Aug. 25, 1959 W. SCHAFROTH 2,900,637

MOVABLE STAPLING HEAD AND MOUNTS THEREFOR

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FIG. 5.

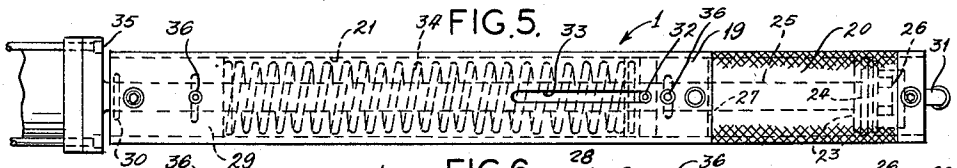


FIG. 6.

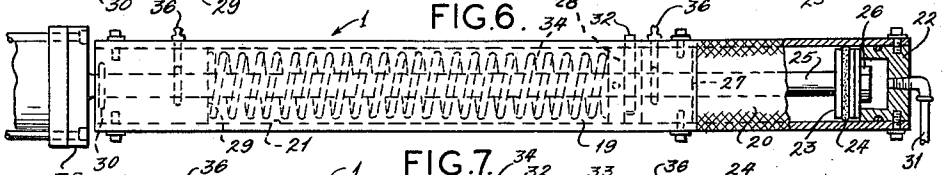


FIG. 7.

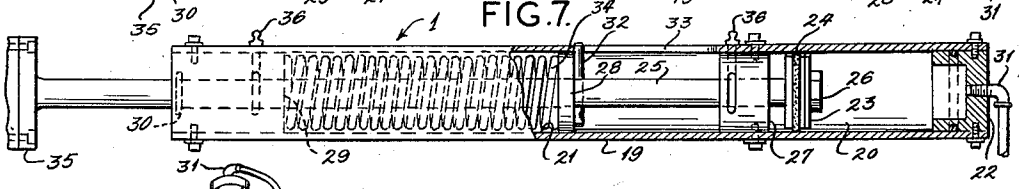


FIG. 1.

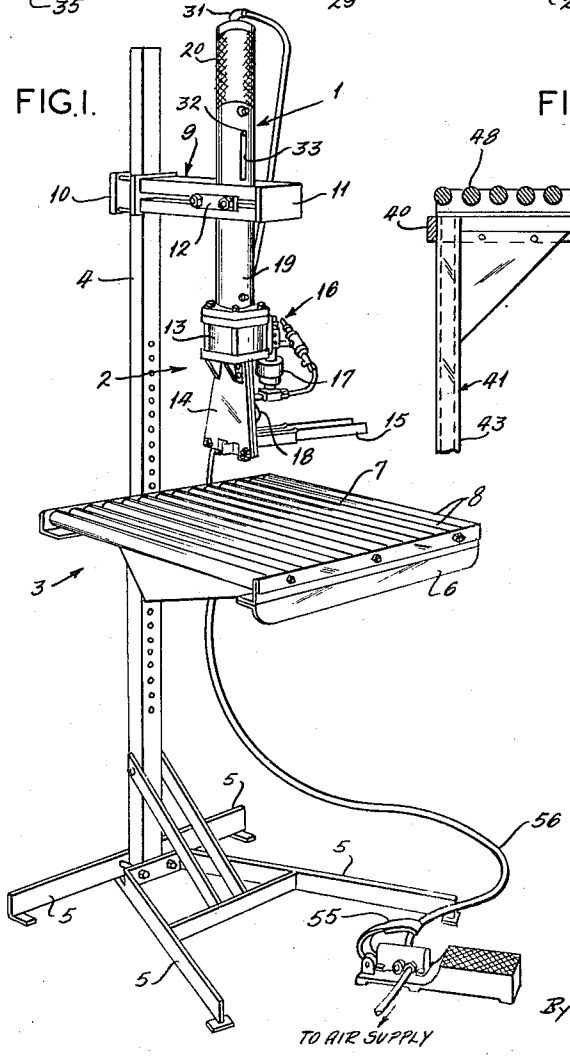
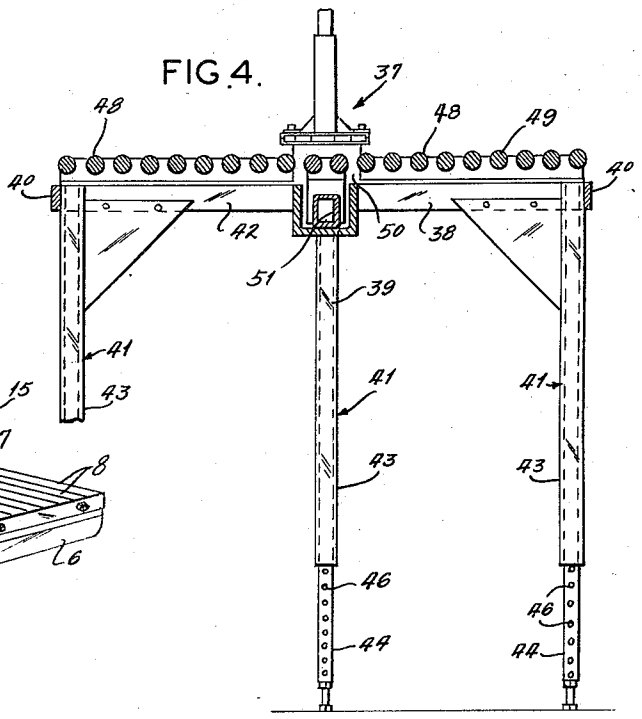


FIG. 4.



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FIG 2

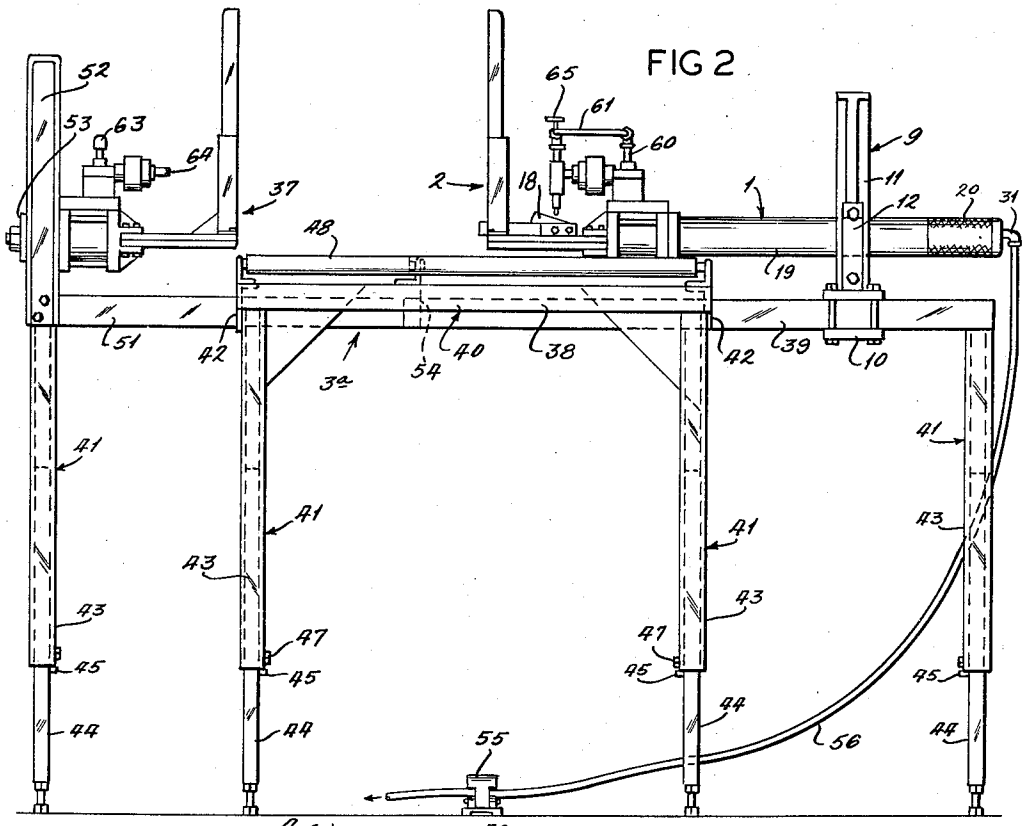
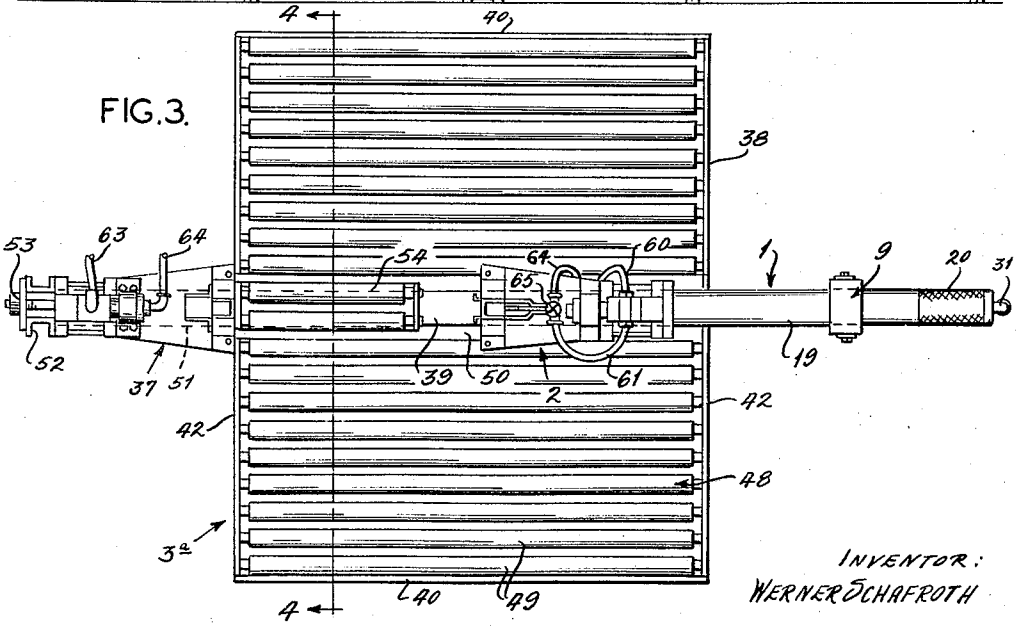


FIG.3.



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FIG. 8.

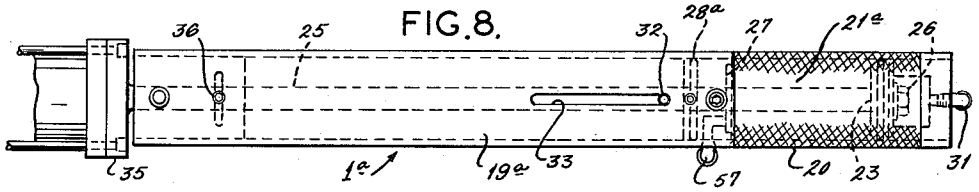


FIG. 9.

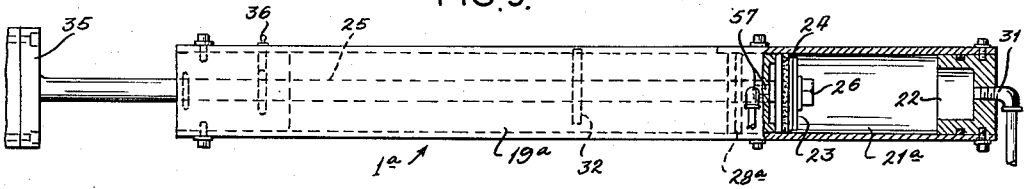
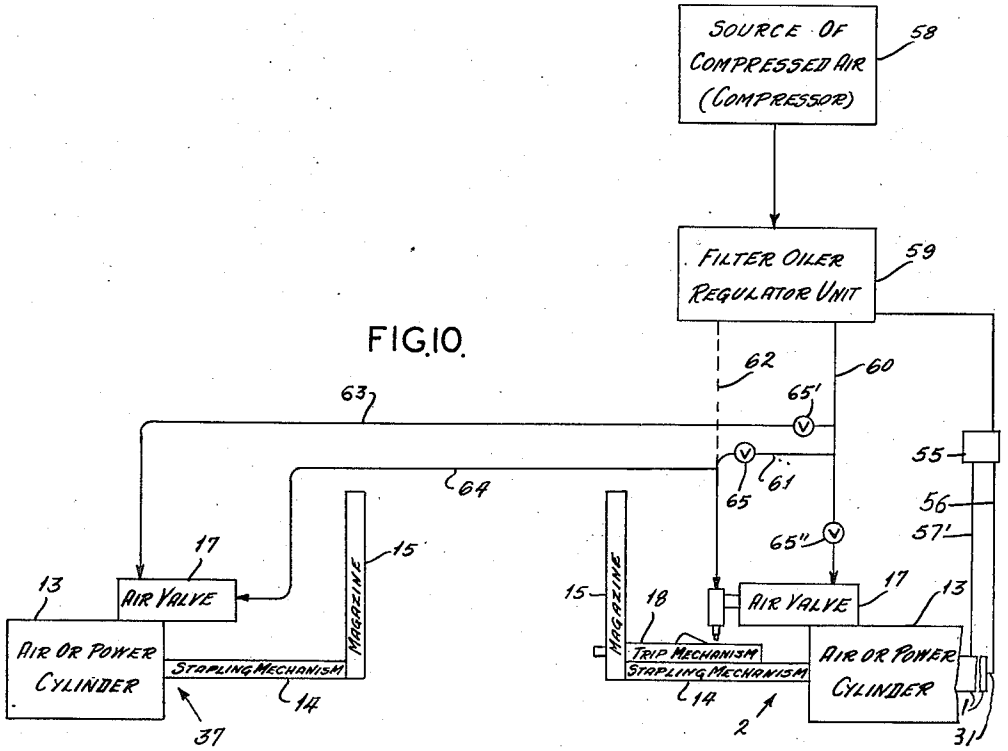


FIG. 10.



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MOVABLE STAPLING HEAD AND MOUNTS THEREFOR

Werner Schafroth, Herrin, Ill.

Application March 26, 1956, Serial No. 573,797

4 Claims. (Cl. 1—13)

This invention relates generally to stapling machines and more particularly to a movable stapling head in a table stapling machine or mount.

Staples are commonly used for closing cartons or master shipping containers which are filled or loaded with goods. The stapling machines which are used are preferably of the retractable anvil type wherein anvils are projected from the bottom edge of the stapling machine itself and penetrate the material to be stapled so that the staple is clinched from the same side from which it is driven. Stapling machines of this type are shown in the Taylor and Sharpnack Patent No. 2,012,027, dated August 20, 1935, and in the Schafroth application Serial No. 340,443, filed March 5, 1953, now U.S. Patent No. 2,740,119, and others.

For production purposes, these stapling machines are frequently mounted in tables or other suitable supporting structures and are power operated. The stapling machines or so-called stapling heads are mounted in the supporting structure so that the covers, the bottoms, or the side or end walls of a carton, or some combination thereof, can be stapled quickly and conveniently. Since the stapling machines are usually placed at the end of a conveyor line, they are usually power driven so that an operator need only actuate certain controls in order to perform the stapling operation after the carton has been properly positioned or oriented in the machine.

It is common practice to use a source of compressed air which is directed into a power air cylinder on the stapling head for operating the staple driving blade and linkage which moves the retractable anvils to effect the clinching of a staple. In the past, it has been common practice to move the movable stapling head either manually or electrically. In many installations, the bulk or mass of the stapling head, which includes the staple mechanism, the air cylinder and the control means, was so great that it was impossible or impractical to move the movable stapling head manually toward the carton to be closed, especially since the control means thereon sometimes consisted of relatively heavy electrical equipment. Moving the stapling head electrically by means of motors added still more weight to the machine, introduced further problems, and greatly increased the cost of the machine.

One of the principal objects of the invention is to cause and control the movement of the movable stapling head in a stapling machine by the same source of power which actuates the stapling mechanism. Another object of the present invention is to provide a power driven stapling machine having a movable stapling head but requiring no expensive electrical control system for moving the stapling head or actuating the stapling mechanism. Another object is to provide a stapling machine which is fully pneumatically operated.

Another object is to use compressed air to quickly and positively move the stapling head into contacting relation with a carton to be stapled. Another object is to provide a simple and inexpensive actuator which requires

only a source of air under pressure to move the stapling head.

These and other objects and advantages will become apparent hereinafter.

The present invention is embodied in an actuator for moving a stapling head a limited distance and then retracting same, said actuator having an air cylinder with a piston therein and means for returning said piston. The invention is also embodied in a stapling machine having a removable center frame therein, said center frame having a fixed stapling head and a movable stapling head mounted thereon.

The invention also consists in the parts and in the arrangements and combination of parts hereinafter described and claimed. In the accompanying drawings which form part of this specification and wherein like numerals and letters refer to like parts wherever they occur:

Fig. 1 is a perspective view of a movable stapling head embodying the present invention vertically mounted in a stapling machine,

Fig. 2 is a side elevational view of a movable stapling head embodying the present invention mounted horizontally in a table stapling machine embodying the present invention,

Fig. 3 is a top plan view of the machine shown in Fig. 2,

Fig. 4 is a cross-sectional view of the machine taken along the line 4—4 of Fig. 3,

Fig. 5 is a side elevational view, partially broken, of an actuator embodying the present invention,

Fig. 6 is a side elevational view, partially broken, of the actuator shown in Fig. 5 rotated 90 degrees,

Fig. 7 is a side elevational view, partially broken, of the actuator shown in Fig. 6 showing the piston and mounting plate at the end of their stroke,

Fig. 8 is a side elevational view, partly broken, of a modified form of actuator,

Fig. 9 is a side elevational view, partly broken, of the actuator shown in Fig. 8, rotated 90°, and

Fig. 10 is a diagrammatic view of the pneumatic system for actuating and operating the stapling heads of the table stapling machine shown in Figs. 2–4.

Referring now to the drawings in detail, it will be seen that the embodiment of the invention which has been illustrated in Fig. 1 shows an actuator 1 mounted in a vertical position with a stapling head 2 therebelow in a table stapling machine 3. The machine 3 comprises an upstanding mast or tower 4 having legs 5 thereon and a vertically adjustable table 6 with a work surface 7 of spaced rollers 8. A carriage 9 is adjustably mounted on said mast 4 by vertical adjustment means 10 and has a support bracket 11 extending laterally over said table 6. The actuator 1 is mounted in said bracket 11 by lateral adjustment means 12 in a substantially vertical position. The stapling head 2 is secured to the actuator 1, said stapling head having an air cylinder 13, a stapling mechanism 14 therebelow, a magazine 15 and an air operated control means 16 comprising an air valve 17 and a trip mechanism 18 which is more fully described in my co-pending patent application entitled "Air Operated Control Means for Stapling Machines" executed and filed concurrently herewith and given Ser. No. 573,796.

The actuator 1, as best shown in Figs. 5–7, comprises a cylindrical casing 19 having an air cylinder 20 in one end portion thereof and a relatively long spring chamber 21 in the other end portion. The air cylinder 20 has an end cap 22 and a movable piston 23 with a suitable O ring seal 24 therearound. A piston rod 25 is secured thereto by a lock nut 26. The piston rod 25 extends through an upper bearing 27 and a washer 28

and through the spring chamber 21 and a lower bearing 29 having an O ring 30 therein. The air chamber 20 has a combined inlet and outlet 31 for receiving and exhausting compressed air therefrom.

The piston rod 25 is provided with a cross pin 32 which is slidably mounted in a longitudinally extending slot 33 in said casing 19. A coil spring 34 circumscribes said piston rod 25. The lower end of the spring 34 abuts against the fixed lower bearing 29 and the upper end abuts against the washer 28. The lower end of the piston rod 25 extends through the bearing 29 and is provided with a mounting plate 35 on which the air cylinder 13 of a stapling head 2 may be mounted by means of bolts or the like. The casing 19 is provided with suitable grease fittings 36 for properly lubricating the moving parts and bearings.

Referring now to Figs. 2–4, the actuator 1 is shown in a horizontal position connected to the movable stapling head 2 on a table stapling machine 3*a* having a fixed stapling head 37 thereon in opposing relation thereto. As shown, the stapling heads 2 and 37 are mounted in a horizontal position for stapling the end flaps of a carton. The table stapling machine 3*a* shown in Figs. 2–4 comprises a rectangular table frame 38 and a center or inverted U-frame 39 which can be removed therefrom and placed in straddling position over a conveyor line if desired. The rectangular table frame 38 comprises two side units 40 with supporting legs 41 thereon and two detachable end units 42 which are secured thereto by means of bolts or the like. Each leg 41 has an upper leg portion 43 which telescopes over a lower leg portion 44 and is maintained in fixed relation thereby by means of a pin 45 inserted through one of a series of vertically spaced holes 46 and a screw 47 which extends through the upper leg portion 43 and prevents the lower leg portion 44 from falling if the table frame 38 is lifted. The table frame 38 is provided with a divided work surface 48 having a plurality of spaced rollers 49 thereon with an enlarged space 50 between two rollers to accommodate the movable stapling head 2 which can be mounted only several inches from the fixed stapling head 37 if desired or several feet away.

The center frame 39 is provided with adjustable legs 41 thereon at either end of a center bar 51. The fixed stapling head 37 is fixedly mounted on an upstanding support 52 at one end of said bar 51. The fixed head 37 is adjustable in a vertical direction on the support 52 by reason of the adjusting means 53 which takes the form of a bolt and plate. A carriage 9 is mounted on said bar 51 and can be moved thereon by means of the horizontal adjustment means 10. The carriage 9 has a bracket support 11 in which is mounted an actuator 1 by the vertical adjustment means 12. The stapling head 2 is secured to the lower or inner end of the actuator 1 in opposing relation to the fixed stapling head 37. When the staple heads 2 and 37 are relatively far apart, a removable unit 54 of two rollers is placed in straddling relation over the center bar 51 to cover the relatively wide opening 50. When the heads 2 and 37 are relatively close, no spacer unit 54 is required but when the heads are relatively far apart, one or more spacer units should be used to prevent a carton which passes between said stapling heads from tipping. The stapling heads 2 and 37 shown in Figs. 2–4 comprise the same elements as previously described, except that stapling head 37 requires no trip mechanism 18 since the operation of both heads 2 and 37 are controlled by the trip mechanism 18 mounted on the head 2.

The end units 42 are detachable from the side units 40 and the center frame 39 so that the entire table shown in Figs. 2–4 can be knocked down for shipping or storage purposes. In the knocked down form, the various units may be positioned side by side to form a relatively small compact unit for shipping or storage.

In operation, with the parts as shown in Figs. 1 and 2, compressed air is directed into the air cylinder 20 by actuating a pedal 55 or other control means which allows compressed air to flow through a conduit 56 to force the piston 23 away from the end cap 22 thereby compressing the spring 34 and moving the mounting plate 35 with the stapling head 2 thereon a predetermined distance, as shown in Fig. 7. When air is released from the air cylinder 20 through the outlet 31, the spring 34 forces the washer 28, piston 23 and piston rod 25 back to their normal inoperative position shown in Figs. 5 and 6. The distance which the mounting plate 35 moves can be varied and depends upon the size of the air cylinder 20 and size of the spring 34 used. In practice, a three or four inch stroke has been found to be satisfactory.

The purpose of the actuator 1 is to mount a movable stapling head 2 above the top of a carton to be stapled or beyond the end thereof so that the carton can be properly positioned within the machine with ease. The operator can then actuate the control means 55 which forces air into the air cylinder 20 and drives the movable stapling head 2 toward the carton thereby actuating the trip mechanism 18 and air valves 17 secured to the air cylinders 13 of the stapling heads 2 and 37 to clinch a staple. The stapling heads 2 and 37 are preferably provided with horizontal and lateral adjustment means so that one machine may staple a number of cartons of different sizes at a relatively high rate of speed.

One of the advantages of the mounting for two opposed stapling heads 2 and 37 as shown in Figs. 2–4 is that the rectangular table frame 38 may be removed therefrom leaving the center U-frame 39 with the two stapling heads 2 and 37 adjustably mounted thereon. This center U-frame 39 can then be placed over a belt conveyor or other conveyor means, not shown, for stapling the end flaps of cartons traveling thereon. The adjustable legs 41 and horizontal and vertical adjustment means 53, 10, and 12 for the stapling heads 37 and 2 permit the center frame 39 to straddle a conveyor of most any width and any height within limits.

In practice, it has been found that an actuator 1 having a stroke of about three to four inches is sufficient for good results. This allows the carton to be properly positioned within the margin with ease after which the operator can actuate the control means 55 which forces air into the air cylinder 20 and drives the stapling head 2 toward the carton to actuate the trip mechanism 18 at any time prior to reaching the maximum stroke. When the movable stapling head 2 is in abutting relationship to the carton, the piston 23 can be moved no further. After a staple has been clinched, the operator actuates the control means 55 to release compressed air from the air cylinders 20 and 13 thereby allowing the stapling head 2 to retract to its inoperative position shown in all views except Fig. 7. The actuator 1 can be mounted vertically, horizontally, or in any desired slanted position as is necessary to staple a carton.

Referring now to Figs. 8 and 9, the modified actuator 1*a* is shown therein having the same basic elements as the actuator 1 shown in Figs. 5–7, except that the piston 23 is returned by compressed air admitting compressed air to a piston return air chamber 21*a* to the left of the piston 23 instead of by the coil spring 34. The actuator 1*a* comprises a cylindrical casing 19*a* having an air cylinder 20 in one end portion and a piston return air chamber 21*a* within said cylindrical casing 19*a* on the opposite side of the movable piston 23. The piston return chamber 21*a* is provided with a fitting 57, which is a combined inlet and outlet for the chamber 21*a* and to which a separate conduit 57′ from the foot pedal 55 is attached. Thus, the modified actuator 1*a* requires two conduits 56, one for the air chamber 21 to the right of the piston 23 and one for the piston return air

chamber 21*a* to the left of the piston 23. The foot pedal 55 controls a four-way valve when the modified actuator 1*a* is used or a three-way valve when the actuator 1 is used.

The piston rod 25 extends through the upper bearing 27 which may be suitably supplied with sealing means 28*a* for preventing the escape of air from the piston return chamber 21*a*, which is in effect that portion of the air cylinder 20 to the left of the piston 23.

To operate the modified actuator 1*a*, the pedal 55 is depressed to direct compressed air into the air cylinder 20 through the conduit 56 thereby forcing the piston 23 leftwardly thereby moving the mounting plate 35 and the stapling head 2 to effect a stapling operation. To withdraw the stapling head 2, the foot pedal 55 is operated so as to direct compressed air to the left side of the piston 23, that is, into the piston return chamber 21*a*, so as to cause the piston 23 and stapling head 2 to move rightwardly, thereby returning the machine to the inoperative position shown in Figs. 2–4.

Fig. 10 shows a diagrammatic view of the pneumatic system for operating a table stapling machine having a plurality of stapling heads therein such as shown in Figs. 2–4 and having a modified actuator 1*a* thereon. Referring to Fig. 10, a commpressor 58 supplies compressed air to a filter, oiler, and regulator unit 59 which is usually mounted on the table stapling machine itself. Compressed air is fed to the air valve 17 of the movable stapling head 2 through a conduit 60 having a short conduit 61 extending to the opposite side of said air valve so that the same pressure is directed into each end of the air valve 17. If desired, the short conduit 61 can be eliminated and replaced by a separate conduit 62 shown in the dotted lines, leading directly from the unit 59. A supply or working conduit 63 is connected to the conduit 60 so that the same air pressure is directed to the corresponding places of the air valves 17 on both heads 2 and 37. Another conduit or control line 64 extends from the conduit 61 into the corresponding portion of the air valve of the second stapling head 37. In instances where the separate line 62 is not used, valves 65, 65′, and 65″ may be included in the conduits 61, 63, and 65 respectively as shown in Fig. 10 to render the second or fixed stapling head 37 inoperative, or if preferred, the first or movable stapling head 2 inoperative. The valve 65 is a needle valve, and the valves 65′ and 65″ are manual shut off valves for the fixed head 37 and movable head 2.

Thus, it is apparent that only one trip mechanism 18 is necessary in each system since conduits can be taken from the lines leading to said first stapling head and inserted at corresponding places in the air valves of other staple heads. It is also apparent that the lines such as 60 and 63 which supply air to the air valves 17 and air cylinders 13 for operating and actuating the stapling mechanisms 14 receive a constant supply of compressed air and are completely independent of the air system which supplies air through the conduit 56 to the actuator 1 upon actuation of the pedal 55, even though the same source of compressed air may be used.

The invention is intended to cover all changes and modifications of the example of the invention herein chosen for the purposes of the disclosure, which do not constitute departures from the spirit and scope of the invention.

What I claim is:

1. A stapling machine adapted to straddle moving conveying means for stapling the opposite sides or ends of cartons traveling thereon, said stapling machine comprising a frame having a center bar extending transversely of said conveying means with supporting means on the end portions thereof, said center bar having a pair of upstanding supports thereon, at least one of said supports being horizontally adjustable on said center bar toward and away from said other support, a stapling head connected to each of said upstanding supports in opposing relationship to each other for stapling a carton therebetween, at least one stapling head having an actuator thereon actuated by compressed air and connected to said upstanding support for moving said stapling head toward and away from a carton to be stapled, each of said stapling heads having air operated means thereon for controlling and operating said stapling head for driving and clinching a staple, a trip mechanism on one of said stapling heads for actuating said air operated means, and operator control means for allowing compressed air to flow to said actuator to move one of said stapling heads toward the other to operate the trip mechanism thereby causing a stapling operation.

2. A stapling machine adapted to straddle moving conveying means for stapling the opposite sides or ends of cartons traveling thereon, said stapling machine comprising an inverted U-frame having a center bar extending transversely beneath said conveying means with adjustable legs extending downwardly from the end portions thereof, said center bar having an upstanding support at one end thereof and a horizontally adjustable support on said center bar movable toward and away from said first support, a stapling head connected to said first upstanding support, said horizontally adjustable support having an actuator connected thereto in parallel relation to said center bar, said actuator being actuated by compressed air and having a stapling head thereon in movable opposing relation to said first stapling head, said actuator adapted to move said stapling head toward and away from a carton to be stapled, each of said stapling heads having an air cylinder thereon and an air valve for controlling said air cylinder for driving and clinching a staple, a trip mechanism on said stapling head connected to said actuator, and operator control means for allowing compressed air to flow to said actuator to move the stapling head connected thereto toward said other stapling head to operate said trip mechanism thereby causing a stapling operation, compressed air flowing to said air cylinders and air valves on said stapling heads upon actuation of said trip mechanism.

3. A stapling machine comprising a frame, said frame having a center frame having a center bar with legs at either end thereof, a removable rectangular table frame mounted in straddling relation to said center frame, said table frame having legs at the corners thereof, said center frame having an upstanding support at one end thereof for receiving a fixed stapling head, said center frame having a support at the other end thereof which is horizontally adjustable on said center bar toward and away from said first mentioned support, a movable stapling head mounted on said last-mentioned support, said stapling head adapted to move toward and away from said fixed stapling head.

4. A stapling machine comprising a frame, said frame having a center frame having a center bar with adjustable legs at either end thereof, a rectangular table frame removably connected to said center frame for supporting the latter in an upright position, said table frame having two side units with adjustable legs thereon and end units connecting said side units, said table frame having a plurality of rollers thereon mounted parallel to said center bar on either side thereof thereby leaving an open space above said center bar, an upstanding support on one end of said center bar for receiving a stapling head, said stapling head being vertically adjustable in said support, a second upstanding support mounted on said center bar at the opposite end portion thereof, said second support being adjustable on said center bar toward and away from said first support, an actuator adjustably mounted in said second support and in parallel relation to said center bar, said actuator being actuated by compressed air and having a stapling head connected thereto in opposing relation to said first stapling head, air oper-

ated means mounted on said stapling heads for controlling the operation thereof, and operator controlled means for allowing compressed air to flow to said actuator to move one of said stapling heads toward the other to operate the trip mechanism thereby causing a stapling operation.

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