

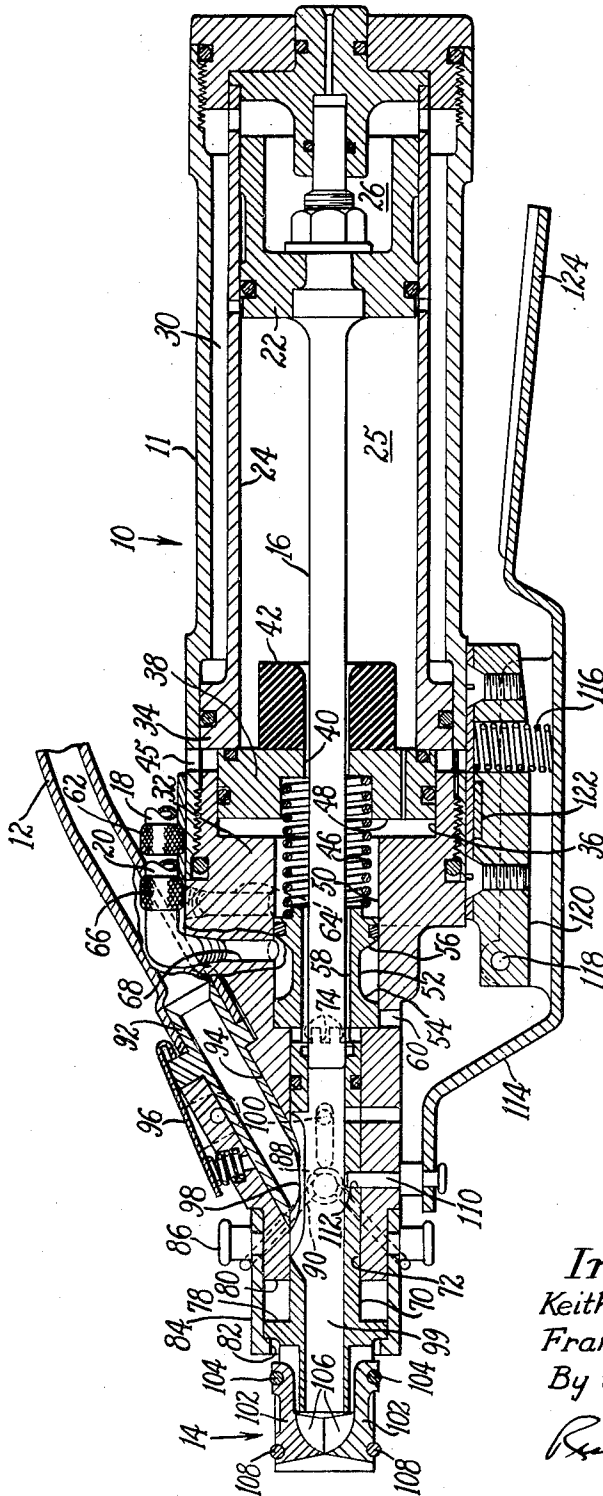
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FASTENER INSERTING DEVICES

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FASTENER INSERTING DEVICES

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1 Claim. (Cl. 1—44.4)

This invention relates to fastener inserting and particularly to portable pneumatic tools of the percussive type which are adapted for impact driving of fasteners, such as nails, sash pins, etc. Tools of this type are described in United States Patent No. 2,826,176, granted March 11, 1958, to Fred F. Chellis et al., and United States Patent No. 2,802,451, granted August 13, 1957, to Fred F. Chellis et al., and in our copending United States patent application Serial No. 622,458, filed November 15, 1956 (now Patent No. 2,875,730, granted March 3, 1959), of which this application is a division.

In the above-identified patents and in our application there are disclosed fastener inserting tools or guns which are effective in providing high impact energy for their size and weight. These guns each include a fluid motor comprising a piston slidable in a cylinder, the piston separating the cylinder into first and second chambers. A fastener driver in the form of a rod is attached to the piston and extends through the first chamber and out of the cylinder. To cock or activate these guns, pressurized fluid, preferably compressed air, is introduced into the first chamber moving the piston toward the opposite end of the cylinder. When the pressure of compressed air admitted to or trapped in the second chamber balances that admitted to the first chamber, the motion of the piston stops and it is ready to drive a fastener by means of the driver rod affixed thereto. To initiate driving, the pressurized air in the first chamber is rapidly released to atmosphere allowing the pressurized air in the second chamber to expand and move the piston and its driver rod in a percussive manner against a fastener positioned in the path of movement of the driver rod. The admission and release of compressed air to and from the first chamber is controlled by an internal pilot valve which is movable relatively to the motor and consequently to the tool as a whole.

It is the usual practice to trigger the pilot valve of a tool of the above-described type by simply pressing a movable portion of the tool, frequently a fastener positioning nosepiece, against the work, which effects a relative movement between it and the rest of the tool. This movement is transmitted to the pilot valve to release the compressed air from the first chamber. With this type of trigger mechanism it is possible to discharge the tool accidentally as, for example, by dropping the tool or by inadvertent contact with a person or object other than the work piece. The advantage in providing safety mechanism whereby the tool cannot be fired accidentally but rather only as a result of an intentional act on the part of an operator is obvious.

It is an object of this invention to provide a fastener inserting gun of the manually triggered type with means to prevent its accidental discharge.

Another object of this invention is to provide an impact fastener inserting tool of the type having a fluid motor which is triggered by effecting relative movement

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between two portions of the tool with means for preventing their accidental relative movement thereby to prevent inadvertent triggering of the tool.

In the guns of the type disclosed in the above-mentioned Chellis et al. patents, and in our copending application, the cocking and firing operations of the fluid motor are brought about by an internal pilot valve, the position of which, relative to the motor and consequently to the gun as a whole, determines the flow of pressurized air toward and away from a movable control valve. The control valve, in turn, controls the admission and release of air to and from the driver cylinder by moving into positions alternately to seal and unseal the cylinder. The gun is fired by physically moving the pilot valve relative to the motor or vice versa, which is accomplished by either moving the nosepiece of the gun against the work or the work against the nosepiece, respectively, the nosepiece being constructed so that its movement is translated to the pilot valve. The gun is recharged or cocked after firing by disengaging the gun and the work piece (a physical movement) whereby the pilot valve is returned to its original position either by air pressure acting on a differential area obtained by constructing the pilot valve as a two-diameter spool as disclosed in the Chellis et al. patents, or by a compression spring acting upon the pilot valve as disclosed in our copending application. Applicants have found that releasable locking means normally restricting the movement of the nosepiece, and hence the pilot valve, will prevent the inadvertent discharge of the gun since the discharge is contingent upon the pilot valve's physical movement. Furthermore, applicants have found that means in the form of a manually operated lever for releasing the locking means may be constructed and positioned in such manner as to permit one hand operation of the inserting gun with the same ease and speed of operation as has heretofore been possible without this safety feature.

In accordance with the various features of the invention, there is provided a fastener inserting tool having a driver operated by a fluid motor comprising a cylinder and a piston slidable therein and separating the cylinder into first and second chambers on either side thereof. Flow of pressurized fluid, preferably compressed air, into and out of the first chamber controls the movement of the piston within the cylinder. A valve casing communicates with the first chamber and a pilot valve slidably mounted in the valve casing controls the flow of fluid into and out of the casing and hence into and out of the first chamber of the cylinder by opening and closing appropriate entry and exhaust ports in the valve casing. Pressure, either fluid or mechanical, at all times urges the pilot valve into position for closing the exhaust ports. A pilot valve operating member in the form of a slidable sleeve is provided for moving the pilot valve to a position where the exhaust port is opened and the pressurized fluid is able to vent from the first chamber permitting pressurized fluid in the second chamber to expand and move the piston and its driver rod in a percussive manner against a fastener positioned in the path of movement of the driver rod. The sleeve is mounted for movement relative to the inserting tool having one end in contact with the pilot valve and on the opposite end it mounts jaw mechanism for releasably retaining a fastener in the path of movement of the driver. Releasable locking means normally restricting the movement of the sleeve relatively to the tool is provided to prevent the accidental displacement of the pilot valve and means in the form of a conveniently located manually operated lever is provided for releasing the locking means in order to permit the sleeve and hence the pilot valve to be moved to fire the gun.

The above and other features of the invention, in-

cluding various novel details of construction and combinations of parts, will now be more particularly described with reference to the accompanying drawing and pointed out in the claim.

In the drawing, the figure is a sectional view of a preferred form of fastener inserting tool embodying the invention.

The gun comprises an air motor 10 having an outer casing 11 which may be gripped by an operator while inserting fasteners, such as nails, sash pins, tacks, etc., which are delivered one at a time through a flexible tube 12 to a nosepiece 14 wherein they are held until they are engaged by an impact delivering rod or driver 16. Power is delivered to the driver by the air motor 10 which is connected by a line 18 to a source of compressed air. When the gun is fired, in a manner hereinafter to be described, pressurized air flows from the gun through a signal line 20 to actuate a remotely located fastener feeding mechanism (not shown) which delivers another nail to the gun through the tube 12. The feeding mechanism forms no part of the present invention.

The air motor comprises a piston 22 which slides in a cylinder 24 dividing the cylinder into a first chamber 25 and a second chamber 26. The cylinder 24 is concentric with and spaced from the casing 11, the space between the cylinder and the casing forming an air accumulator 30. Threaded in the casing 11 is a valve casing 32 in the form of an irregularly shaped, one-piece plug which extends from adjacent a flange 34 formed on the cylinder 24 to the left-hand end of the gun adjacent the nosepiece 14. The valve casing 32 is provided with a valve chamber 36 in which a control valve 38 is slidably mounted. The driver 16 passes through an enlarged bore 40 in the control valve 38 and through a similar bore in a shock absorber 42 fixed to the control valve. A plurality of passageways or exhaust ports 45 are circumferentially spaced in the casing 11 adjacent the flange 34. When the control valve 38 is in the position shown in the drawing, the exhaust ports 45 are blocked and compressed air will be retained in the tool, particularly chamber 25. A compression spring 46 urges the control valve 38 into its exhaust port sealing position. When, however, compressed air normally acting upon the left-hand face 48 of the control valve 38 is reduced sufficiently in pressure, in a manner hereinafter to be explained, the compressed air within the chamber 25 moves the control valve 38 to the left uncovering the exhaust ports 45 whereupon the compressed air in the chamber 25 escapes to atmosphere and the compressed air in the chamber 26 expands causing the driver 16 to be forceably driven to the left all in a manner explained in more detail in our above-identified application.

Adjoining the valve chamber 36 is a second valve chamber 50 also formed in the valve casing 32. Slidably in the valve chamber 50 is a pilot valve 52 in the form of a spool having flanges 54 and 56. The driver 16 passes axially through the pilot valve which is bored to provide a passageway 58 of greater diameter than the driver 16 to permit the flow of air from one end of the pilot valve to the other. A plurality of circumferentially spaced passageways or exhaust ports 60 in the valve casing 32 (only one of which is seen in the drawing), communicate with the valve chamber 50. The main air line 18 is connected by means of a fitting 62 to a passageway 64 communicating with the valve chamber 50. Similarly, the signal line 20 is connected by means of a fitting 66 to a passageway 68 also communicating with the valve chamber 50. The fittings 62 and 66 are circumferentially spaced apart sufficiently to permit the fastener delivery tube 12 to be accommodated between them.

A sleeve 70 is slidable in a bore 72 adjoining the second valve chamber 50 in the valve casing 32. Hereinafter the bore 72 is also referred to as the first bore and the second valve chamber 50 as the second bore. One end of the sleeve 70 mounts the nosepiece 14 and the other

end engages the flange 54 of the pilot valve 52. In this area of engagement the sleeve 70 is provided with circumferentially spaced slots 74, the reason for which will become more apparent hereinafter. The spring 46 acts against the flange 56 of the pilot valve 52 to urge the pilot valve 52 and the sleeve 70 to the left as seen in the drawing. The sleeve 70 has a flange 78 to limit its sliding movement between a shoulder 80 on the valve casing 32 and an annular shoulder 82 formed on a collar 84 slidably mounted on the valve casing. The collar 84 has a pair of ears 86 and the valve casing 32 is provided with a similar pair of ears 88 only one of which is seen in the drawing. Around the ears 86 and 88 is placed a spring 90 or other resilient means to hold the collar 84 on the valve casing 32.

The nail delivery tube 12, which passes between the fittings 62 and 66 on the outside of the gun, fits on the end of a tube 92 which is removably secured within a bore 94 in the valve casing 32 by a spring-biased pivotal clamp 96. The end of the tube 92 intersects a cut-away portion 98 of the sleeve 70 to permit the entry of fasteners to a fastener receiving chamber 99 which comprises a portion of the interior of the sleeve 70. To prevent rotation of the sleeve 70 relative to the valve casing 32, in order to assure that the cut-away portion 98 remains aligned with the tube 92, there is provided a conventional pin and slot connection 100 between the sleeve 70 and the valve casing 32.

The nosepiece 14 comprises a pair of jaws 102 which are pivotally secured by a ring 104 in slots formed in the end of the sleeve 70. The jaws have converging camming surfaces 106 which contact and retain a nail within the gun when it is delivered to the nail receiver 99. The jaws are yieldingly held together by a garter spring 108 in order to retain the nail in position to be driven. The jaws are pivoted outwardly against the force of the spring 108 as the nail passes through the camming surface 106 on its way into a work piece.

To prevent the gun from accidentally being fired, a safety locking mechanism is provided comprising a pin 110 slidable in the valve casing 32 transversely of the axis of the driver 16 and of the sleeve 70. It is engageable within a transverse bore 112 in the sleeve 70 to prevent movement of the sleeve relative to the valve casing 32 which movement, as will be explained in more detail hereinafter, initiates firing of the gun. The pin 110 is mounted on a lever 114 which is urged by a spring 116 in a clockwise direction, as seen in the drawing, about a fulcrum 118 comprising a pin fitted in a boss 120. The boss 120, and accordingly the lever 114, are secured to the outer casing 11, in any convenient manner, as for example, by a clamping bracket 122. On the end of the lever 114 remote from the pin 110 is a handle 124, which when pressed toward the outer casing 11, causes the pin 110 to be withdrawn from the bore 112 in the sleeve 70 permitting the sleeve to be moved relative to the valve casing 32.

The gun is operated to drive a fastener in the following manner. Before the gun has been fired once, there is no nail in the receiver 99; therefore, the gun must be either discharged once, in the manner now to be described, in order to have a nail delivered to the nail receiver or one may be inserted manually by removing the tube 92. The pilot valve 52 and the control valve 38 occupy the positions shown in the drawing, also referred to as their first positions, the spring 46 urging them in opposite directions. When the elements occupy the positions shown in the drawing, the air within the valve chambers 50 and 36 as well as the first chamber 25 of the motor is compressed. The gun is triggered to allow the pressurized air in the second chamber 26 and in the accumulator 30 to drive the piston to the left to a force delivering position by causing relative movement between the nosepiece 14 and the valve casing 32. As long as the pin 110 remains within the transverse bore

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112 in the sleeve 70, this relative movement cannot take place. Accordingly, before the gun can be triggered the handle 124 must be pressed toward the casing 11 to withdraw the pin 110 from the bore 112 in the sleeve 70. As heretofore, the operator grips the casing 11 with one hand and because of the convenient position of the handle 124 it can be pressed by one or more fingers.

Relative movement between the nosepiece and the valve casing 32 may be obtained in two ways: (1) by moving the entire gun against a stationary work piece whereupon the nosepiece 14 upon contact with the work piece is prevented from further movement while the outer casing 11 and the valve casing 32, which is secured thereto, move relatively to the nosepiece, or (2) by maintaining the gun stationary as, for example, clamped in a frame or on a bench and moving the work piece toward the gun to displace the nosepiece. The operation of the gun will be described by way of illustration only, with reference to the outer casing 11, and thus the valve casing 32, maintained in a stationary position, the work piece being moved against the nosepiece 14. Movement of the nosepiece 14 to the right results in movement of the sleeve 70 which in turn moves the pilot valve 52 to the right until it occupies a position called the second position with its flange 56 to the right of the air inlet passageway 64. The flange 78 of the sleeve 70 will then have contacted the shoulder 80 on the valve casing 32.

Movement of the pilot valve 52 to the right causes the exhaust ports 60 to be uncovered whereupon pressurized air within the valve chambers 50 and 36 flows rapidly to atmosphere through the bore 58 in the pilot valve, the slots 74 in the sleeve 70 and the ports 60. The passageway 68 which leads to the signal line 20 is in communication with the passageway 64, thus pressurizing the signal line 20 which causes the above-mentioned fastener delivering means to be actuated to deliver a subsequent fastener to the gun in a known manner. With the pressure on the left-hand face 48 of the control valve 38 thus relieved, the compressed air within the chamber 25 displaces the control valve 38 to the left uncovering the ports 45 through which the compressed air in the chamber 25 subsequently escapes. With the pressure within the first chamber 25 thus rapidly reduced the pressurized air within the chamber 26 and the accumulator 30 causes the piston 22 and the driver 16 to be propelled to the left in a progressive manner to the force delivering position wherein the nail then within the fastener receiver 99 is driven through the jaws 102 into the work piece. The piston continues toward the left in its force delivering stroke until it strikes the shock absorbing bumper 42, whereupon the nail will have been driven home.

As described in greater detail in our above-identified copending application, when the pressure within the chamber 25 approaches, but never reaches atmospheric, the control valve 38 will be re-seated by the spring 46 closing the passageways 45 and when the nosepiece 14 is disengaged from the work, the spring 46 will return the

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pilot valve 52 and the sleeve 70 to their original positions, as shown in the drawing thereby returning the driver 16 to its original position.

If it is desired to fire fasteners in rapid succession, the same may be accomplished by holding the handle 124 inwardly against the casing 11 and thus not permitting the pin 110 to enter the bore 112 in the sleeve 70. Thus, the nosepiece can be repeatedly pressed into and out of engagement with the work, each time a fastener being driven from the jaws. When the tool is to be put aside or if it is desired to cease driving fasteners temporarily, the handle 124 is merely released with the pin 110 entering the bore 112 under the action of the spring 116 when it becomes aligned therewith, thus providing a positive locking means to prevent the unintentional discharge of the tool.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent of the United States is:

A fastener inserting tool having a substantially elongated cylindrical configuration and comprising a driver, a motor for operating the driver, a valve casing attached to the motor, a first bore in the valve casing, a sleeve slidable in the first bore toward and away from the motor, fastener positioning jaws on the end of the sleeve remote from the motor for releasably retaining a fastener in the path of movement of the driver, a second bore in the valve casing contiguous with the first bore, a valve slidable in the second bore for controlling the flow and pressure of air therein, the valve being engageable by the end of the sleeve opposite the jaws and movable by the sleeve, movement of the valve toward the motor causing actuation of the motor to propel the driver against a fastener in the jaws, a transverse bore formed in the sleeve intermediate its ends, a pin slidable in the valve casing and engageable with the transverse bore in the sleeve to cause positive locking of the sleeve in the valve casing to prevent its movement and thereby to prevent actuation of the motor, a lever extending substantially lengthwise of the tool between the first bore and the motor for controlling movement of the pin, means pivotally mounting the lever on the tool intermediate its ends, one end of the lever engaging the pin in the valve casing, spring means in engagement with the lever to urge the pin into engagement with the transverse bore, the opposite end of the lever comprising a handle adjacent the motor whereby the pin may be withdrawn from the transverse bore to unlock the sleeve when the tool is grasped by its motor portion.

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