any conventional stationary pivot 26. Said levers have adjacent shorter arms 27 and 28 and corresponding longer arms 29 and 30, the said shorter arms being established by said pivot 26 and having jaw members 31 and 32 on their respective swinging ends (see Fig. 3) and the said longer arms having respective diagonal slots 33 and 34 near their swinging ends engaged by a swinging pivot member 35 which is connected perpendicularly to the outer end 36 of piston rod 20. The interconnection of said swinging pivot member 35 and said diagonal slots 33 and 34 converts the reciprocal linear motion of said swinging pivot 35 into a reciprocating curvilinear motion of the said levers 24 and 25. Said swinging pivot member 35 extends on its upper end, as viewed in Fig. 1, into a guide slot 23a in said base plate portion 23 to stabilize the reciprocal motion of said member.

As shown in Figs. 5 and 6, said jaw members 31 and 32 each have female anvil portions or slots 37 and 38 in their respective oppositely disposed faces 39 and 40 for receiving and holding a staple 41 as it is delivered to said jaws and for the subsequent forming of said staple as will be described below.

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On the opposite end plate 11, and diagonally opposite the corresponding position of said base plate 23 on the other end plate 12, is connected one end 42 of a staple magazine 43 by a means of a hinge 44. The said magazine is comprised of a relatively thin flat strip of metal 45 constructed so as to receive a stack of wire staples 46, and is bent from said hinge 44 around and in proximity to the surface 47 of said cylinder in a J-form, and is detachably connected on its other end 48 to said base plate 23 by means of a hinge 49, the pin 50 thereof being a cotter pin or the like which can be removed for reloading the said magazine with staples.

Wound around said magazine strip 45 and extending for a portion of the length thereof from its permanently hinged end 42 is a coil spring 51 to urge the stack of staples 46 on said magazine 43 toward its base plate end 48. A locking device 52 is attached to the staple end 53 of said spring 51 to hold the latter compressed while adding more staples to said magazine. Said locking device may be of any convenient construction, such as a slotted metallic block 54 which will slide along said magazine strip and urge a stack of staples along it in response to said spring 51, and having a set screw 55 which can be manually tightened to stop said block 54 against said strip 45 for reloading, or a hole 55a can be located in the magazine strip as shown in Figs. 4 and 5 into which said set screw can be tightened to hold said spring compressed while reloading.

Extending along the top of said pneumatic cylinder 10 as viewed in Fig. 1 is a flat metallic strip or feed bar 56 having one end portion 57 with a notched end surface 58 slidably received by a sheath portion or feed guide 60 located near the outer end 61 of base plate 23 and adjacent said jaws 31 and 32. Flat spring 62 attached on one of its ends to the said feed guide 60 extends forward and downward on its other end into a longitudinal recessed portion 56a in the top surface of the said forward end portion 57 of said feed bar 56 and exerts a moderate pressure against said feed bar to further guide the reciprocal motion of the latter. The said feed bar 56 has a longitudinal slot 56b further removed from said end portion 57 through which a bolt 23b is connected to said base plate 23. This provides an additional guiding and stabilizing means for the said feed bar.

The other end 63 of said feed bar 56 is connected by any suitable connector 64 to the outer end 65 of piston rod 19, the said feed bar thus being reciprocally movable in response to the motion of said piston rod 19 to push staples received at magazine end 48, through said feed guide 60 and into a position of retention by said jaws, or in other words to push staples from position A to position B in Fig. 4, and then return to receive the next staple from the magazine.

Formed integrally with and extending perpendicularly from the side wall 66 of cylinder 10 is a handle 67 which together with said cylinder can be adjusted circumferentially with respect to the said magazine and said jaws for either right- or left-handed operation or to a neutral position as shown. The handle contains tubular channels 68 and 69 having threaded openings 70 and 71 for connecting fluid pressure (e. g. compressed air) intake and exhaust lines respectively. The said tubular channels are communicable via plunger valve 72, with fluid passage 73 which connects with the space between the separator 13 and face 74 of piston 16 in compartment B of cylinder 10.

Valve 72 has a plunger 75 with a button 76 on one of its ends which extends externally of said handle 67 into engagement with a pivotally mounted trigger 77. Coil spring 78 at the other end of said plunger biases the latter toward said trigger, in which position exhaust channel 69 is connected with said fluid passage 73 and intake channel 68 is shut off therefrom. Said plunger 75 is movable against said spring 78 when the trigger 77 is manually depressed to shut off exhaust channel 69 from said

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passage 73 and to interconnect fluid intake channel 68 therewith.

The operation of the staple-clinching tool may be described briefly as follows. To load the magazine 43, first the magazine spring locking device 52 is pushed back along the magazine strip 45 against the pressure of spring 51 for a distance to accommodate the staples to be added, or until the said device is in line with hole 55a in said strip, and then set screw 55 is manually tightened to hold said locking device 52 in place. The cotter pin 50 is then removed from hinge 49 at the delivery end 48 of the said magazine and the latter is rotated about its hinged end 42 to a position convenient for sliding said staples onto said strip 45 in such fashion that the staple ends 79 and 80 will project forward in the direction of the jaws 31 and 32 as they leave the magazine.

After a sufficient number of staples have been so added, the magazine is returned to its engaged position with hinge 49 and cotter pin 50 is replaced to secure it. Set screw 55 is backed off to release the locking device 52 and permit spring 51 to urge the slotted block 54 against the stack of staples 46.

For the sake of clarity it will be assumed for the purposes of this description that a staple 41 is already held by the jaws from the last operation, and that fluid pressure intake and exhaust lines have been connected to the respective apertures 68 and 69.

The staple 41 held by jaws 31 and 32 is positioned by the operator so as to straddle rod, bar or frame about which it is desired to secure the fabric or other material. Since the staple ends 79, 80 extend outwardly from the respective jaws as shown in Fig. 4, the appropriate one of such ends may be inserted into the fabric and a pull exerted thereon by the operator to stretch the fabric taut around the rod or frame before each stapling operation, after, of course, the fabric has been first secured to the opposite portion of the frame to anchor it against such a pull. By pressing trigger 77 plunger 75 is moved against its coil spring 78 shutting off exhaust channel 69 and introducing fluid pressure from intake channel 68 through passage 73 into cylinder compartment B between separator 13 and face 74 of piston 16. Such fluid pressure moves said piston 16 against its biasing spring 18 and moves swinging pivot 35 in lever slots 33 and 34 toward stationary pivot 26, thereby causing jaws 31 and 32 at the swinging ends of shorter arms 27 and 28 to move toward one another and consequently said female anvil portions 37 and 38 to close said staple ends 79 and 80 around said frame.

A fraction of a second after the fluid under pressure has been introduced to compartment B, it leaks through orifice or hole 14 into compartment A and moves piston 15 against its biasing spring 17. Such action is imparted through piston rod 19 and connector 64 to feed bar 56 which slides back away from said jaws 31 and 32 and said delivery end 48 of the magazine 43. This permits magazine spring 51 to force the next staple into position against the base plate 23 and in between the notched end surface 58 of feed bar 56 and the feed guide 60.

After the staple has been closed around the frame by the jaws as above described, the operator releases trigger 77 shutting off the fluid pressure intake channel 68 and exhausting cylinder compartments A and B through passage 73 and channel 69. Spring 18 forces piston 16 back toward the separator 13, thus opening jaws 31 and 32 to receive another staple. Because of the constriction due to orifice 14, compartment A exhausts more slowly and spring 17 moves piston 15 back toward the separator more slowly. The latter motion is imparted to feed bar 56 which moves toward jaws 31 and 32, and in so doing its notched end surface 58 separates the next staple from the stack and pushes it through the feed guide 60 into a position of retention by said jaws. This slower motion of feed bar 56 gives

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a safer and surer action for feeding the next staple from the magazine to the jaws and allows the said jaws to be fully opened before the feed bar 56 starts on its return stroke. In its at rest position the feed bar presses against the staple, further stabilizing its retention by said jaws. At this point the tool is ready for the next stapling operation.

While one particular embodiment of this invention has been described herein, it is understood that certain changes in construction can be made without departing from the inventive ideas herein disclosed.

What I claim is:

1. A staple-clinching tool comprising a pair of pivotally mounted levers, oppositely disposed clinching jaws one at the end of each lever, female anvil portions in said jaws, a staple feed magazine, a staple feed guide between said magazine and said jaws, a feed bar movable along said feed guide to deliver staples from said magazine into a position of retention by said anvil portions, a hollow cylinder, a separator located within said cylinder, a pair of pistons reciprocally mounted in said cylinder on opposite sides of said separator, spring means for biasing said pistons toward said separator, said separator having a fluid passage communicating between the facing ends of said pistons, and control valve means manually shiftable to an intake position for delivering fluid pressure directly between one side of said separator and the piston adjacent thereto and then through said passage between the other side of said separator and the piston adjacent to the latter side to operate the latter piston in a time-delayed relationship to the former piston, said latter piston operatively connected to said feed bar and said former piston operatively connected to said levers, said valve means releasable to an exhaust position for exhausting the fluid pressure from said cylinder.

2. The staple-clinching tool of claim 1 in which said feed magazine comprises a band constructed to receive a stack of staples, said band hinged at one end to said cylinder, the other end of said band detachably engageable with said feed guide, the intermediate portion of said band proximate to said cylinder when said other end is engaged with said guide, and spring means located on said band for urging the stack of staples on said band toward said feed guide, and locking means for holding said spring means compressed while staples are being added onto said band.

3. A staple-clinching tool comprising a pair of pivotally mounted levers, oppositely disposed clinching jaws one at the end of each lever, female anvil portions in said jaws, a staple feed magazine, a staple feed guide between said magazine and said jaws, a feed bar movable along said feed guide to deliver staples from said magazine into a position of retention by said anvil portions, a hollow cylinder, a separator having a concavo-convex surface configuration located within said cylinder, a pair of pistons reciprocally mounted in said cylinder on opposite sides of said separator, spring means for biasing said pistons toward said separator, said separator having a fluid passage communicating between the facing ends of said pistons, a supporting handle connected to the outside of said cylinder, said handle and said cylinder radially adjustable with respect to said magazine and said jaws, a control valve means located in said handle, said valve means manually shiftable to an intake position for delivering fluid pressure directly between one side of said separator and the piston adjacent thereto and then through said passage between the other side of said separator and the piston adjacent to the latter side to operate the latter piston in a time-delayed relationship to the former piston, said latter piston operatively connected to said feed bar, and said former piston operatively connected to said levers, said valve means manually releasable to an exhaust position for exhausting the fluid pressure from said cylinder.

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4. A staple-clinching tool comprising a pair of pivotally mounted levers, oppositely disposed clinching jaws one at the end of each lever, supply means for storing staples, feeding means for delivering said staples from said supply means to said jaws, a hollow cylinder, a separator having a concavo-convex surface configuration located within said cylinder, a pair of pistons reciprocally mounted in said cylinder on opposite sides of said separator, spring means for biasing said pistons toward said separator, said separator having a fluid passage communicating between the facing ends of said pistons, and control valve means manually shiftable to an intake position for delivering fluid pressure directly between one side of said separator and the piston adjacent thereto and then through said passage between the other side of said separator and the piston adjacent to the latter side to operate the latter piston in a time-delayed relationship to the former piston, said latter piston operatively connected to said feeding means and said former piston operatively connected to said levers, said valve means releasable to an exhaust position for exhausting the fluid pressure from said cylinder.

5. A staple-clinching tool comprising a pair of pivotally mounted jaw members, supply means for storing staples, feeding means for delivering said staples from said supply means to said jaws, a hollow cylinder, a separator having a concavo-convex surface configuration located within said cylinder, a pair of pistons reciprocally mounted in said cylinder on opposite sides of said separator, spring means for biasing said pistons toward said separator, said separator having a fluid passage communicating between the facing ends of said pistons, and control valve means manually shiftable to an intake position for delivering fluid pressure directly between one side of said separator and the piston adjacent thereto and then through said passage between the other side of said separator and the piston adjacent to the latter side to operate the latter piston in a time-delayed relationship to the former piston, said latter piston operatively connected to said feeding means and said former piston operatively connected to said levers, said valve means releasable to an exhaust position for exhausting the fluid pressure from said cylinder.

6. A staple-clinching tool comprising a pair of pivotally mounted levers, oppositely disposed clinching jaws one at the end of each lever, female anvil portions in said jaws, supply means for storing staples, feeding means for delivering said staples from said supply means into a position of retention by said anvil portions, a hollow cylinder, a separator having a concavo-convex surface configuration located within said cylinder, a pair of pistons reciprocally mounted in said cylinder on opposite sides of said separator, spring means for biasing said pistons toward said separator, said separator having a fluid passage communicating between the facing ends of said pistons, and control valve means manually shiftable to an intake position for delivering fluid pressure directly between one side of said separator and the piston adjacent thereto and then through said passage between the other side of said separator and the piston adjacent to the latter side to operate the latter piston in a time-delayed relationship to the former piston, said latter piston operatively connected to said feeding means and said former piston operatively connected to said levers, said valve means releasable to an exhaust position for exhausting the fluid pressure from said cylinder.

7. A staple-clinching tool comprising a pair of pivotally mounted levers, oppositely disposed clinching jaws one at the end of each lever, female anvil portions in said jaws, a staple feed magazine, a staple feed guide between said magazine and said jaws, a feed bar movable along said feed guide to deliver staples from said magazine into a position of retention by said anvil portions, a hollow cylinder, a separator located within said cylinder, a pair of pistons reciprocally mounted in said cylinder,

der on opposite sides of said separator, spring means for biasing said pistons toward said separator, one of said pistons operatively connected to said feed bar, the other of said pistons operatively connected to said levers, said separator having a fluid passage communicating between the facing ends of said pistons, control valve means manually shiftable to an intake position for delivering fluid pressure directly between said separator and the first said piston to move the first said piston away from said separator so as to close said jaws, and then delivering said fluid pressure through said passage between the other side of said separator and the second said piston adjacent thereto to move the second said piston away from said separator in a time-delayed relationship to the first said piston so as to move said feed bar away from said jaws, said valve means releasable to an exhaust position for exhausting the fluid pressure from said cylinder so as to move the second said piston back toward the separator so as to move said feed bar toward said jaws so as to deliver a staple from said magazine to said jaws, and to move the first said piston back toward the separator so as to open said jaws, the latter movement of the second said piston being in a time-delayed relationship to the latter movement of the first said piston.

8. A staple-clinching tool comprising a pair of oppositely disposed clinching jaws, means mounting the jaws for movement toward and away from each other, female anvil portions in said jaws, a staple feed mechanism, a staple feed guide between said mechanism and said jaws, a feed bar movable along said feed guide to deliver staples from said mechanism into a position of retention by said anvil portions, a pair of cylinders fixed with respect to each other, a first piston reciprocally mounted in a first one of said cylinders and a second piston reciprocally mounted in the second cylinder, means for biasing said pistons toward their respective retracted positions, means connecting the first piston to the jaws to close the jaws when the first piston is advanced, means connecting the second piston to the feed bar to retract the bar when the second piston is advanced, means including a main fluid-conducting passage leading to the first cylinder and a branch fluid-conducting passage leading to the second cylinder for selectively subjecting both pistons to fluid pressure to advance the pistons, the branch passage throttling the fluid passing therethrough whereby the second piston is operated in time-delayed relationship to the first piston, and valve means selectively movable into open and closed positions for controlling the admission of fluid to the cylinders.

9. A staple-clinching tool comprising a pair of oppositely disposed clinching jaws, means mounting the jaws for movement toward and away from each other, female anvil portions in said jaws, a staple feed mechanism, a staple feed guide between said mechanism and said jaws, a feed bar movable along said feed guide to deliver

staples from said mechanism into a position of retention by said anvil portions, a pair of oppositely disposed, oppositely acting cylinders fixed with respect to each other and having their axes disposed in a common plane, a first piston reciprocally mounted in a first one of said cylinders and a second piston reciprocally mounted in the second cylinder, means for biasing said pistons toward their respective retracted positions, means connecting the first piston to the jaws to close the jaws when the first piston is advanced, means connecting the second piston to the feed bar to retract the bar when the second piston is advanced, means including a main fluid-conducting passage leading to the first cylinder and a branch fluid-conducting passage leading to the second cylinder for selectively subjecting both pistons to fluid pressure to advance the pistons, a fluid throttling means in the branch passage whereby the second piston is operated in time-delayed relationship to the first piston, and valve means selectively movable into open and closed positions for controlling the admission of fluid to the cylinders.

10. A staple-clinching tool comprising a pair of oppositely disposed clinching jaws, means mounting the jaws for movement toward and away from each other, female anvil portions in said jaws, a staple feed mechanism, a staple feed guide between said mechanism and said jaws, a feed bar movable along said feed guide to deliver staples from said mechanism into a position of retention by said anvil portions, a pair of aligned, oppositely disposed and oppositely acting cylinders, a first piston reciprocally mounted in a first one of said cylinders and a second piston reciprocally mounted in the second cylinder, means for biasing said pistons toward their respective retracted positions, means connecting the first piston to the jaws to close the jaws when the first piston is advanced, means connecting the second piston to the feed bar to retract the bar when the second piston is advanced, means including a main fluid-conducting passage leading to the inner end of the first cylinder and a branch fluid-conducting passage leading to the inner end of the second cylinder for selectively subjecting both pistons to fluid pressure to advance the pistons, the branch passage being of a smaller effective area than the main passage whereby the second piston is operated in time-delayed relationship to the first piston, and valve means selectively movable into open and closed positions for controlling the admission of fluid to the cylinders.

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