

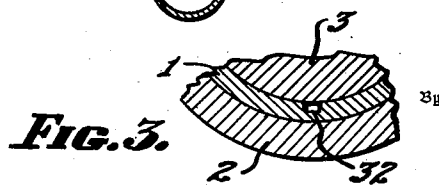
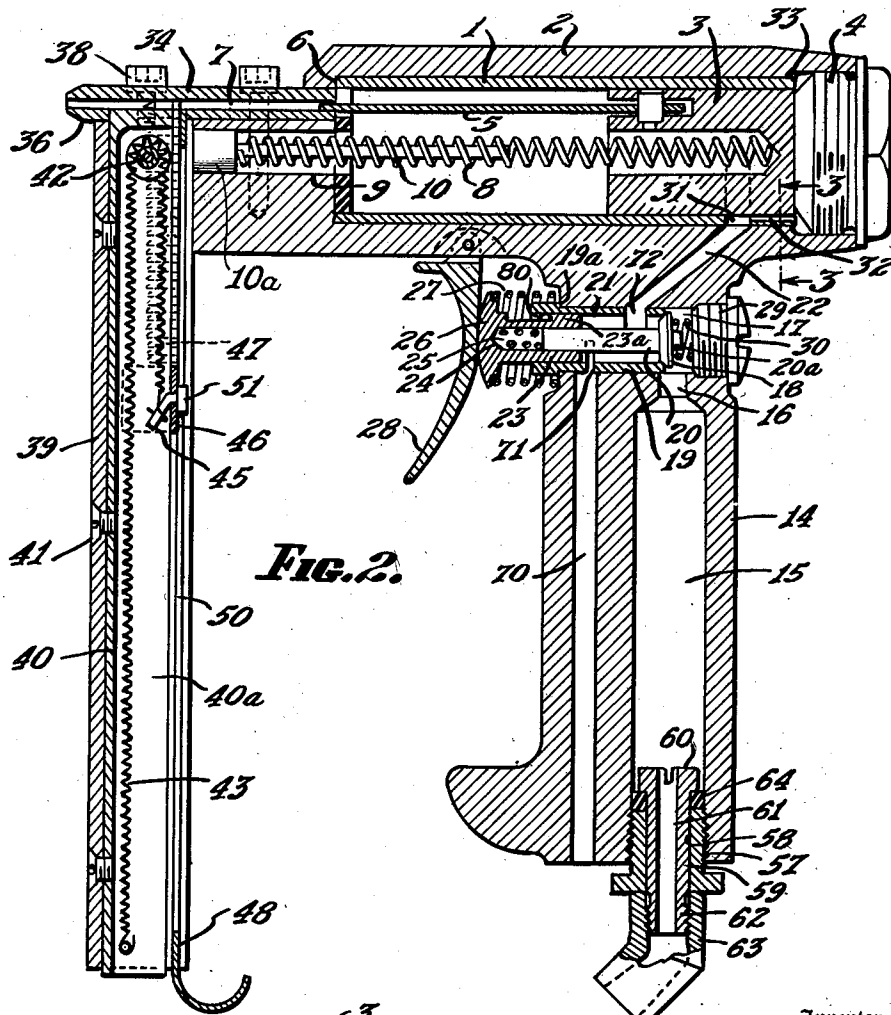
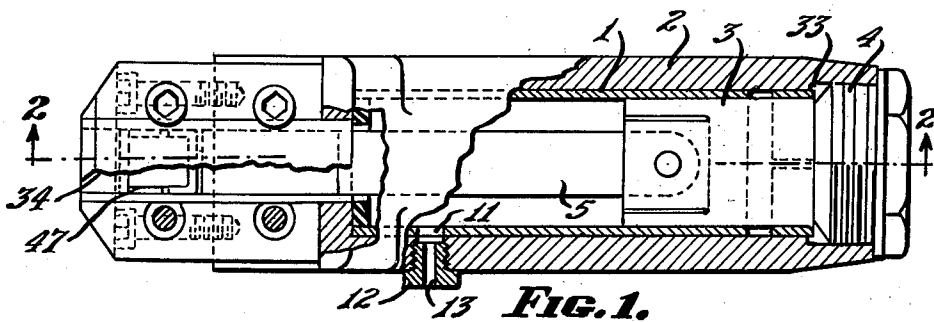
Feb. 19, 1952

A. G. JUILFS

2,585,940

VALVE CONTROL SYSTEM FOR PORTABLE PNEUMATIC STAPLERS

Filed Aug. 23, 1950



Inventor
ALBERT G. JUILFS,
Allen & Allen
Attorneys.

UNITED STATES PATENT OFFICE

2,585,940

VALVE CONTROL SYSTEM FOR PORTABLE
PNEUMATIC STAPLERS

Albert G. Juilfs, Newtown, Ohio, assignor to Senco
Products, Inc., Cincinnati, Ohio, a corporation
of Ohio

Application August 23, 1950, Serial No. 181,026

3 Claims. (Cl. 121—38)

1

2

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 pneumatic operating means and novel valve and port structure for actuating the staple driver. This application is a continuation-in-part of my copending application entitled Portable Pneumatic Stapler, filed November 23, 1949, and bearing Serial No. 128,941. Reference is also made to my copending applications as follows: Staple Drive Mechanism for Portable Pneumatic Stapler, filed of even date herewith and bearing Serial No. 181,023; Staple Feed Mechanism for Portable Pneumatic Stapler, filed of even date herewith and bearing Serial No. 181,024; and Staple Driving Means for Portable Pneumatic Stapler, filed of even date herewith and bearing Serial No. 181,025.

A principal object of the present invention is to provide novel port structure for introducing air into the cylinder, whereby the piston and staple driver associated therewith are driven, and novel port structure for exhausting the air on the return stroke of the piston.

Another important object of my invention is to provide means whereby the staple gun may be used with and adapted to air pressures which may vary from plant to plant.

A further object of my invention is to provide means whereby a relatively small air line may be used to supply the air to the staple gun, thus making the gun easy for an operator to manipulate.

Yet another important object of my invention is to provide novel trigger mechanism whereby the flow of air into the operating cylinder is positively controlled and not dependent on the different "touch" of various operators.

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 my pneumatic stapler with a portion cut away and a portion in section in order to show the internal mechanism of the stapler,

Figure 2 is a cross section of the stapler shown in Figure 1 taken on the section line 2—2 of Figure 1, and

Figure 3 is a sectional view taken on the line 3—3 of Figure 2.

Briefly, in the practice of my invention, a port-

able pneumatic stapler including a cylinder having a piston is actuated by compressed air. The piston drives 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.

I provide a valve for opening and closing the compressed air line into the cylinder which consists of two sleeves, one within the other. These sleeves are urged apart by a relatively strong spring. The internal sleeve embraces a reciprocable rod which carries a valve on its end which closes the inlet port for the compressed air. There is a relatively weak spring between the rod carrying the valve and the push button itself so that as the push button is pressed, the weak spring is first compressed until the compressed pressure of the spring on the rod is sufficient to overcome the pressure on the pneumatic line. When this point is reached and the pressure is overcome, the valve snaps open due to the expansion of the weak helical spring. Thus, no matter how slowly the push button is depressed, the valve will not open until the pneumatic pressure is overcome by an independent spring and then the valve itself is actually opened by the spring and not by pressure of the finger. This insures a quick opening no matter how slowly the button is depressed.

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 forward 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.

The compressed air line is attached to the handle of the staple gun by means of a swivel

3

joint which permits an easy manipulation of the gun. This joint comprises a boss screwed into the aperture of the handle and enclosing a box or pin having an open aperture therethrough. It includes a head on one end which is larger in diameter than the internal bore of the boss and is inserted with the head within the handle. A resilient gasket or washer is positioned between the head and the end of the boss. To the other end of the internal rod is screwed the end of the compressed air line. As pressure is built up within the chamber of the handle, this tends to force the head of the internal bolt against the washer and the end of the boss, thus forming an air-tight seal but permitting the turning or swiveling of the line and the bolt within the boss.

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 may be fixed to a plug 10a which fits just nicely 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 4 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

4

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. The sleeve or tube 19 is provided with a shoulder 19a which determines its position within the body of the stapler. Removably fixed in the tube 19 is a pin 30 which abuts against a portion 23a and thereby prevents the member 23 from being forced out of the tube 19 by the 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.

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 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.

From the above it is apparent that as the trigger 28 is squeezed and the button 26 is pressed against the pressure of the spring 27, first of all the relatively weak spring 25 is compressed since the air pressure in the chamber 17, plus the pressure of spring 30, is normally sufficient to overcome the spring 25 and to hold the valve member 18 in seated position. During this first compression of the spring 25, the member 25-23 moves past the exhaust port 71 and thereby closes it. Secondly, as the spring 25 is further compressed by further movement of the member 26, its compression increases until it is sufficient to unseat the valve member 18 a slight bit. At this instant, air bleeds past the member 18 into the chamber 21, through the passageway 22 and through the longitudinal groove 32 where it meets the resistance offered by the groove 32 and the piston 3. Pressure then builds up in the chamber 21 (the exhaust port 71 being closed as above 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 passage of air through this valve arrangement is as follows. When the trigger 28 is pulled and the button 26 thereby depressed the valve 18 is suddenly fully unseated in the manner just 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 larger 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 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.

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.

As above mentioned, in the particular type of staple gun herein disclosed 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 is bolted as at 38 to the lower plate 36 in which the slot is formed. The plates 34 and 36 form the nose of the staple gun and it should be observed that by the particular construction shown it is a relatively simple matter to change the size of plates 34 and 36 and also the length of the driver 5. In this way the nose construction can be changed without changing the stroke of the piston 3. It should be distinctly understood, however, that although I have shown the particular

driver disclosed herein as being pinned to the piston 3, it is quite possible that other staple driving means may be used, such as, for example, that disclosed in my copending application filed of even date herewith and entitled Staple Drive Mechanism for Portable Pneumatic Stapler, Serial No. 181,023. The important features of the staple drive means contemplated for use in guns built according to my invention is that the piston by which the driver is actuated, regardless of whether or not this driver is directly fastened to the piston, is stopped in its movement by an air cushion. The valve and port mechanism, and the pneumatic operating means herein described and claimed are equally effective regardless of which type staple drive mechanism is employed.

The staple feed shown in connection with the particular gun herein illustrated comprises a staple track 40 having upstanding legs 40a which are straddled by a staple follower 46. The track 40 is bolted as at 41 to a member 39 which is generally U-shaped in cross section, as is the track 40, and the arrangement of the members 39 and 40 is such that the staples straddle the legs 40a within the confines of the upstanding legs of the member 39. The members 39 and 40 are secured to the staple gun beneath the nose and slot determined by the plates 34 and 36.

On top of the staple track I provide a cover 48 which is longitudinally slidable in a second track positioned over the staple track 40 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 track 40 and the body of which rides over a sheave 42 located near the other or staple feeding end of the track. The other end of the spring 43 is attached to the pin 45 carried by the staple follower 46. This spring lies within the confines of the upstanding legs 40a of the track 40 and is therefore straddled by the staples 47 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 47 are then placed about the track, the follower 46 returned and the cover 48 forced completely into its track. The slot in the cover permits the follower to remain behind the staples 47 as the cover 48 is pushed into position and to then follow along the track and force the staples into the slot 7.

It should be understood that insofar as the operation of the novel pneumatic operating means and the novel port and valve structure is concerned, the particular staple feed mechanism employed does not constitute a limitation on my invention.

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 airlines having different air pressures by merely changing the vent nipple 12 to accommodate the different pressures. The connection between airline and the gun itself is rotatable and hence the gun may be handled and placed in different positions with a minimum of difficulty.

The positive trigger mechanism provided insures the complete and efficient stroke of the piston no matter how slowly the trigger mechanism is depressed and the air cushion specifically provided for, which cushion may also be regulated by the nipple 12, prevents undue wear and tear on the staple drive mechanism.

It is to be understood that modifications and changes may 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 insofar 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 pneumatic operating means and valve construction herein set forth and claimed may be used with staple drive mechanisms and staple feed mechanisms 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 having a staple driver actuated by a piston located within a cylinder and driven by compressed air, said cylinder having a cylinder head and means normally holding said piston against said head; control means comprising a manually operable valve controlling the flow of compressed air to said cylinder, an air port in the wall of said cylinder communicating with said valve and closed by said piston when said piston is against said head, an annular recess between said head and said cylinder, and a small longitudinal groove in the interior face of said cylinder wall running from said air port to a position substantially flush with said head and communicating with said recess, whereby air first entering said air port passes through said groove into said recess behind said piston and causes relatively slow movement of said piston, the movement of said piston being much faster after said piston is moved away from said air port.

2. The stapler of claim 1 in which said valve comprises a tube positioned in said stapler and having an opening which communicates with said air port, a member slideable in one end of said opening, inward movement of said member serving to block said exhaust port, a first spring opposing inward movement of said member, said first spring substantially surrounding said member, a valve rod having a sliding fit within a bore provided in said member, said valve rod extending within said tube, a second spring seated within said bore and bearing against one end of said valve rod, the other end of said valve rod carrying a valve member, and a third spring urging said valve member to seat against the other end of said tube whereby compressed air is normally prevented from entering said tube and said opening, said third spring being somewhat weaker than said second spring, the combined force of said third spring and of the incoming compressed air normally being sufficient to hold said valve member in seated position

until said exhaust port is blocked and said second spring so compressed by inward movement of said actuating member that said combined force is overcome and said valve member unseats a slight bit, some compressed air then passing into said tube and continuing through said opening and into said air port where it meets the resistance of said piston and said small groove whereby air pressure then builds up within said tube, the valve member being suddenly moved to its full unseated position by the action of said compressed second spring when the air so built up in said tube has sufficiently counterbalanced the pressure of the incoming compressed air.

3. In a portable pneumatic stapler having a staple driver actuated by a piston located within a cylinder and driven by compressed air and having a cylinder head and means normally holding said piston against said head and an air port in said cylinder; a valve for controlling the flow of compressed air to said air port, said valve comprising a tube positioned in said stapler and having an opening which communicates with said air port, a member slideable in one end of said tube, an exhaust port in said tube between said one end and said opening, inward movement of said member serving to block said exhaust port, a first spring opposing inward movement of said member, said first spring substantially surrounding said member, a valve rod having a sliding fit within a bore provided in said member, said valve rod extending within said tube, a second spring seated within said bore and bearing against one end of said valve rod, the other end of said valve rod carrying a valve member, and a third spring urging said valve member to seat against the other end of said tube whereby compressed air is normally prevented from entering said tube and said opening, said third spring being somewhat weaker than said second spring, the combined force of said third spring and of the incoming compressed air normally being sufficient to hold said valve member in seated position until said exhaust port is blocked and said second spring so compressed by inward movement of said member that said combined force is overcome and said valve member unseats a slight bit, some compressed air then passing into said tube and continuing through said opening and into said air port where it meets the resistance of said piston whereby air pressure then builds up within said tube, the valve member being suddenly moved to its full unseated position by the action of said compressed second spring when the air so built up in said tube has sufficiently counterbalanced the pressure of the incoming compressed air.

ALBERT G. JUILFS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
351,657	Schofield	Oct. 26, 1886
458,191	Ripley	Aug. 25, 1891
1,966,608	Cardwell et al.	July 17, 1934
2,087,138	Brick	July 13, 1937
2,101,159	Stevens	Dec. 7, 1937
2,134,735	Reinhold	Nov. 1, 1938