Feb. 19, 1952 A. G. JUILFS 2,585,939

STAPLE DRIVING MEANS FOR PORTABLE PNEUMATIC STAPLERS

Filed Aug. 23, 1950

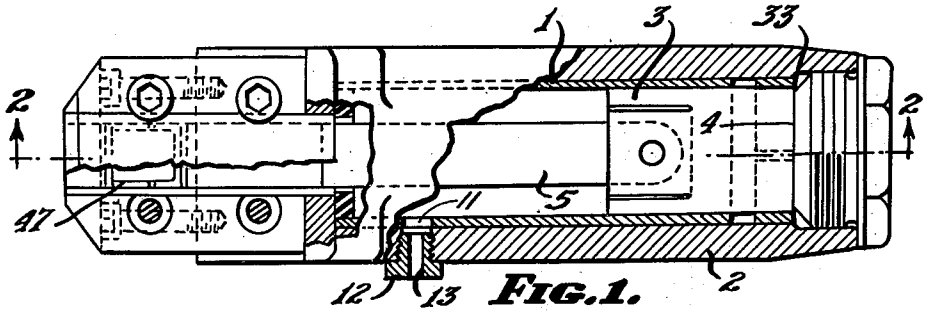

FIG. 1.

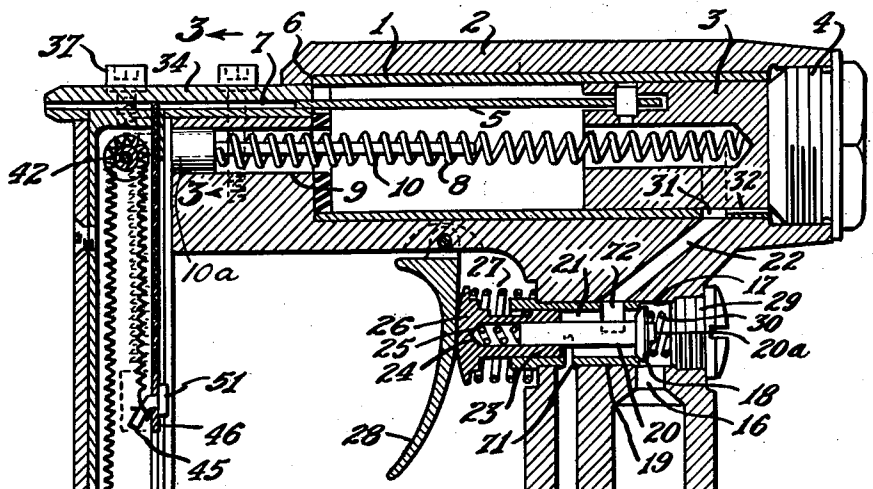

FIG. 2.

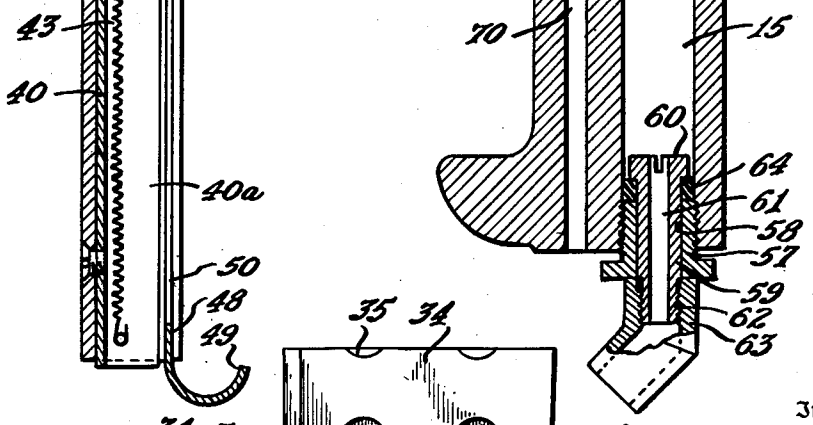

FIG. 4.

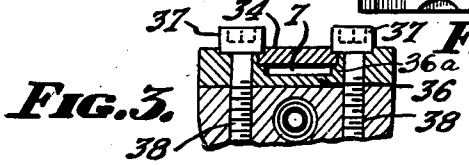

FIG. 3.

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STAPLE DRIVING MEANS FOR PORTABLE PNEUMATIC STAPLERS

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12 Claims. (Cl. 1—49)

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My invention relates to a portable pneumatic stapler primarily designed for stapling upholstery to the interior of automobile bodies, and in particular this invention relates to novel staple drive mechanism for such a stapler. In my copending application entitled Staple Magazine and Feed Means for Pneumatic Staplers, filed November 23, 1949, bearing Serial No. 128 941, and issued as U. S. Letters Patent No. 2,585,941 on February 19, 1952, I have disclosed a staple feed mechanism. Reference is also made to my copending applications as follows: Staple Drive Mechanism for Portable Pneumatic Staplers, filed of even date herewith and bearing Serial No. 181,023; Staple Feed Mechanism for Portable Pneumatic Staplers, filed of even date herewith, bearing Serial No. 181,024, and issued as U. S. Letters Patent No. 2,585,942 on February 19, 1952; and Valve Control System for Portable Pneumatic Stapler, filed of even date herewith, bearing Serial No. 181,026, and issued as U. S. Letters Patent No. 2,585,940 on February 19, 1952.

A principal object of the present invention is to provide a portable pneumatic stapler in which the staple driving means are so arranged that the stapler can be used to drive staples in corners and crevices generally difficult to reach.

A further object of this invention is to provide staple driving means which can be easily and quickly disassembled in order to clear the staple gun of jammed or bent staples.

Another object of this invention is to provide staple driving means of such type that the nose through which the staples are discharged and the driver for driving the staples can be quickly and easily changed without having to make any change in the stroke of the piston to which the staple driver is fastened.

A further object of the present invention is to provide a portable pneumatic stapler which is rugged and which can be manufactured cheaply.

These and other objects and advantages of my invention will become apparent to those skilled in the art during the course of the following description and from reference to the accompanying drawings in which like numerals are used to designate like parts throughout the same, and in which,

Figure 1 is a plan view of a portable pneumatic stapler constructed according to my invention and with parts broken away and parts shown in section in order to show the internal mechanism of the stapler,

Figure 2 is a cross section of the stapler shown

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in Figure 1 taken on the section line 2—2 of Figure 1,

Figure 3 is a cross section of a portion of the forward end of the stapler taken on the section line 3—3 of Figure 2, and

Figure 4 is a plan view of a strap which forms the top wall of the staple driving guide for driveway.

Briefly, in the practice of my invention, a portable pneumatic stapler including a cylinder having a piston is actuated by compressed air. The piston activates a staple driver which picks up a staple from the feed and drives it through the material and into the base to which the material is to be attached.

The piston is actuated by the compressed air in its drive but returned to its home position by a helical spring.

In the wall of the cylinder carrying the staple driving piston, I provide an exhaust or leak vent for permitting the air between the piston and the base of the cylinder to exhaust when the piston is driven. This vent is positioned between the piston in its retracted position, that shown in Figure 2, and the other end or base of the cylinder so that it is sealed off as the piston passes the vent and a cushion of air is formed between the piston and the end of the gun to absorb the shock of the movement of the piston. When air of very high pressure is used, this vent should be relatively small, while when very low air pressure is used, the vent should be larger. In order to provide a gun or staple driver which may operate on different air pressures, I provide a nipple which is removable from the vent so that when high pressure is used, a nipple having a slight aperture may be screwed into the gun, while in using low pressure a nipple having a larger aperture may be screwed into the gun.

Referring to the drawings, I provide a cylinder 1 located in the stapler housing 2 and carrying the piston 3. One end of the cylinder 1 is enclosed by the plug or cylinder head 4. There is a staple driver 5 pinned to the piston 3 which projects beyond the opposite end 6 of the cylinder onto a guiding track 7. The end 6 of the cylinder 1 is closed by the housing 2, excepting for the track 7 which is closed by the driver 5. The piston 3 is urged to its retracted position by the helical spring 8 which is based in an aperture 9 in the housing 2. The spring 8 is kept in line by a rod or pin 10, also based in the housing 2 and aperture 9. This rod 10 may be fixed to a plug 10a just nicely fitting within the bore or aperture 9.

Since the portion of the cylinder 1 between the piston 3 in its retracted position and the end of the gun is thus sealed, a vent 11 is provided in a side wall of the cylinder 1 and a corresponding vent is provided in the housing 2. These vents are located between the piston 3 in its retracted position and the head 6 to permit the exhaust of the air within the cylinder when the piston is actuated. The vent 11 is positioned slightly short of the end 6 so that as the piston 3 passes the vent 11, air is entrapped between the piston 3 and the forward end of the gun, thus forming a cushion. In order to permit the use of different air pressures in actuating the gun, I provide a nipple 12 having an aperture 13. This nipple is located in the housing vent which corresponds to the cylinder vent 11. Different nipples 12 are provided having different sized apertures 13 so that the appropriate nipple may be used with the gun, depending on the air pressure used to operate the gun. Also the striking power of a staple gun constructed according to my invention can be easily changed without having to change the air pressure all over the plant. This is a distinct feature of my invention and one not to be found in other staple guns known to me.

The handle portion 14 of the gun contains a pressure chamber 15, the lower end of which is attached to the compressed air line. The upper end terminates in a passageway 16 which communicates with a chamber 17. Within the chamber 17 is a valve 18 seated against one end of a sleeve 19 so as to seal off the interior of this sleeve from the passageway 16 and chamber 17. The valve 18 is mounted on a rod 20 within the interior or chamber portion 21 of the sleeve 19. There is a passageway 22 which communicates with the chamber 21 and the inlet port of the cylinder 1.

Slidably mounted within the sleeve 21 is a bushing 23 which has an internal bearing 24 to accommodate the end of the rod 20 carrying the valve 18. Within this bearing is a relatively weak coil spring 25 which urges the rod 20 away from the closed end of the bushing 23. The bushing 23 terminates in an abutment 26 which is urged from the handle 14 by a relatively strong helical spring 27. I also provide a trigger 28 pivoted in the stapler body or housing 2 to assist in the pressing of the operating button 26. Located between the valve 18 and a plug 29, and about an extension 20a of the rod 20, there is positioned a spring 30.

From the above, it is apparent that as the trigger 28 is squeezed and the button 26 pressed against the pressure of the spring 27, first of all the relatively weak spring 25 is depressed, since the pressure in the chamber 17 (plus the pressure of spring 30) against the valve 18 is normally greater than the tension of the spring 25. However, as the spring 25 is further depressed, its tension increases until it bears the pressure of the air in the chamber 17 and spring 30. This opens the valve 18 slightly and then the spring 25 snaps the valve 18 wide open. This is explained as follows. At the instant the valve member 18 is first cracked, air bleeds past the member 18 into the chamber 21, through the passageway 22 and through a longitudinal groove 32, to be described, where it meets the resistance offered by the small groove 32 and the piston 3. Pressure then builds up in the chamber 21 (the exhaust port 71 being closed as will be described) and this pressure helps to counterbalance the air

pressure in chamber 17 and the tension in spring 30. When this condition exists the compression of spring 25 serves to force the valve member 18 to its full open position suddenly. Such condition comes into existence very soon after the valve is first slightly cracked in the manner described. It should be noted that the result will be the same regardless of how slowly the trigger 28 is pulled; all that matters is that the spring 25 is finally so compressed that the valve is first cracked slightly—the sudden and complete opening of the valve will then occur automatically if the other parts are arranged as described. By this arrangement the operation of my staple gun is made independent of the "touch" of the operator; even and smooth driving power and operation are thus assured at all times.

The inlet passageway 22 terminates in a port 31 of substantial size. There is a small groove 32 cut in the inner wall of the cylinder 1 under the piston 3 in its retracted position which runs to the rear of the piston 3, so that as air is admitted to the rear of the piston 3 by the groove 32 there is a relatively short, slow travel of the piston 3 and then a hard, rapid travel when it passes the port 31. To this end there is provided an annular recess 33 near the head 4 which communicates with the groove 32.

Also provided in the handle 14 of the staple gun is an exhaust passageway 70. This passageway communicates with the chamber 21 through an exhaust port 71 formed in the sleeve 19. Another port 72 is formed in the sleeve 19 and this latter port communicates with the passageway 22.

The operation of this valve arrangement is as follows. When the trigger 28 is pulled and the button 26 thereby depressed the valve 18 is moved away from the end of the sleeve 19 in the manner above described. Air then passes from the chamber 15, through the passageway 16, into the chamber 17, past the valve 18 into the chamber 21, through the port 72, into the passageway 22, through the port 31 and groove 32, and piles up behind the piston 3 thereby moving it away from the head 4. When the piston 3 moves past the port 31 a large amount of air enters behind the piston and drives it hard and fast whereby the staple driver 5 picks up a staple 47 positioned in the slot 7 and drives it into the work. Such drive is cushioned by the air cushion governed by vent nipple 12. During this time the exhaust port 71 is blocked by the bushing 23.

On release of the trigger 28 the spring 27 returns the button 26 to the position of Figure 2 and the spring 8 returns the piston 3 to its starting position. Air collected between the piston 3 and head 4 is exhausted out the port 31 (and groove 32), through the passageway 22, through the port 72 into chamber 21, out port 71 (valve 18 now seating against the end of sleeve 19) and finally through the exhaust passageway 70.

The large air chamber 15 permits the use of relatively small air lines thereby making the staple gun very easy to manipulate.

The staple driver 5 is pinned at one end to the piston 3 and the head or driving end rides in a groove or slot 7. The slot 7 is closed by means of a plate 34 which has beveled or cut away portions 35 (see Figure 4). The plate 34 when placed in position over the passageway 7 rests on shoulders 36a of the member 36 (this member forming the bottom of slot 7 and may be considered as a base plate on which the plate 34 rests) and is held in position by the heads 37 of the bolts 38 resting in the indentations 35 (see Figure 3),

This permits the easy removal and replacement of the plate 34 and the availability of the passageway 7 and the nose and feed mechanism in the event a staple becomes jammed.

A particular feature of the novel drive mechanism just described—and of the slot forming portions 34 and 36—is that by this construction the nose of the gun, and the driver 5 operating therein, can be changed without changing the stroke of the piston. Such arrangements make my staple gun quite adaptable to a great many jobs that can't be handled by conventional guns having a fixed staple drive condition. For example, by replacing the staple driver 5 with a longer member, and by substituting longer members for the slot forming portions 34 and 36, a staple gun having a staple ejecting nose which protrudes a considerable extent past the staple feed track may be achieved. A gun having such a long, relatively thin nose can be used to do stapling in deep crevices not accessible to the ordinary gun. The amount by which the length of the driver 5 can be increased is determined, see Figure 2, by the distance between the forward end of the driver 5, when the piston 3 is in its retracted position, and the point at which the feed track brings staples into position at the slot 7.

It should also be noted that I have so arranged the driver 5 and piston 3 that the driver is located or pinned to the piston above its axis. By so positioning the driver 5 I have provided a staple gun which can be used in crevices and the like heretofore not accessible to staple guns of this general type.

The staple feed comprises a staple track 40 having upstanding leg members 40a upon which rides a staple follower 46. On top of the staple track I provide a cover 48 which is longitudinally slidable in a second track positioned over the staple track and which in turn has a slot 50 which receives a projecting boss 51 on the staple follower 46. One end of the cover 48 projects beyond the track and terminates in a hook shaped finger grip 49. In order to feed the staples 47 uniformly, I provide a spring 43, one end of which is attached near one end of the staple tracks 40 and the body of which rides over a sleeve 42 near the other or staple feeding end of the track. The other end of the spring 43 is attached to a pin 45 carried by the staple follower 46. This spring lies within the upstanding leg members 40a of the track 40 and is straddled by the staples which are placed about the track. By this means the spring which feeds the staples is extremely long, so that tension at all times is uniform. In loading the stapler, the cover 48 is pulled down along its track. This in turn pulls the staple follower 46 towards one end of its track. Staples are then placed about the track, the cover forced completely into its track, and the follower moved against the stack of staples by the spring 43. The slot 50 in the cover 48 permits the cover to be forced into closed position even though the follower must initially remain near that end of its track removed from the gun nose, and it also permits the follower 46 to move along the track and feed the staples as so urged by the spring 43. It is to be understood that other means of feeding staples into the slot 7 in front of the driver 5 may be used.

By the above construction, a staple feeder is provided which permits the easy loading of the whole staple track without the necessity of having to completely remove any single part.

The staples 47 are continually fed into the nose of the gun and positioned in the slots 7 between the members 34 and 36 by the spring 43 and follower 46. When the driver 5 has picked up one of the staples and forced it out of the gun, another staple will be forced into the slot as the driver returns to its retracted position as seen in Figure 2.

In order to permit the easy manipulation of my gun, I provide a swivel coupling at the end of the chamber 15 and the handle 14 of the gun. This swivel connection consists of a nipple 57 screwed into the end of the chamber 15 and having a bore 58. A second nipple 59 is slidably positioned in the bore 58 of the nipple 57 with an annular head 60 within the chamber 15. The head 60 is larger than the body portion 59, so a shoulder or flange is formed which projects out over the inner end of the nipple 57 and prevents the nipple 59 from sliding out. An air passageway 61 is drilled through the nipple 59 and its outward end 62 is screwed into a hose coupling 63.

Between the head 60 of the nipple 59 and the end of the nipple 57, I provide an annular gasket 64.

From the above, it is apparent that when pressure is built up in the chamber 15, appreciable force is exerted against the head 60 of the nipple 59 attempting to drive it outwardly. However, this pressure forces the head 60 against the gasket 64 and thus provides a tight seal between the nipple 59 and the chamber 15. The nipple 59 may, however, be rotated within the nipple 57 and permit the easy movement of the gun during its operation.

From the above, it is apparent that I have provided a portable pneumatic stapler which is compact and light and which may be used in remote and inaccessible spots and corners.

The stapler may be used on air lines having different air pressures by merely changing the vent nipple 12 (Figure 1) to accommodate the different pressures. A novel feed is provided for the staples which permits a maximum of staples to be loaded without any projections riding with the staples which would catch in the clothing of the operator and tend to destroy the feed.

The connection between the air line and the gun itself is rotatable and hence the gun may be handled and placed in different positions with a minimum of difficulty.

The passageway which accommodates the staple driver 5 and the port through which the staples are fed into the nose of the gun are easily accessible by the mere removal of the two or more bolts.

A positive trigger mechanism is provided which insures the complete and efficient stroke of the piston no matter how slowly the trigger mechanism is depressed.

It is to be understood that modifications and changes can be made in my invention without departing from the scope and spirit thereof, and while I have shown my invention as embodied in certain structure for purposes of illustration, I do not intend to be limited by such structure except in so far as it is incorporated in the subjoined claims. It should be further understood that while I have shown certain novel features of staple gun construction in combination with one another—so that a full and complete disclosure of an operative staple gun could be made—many of these features can be employed independently of one another. Thus, the particular staple drive mechanism herein set forth and claimed may be used with staple feed mechanisms and valve con-

structions other than those disclosed herein. Having thus described my invention, what I claim as new and what I desire to protect by United States Letters Patent is:

1. In a portable pneumatic stapler, staple drive mechanism comprising a cylinder and cylinder head, a piston in said cylinder, means to admit compressed air into said cylinder near said head and behind said piston, a staple driver secured to said piston, said driver comprising a flat plate pinned to said piston, nose structure for said stapler having a slot therethrough adapted to receive said staple driver, means to feed staples into said slot ahead of said driver when said piston is against said head, means to cushion the driving stroke of the piston comprising an outlet vent located towards that end of said cylinder which is opposite said cylinder head and which outlet vent is closed before the end of the driving stroke, the stapler being substantially closed to the passage of air moved by said piston after said outlet vent is closed, and means to return said piston to said cylinder head when the supply of compressed air is cut off.

2. The stapler of claim 1 in which said outlet vent is closed by said piston, and in which said return means comprises a relatively long and weak spring.

3. The stapler of claim 1 in which said piston is provided with a slot thicker than said blade and substantially wider than said blade, said blade being pinned to said piston within said last mentioned slot for lateral movement with respect thereto.

4. The stapler of claim 1 in which said nose structure comprises a base plate, said slot being located in said base plate, and a cover plate secured to said base plate over said slot.

5. The stapler of claim 4 in which said base plate and said cover plate are removably secured to said stapler.

6. In a portable pneumatic stapler, staple drive mechanism comprising a cylinder and cylinder head, a piston in said cylinder, means to admit compressed air into said cylinder near said head and behind said piston, a staple driver secured to said piston, said driver comprising a flat plate pinned to said piston, nose structure for said stapler having a slot therethrough adapted to receive said staple driver, means to feed staples into said slot ahead of said driver when said piston is against said head, and means to return said piston to said cylinder head when the supply of compressed air is cut off, said nose structure comprising a base plate, said slot being located in said base plate, and a cover plate secured to said base plate over said slot, said plates being removably secured to said stapler.

7. The stapler of claim 6 in which said flat plate is pinned to said piston to one side of the axis thereof.

8. In a portable pneumatic stapler, staple drive mechanism comprising a cylinder and cylinder head, a piston in said cylinder, means to admit compressed air into said cylinder near said head and behind said piston, a staple driver secured to said piston, said driver comprising a flat plate pinned to said piston, nose structure for said stapler having a slot therethrough adapted to receive said staple driver, means to feed staples into said slot ahead of said driver when said piston is against said head, and means to return said piston to said cylinder head when the supply of compressed air is cut off, said piston having a slot thicker than said blade and substantially wider than said blade, said blade being pinned to said piston within said last mentioned slot for lateral movement with respect thereto.

9. The stapler of claim 8 in which said last mentioned slot is offset with respect to the axis of said piston.

10. The stapler of claim 1 in which said outlet vent is provided with a nipple having an orifice therethrough, said nipple being removable from said vent.

11. In a portable pneumatic stapler, staple drive mechanism comprising a cylinder and cylinder head, a piston in said cylinder, means to admit compressed air into said cylinder near said head and behind said piston, a staple driver secured to said piston, nose structure for said stapler having a slot therethrough adapted to receive said staple driver, means to feed staples into said slot ahead of said driver when said piston is against said head, means to cushion the driving stroke of the piston comprising an outlet vent located towards that end of said cylinder which is opposite said cylinder head and which outlet vent is closed before the end of the driving stroke, the stapler being substantially closed to the passage of air moved by said piston after said outlet vent is closed, and means to return said piston to said cylinder head when the supply of compressed air is cut off.

12. In a portable pneumatic stapler, staple drive mechanism comprising a cylinder and cylinder head, a piston in said cylinder, means to admit compressed air into said cylinder near said head and behind said piston, a staple driver secured to said piston, nose structure for said stapler having a slot therethrough adapted to receive said staple driver, means to feed staples into said slot ahead of said driver when said piston is against said head, means to return said piston to said cylinder head when the supply of compressed air is cut off, said nose structure comprising a base plate, said slot being located in said base plate, a cover plate disposed on said base plate over said slot, and means for removably securing said plates to said stapler.

ALBERT G. JUILFS.

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