

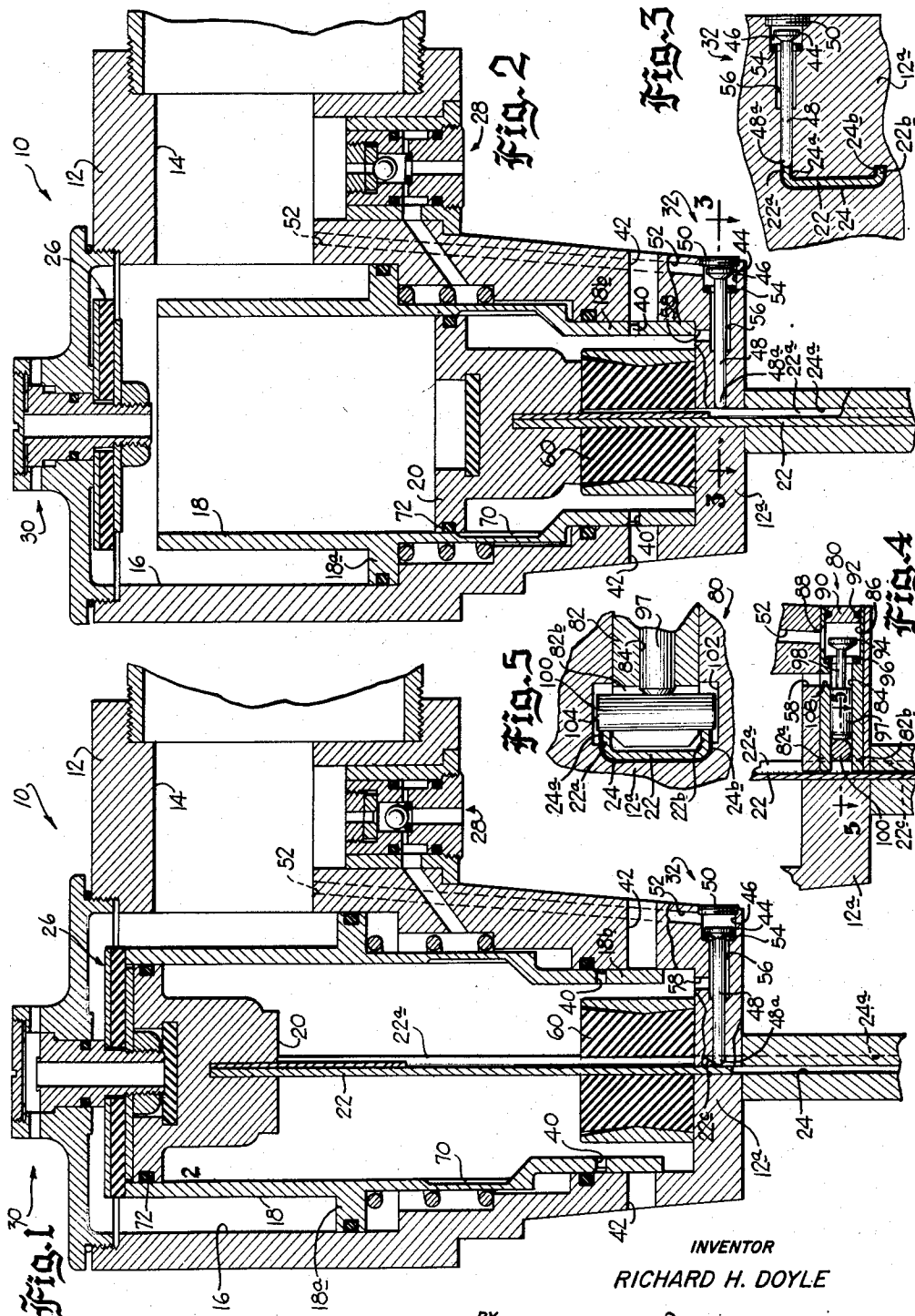
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FASTENER DRIVING APPARATUS

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FASTENER DRIVING APPARATUS

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This application relates to a fastener driving apparatus and, more particularly, to a new and improved pneumatically operated device for driving fasteners, such as staples and nails.

In the copending application of Oscar A. Wandel and Richard H. Doyle, Serial No. 630,883, filed December 27, 1956, which application is assigned to the same assignee as the present application, there is disclosed a pneumatically operated fastener driving device using a slidably mounted cylinder in which is disposed a piston for actuating a fastener driving blade or element. This driving device, by providing a lightweight piston and improved means including the movable cylinder for instantaneously admitting a large volume of compressed air to the cylinder, obtains deep penetration of a workpiece by a driven fastener. However, this prior driving device uses a compression spring interposed between the piston and a nosepiece for the apparatus in order to return the piston to its normal or released position at the end of each power or driving stroke. This spring somewhat complicates the design of the housing for the movable cylinder and also restricts the size of a piston bumper which is used to cushion the power stroke of the piston.

Accordingly, one object of the present invention is to provide a new and improved fastener driving apparatus.

Another object is to provide such an apparatus using a pneumatic piston return.

Another object is to provide a fastener driving device which obviates the need for a mechanical spring to return a work piston to a normal or released position.

A still further object is to provide a pneumatically operated fastener driving device including a cylinder and having novel means for selectively controlling the exhaustion of a portion of said cylinder.

A further object is to provide new and improved means controlled by movement of a fastener driving element for supplying compressed air to return a piston.

Another object is to provide a control valve having a valve operator including a fastener driving blade.

Another object is to provide a piston and fastener driving blade assembly including means for operating a valve.

Another object is to provide a fastener driving assembly including a movable cylinder for providing valve means for controlling communication between the atmosphere and the interior of the cylinder.

A still further object is to provide fastener driving apparatus including pneumatic means controlled by a fastener driving element for holding a work piston in a normal or released position.

In accordance with these and many other objects, one embodiment of the invention comprises a pneumatically operated tacker of the type disclosed and described in detail in the above identified copending Wandel et al. application. This device generally comprises a housing defining a chamber in which is slidably mounted a cylinder having a radially extending flange defining a piston. A piston having a connected driver blade is slidably

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mounted within the cylinder. The cylinder is normally biased into engagement with a movably mounted valve seat carried on the housing to close off communication between the chamber and the interior of the cylinder.

When the tacker is to be operated, compressed air is exhausted from one side of the radially extending flange to displace the cylinder and thus admit a large volume of compressed air from the chamber into the cylinder, thereby to drive the piston downwardly at a high rate of speed so that the driving blade engages and drives a fastener, such as a staple or nail, which is supplied to a drive track through which the driving blade extends. In accordance with the features of the present invention, when the cylinder moves downwardly, an aperture formed in the lower extremity thereof moves into alignment with an aperture formed in the wall of the housing defining the chamber to provide an exhaust port to permit the air entrapped below the piston to be exhausted to the atmosphere so that downward movement of the piston is not thereby retarded. Further, during this downward movement of the driver blade, a lower extremity of the blade engages a valve operating element so that a piston return valve is opened and held open to admit compressed air to the lower portion of the interior of the cylinder. However, this air is exhausted to atmosphere through the exhaust passageways in the cylinder described above.

When the apparatus is released, compressed air is again supplied to one side of the piston defining flange on the cylinder so that this cylinder is moved upwardly to close the exhaust passageways for the lower portion of the cylinder. When the cylinder moves to its uppermost position in which it again engages the main valve seat, passageways formed on the inner wall of the cylinder bypass a portion of the compressed air entrapped in the upper portion of the cylinder to provide a pressure differential which causes downward movement of the valve seat and the cylinder to a normal position. This downward movement of the main valve seat opens an exhaust valve to vent the upper portion of the cylinder. Concurrently therewith, the compressed air admitted by the piston return valve, which is held open by the displaced blade, builds up in the lower portion of the cylinder so that the piston is pneumatically returned to its normal position together with the driving element. Returning the driver blade to its normal position closes the piston return valve so that compressed air is no longer supplied to the lower portion of the cylinder. If the piston and the driver blade inadvertently are moved downwardly, the piston return valve is again operated by the driver blade to admit compressed air to the lower portion of the cylinder so as to hold the piston in its normal or uppermost position.

In one embodiment of the present invention, the piston return valve includes an operating stem which is directly engaged by a flange formed on one side of the driver blade so as to open this valve after a short initial downward movement of the piston. In another embodiment, the control valve is located along the center line of the driving blade, and a valve operating element extending substantially parallel to the blade is provided with portions which extend outwardly into offset openings formed in the drive track to be engaged by flanges or offset portions formed at both edges of the driver blade.

Many other objects and advantages of the present invention will become apparent from a consideration of the following description when taken in conjunction with the following drawings wherein:

Fig. 1 is a fragmentary sectional view of a pneumatically operated fastening device embodying the present invention which is shown in a normal or released position;

Fig. 2 is a fragmentary sectional view similar to Fig. 1

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showing the fastener driving device in an operated position;

Fig. 3 is a fragmentary sectional view taken along line 3—3 in Fig. 2, assuming that the entire fastener driving device is illustrated therein, which shows one embodiment of a piston return valve and operator means therefor;

Fig. 4 is a fragmentary sectional view illustrating another embodiment of the piston return valve and operator means therefor; and

Fig. 5 is an enlarged fragmentary sectional view of the piston return valve taken along line 5—5 in Fig. 4, assuming that the complete valve structure is shown therein.

Referring now to Fig. 1 of the drawings, therein is disclosed a pneumatic tacker or fastener driving device, indicated generally as 10, which is of the same type as that shown and described in the above identified copending Wandel et al. application. In general, the driving device 10 includes a housing 12 in which is defined a compressed air reservoir 14 and an enlarged chamber 16 in which is disposed a cylinder 18 having a piston defining flange 18a slidably mounted in a cylindrical portion of the chamber 16. A fastener driving means includes a piston 20 slidably mounted within the cylinder 18 and a driving blade 22 secured to the piston 20 which is adapted to move outwardly through a drive track 24 formed in a nosepiece 12a of the housing 12 to engage and drive suitable fasteners, such as staples or nails, supplied to the drive track 24 by a magazine (not shown). The upper end of the cylinder is normally closed off from communication with the chamber 16, which is continuously supplied with compressed air from the reservoir 14, by a main valve assembly 26 which is movably mounted on the housing 12.

To operate the tacker 10, a control valve assembly 28, which may be of the type disclosed in the copending application of Oscar A. Wandel and Richard H. Doyle, Serial No. 546,377, filed November 14, 1955, now abandoned, and assigned to the same assignee as the present application, is actuated to exhaust compressed air normally supplied to one side of the piston defining flange 18a. This creates a pressure differential across the flange 18a sequentially to cause downward movement of the work cylinder 18 and upward movement of the main valve assembly 26 so that compressed air from the chamber 16 and the reservoir 14 flows into the interior of the cylinder 18 at substantially full line pressure, without turbulence, and in large quantities to drive the lightweight piston 20 downwardly at a high rate of speed so that the blade 22 engages and drives a fastener. The upward movement of the main valve assembly closes an exhaust valve assembly 30 to permit the compressed air pressure to build up rapidly within the upper portion of the cylinder 18, and the downward movement of the cylinder 18 vents the lower portion thereof to the atmosphere to prevent any damping of the downward movement of the piston 20.

In accordance with the present invention, when the drive blade 22 moves downwardly through the drive track 24, a control or piston return valve 32 is operated and held open by the blade 22 to admit compressed air to the lower portion of the cylinder 18 beneath the piston 20. However, this compressed air does not retard the downward movement of the piston 20 inasmuch as the lower portion of the cylinder 18 is vented to the atmosphere, as described above.

When the valve 28, which is manually or automatically operated, is released, the cylinder 18 moves upwardly to engage the main valve element 26, which is disposed immediately adjacent the housing 10, to close off communication between the chamber 16 and the interior of the cylinder 18. During this upward movement, the exhaust connection for the lower portion of the cylinder 18 is closed. Further, during this movement, the interior of

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the cylinder 18 disposed above the piston 20 is placed in communication with the lower portion of the cylinder 18 by a plurality of restricted orifices so that the pressure of the compressed air in the upper portion of the cylinder 18 is decreased below that of the chamber 16. This pressure differential acts on the upper surface of the main valve assembly 26 to provide a force which moves the engaged cylinder 18 and the main valve assembly 26 downwardly to the position illustrated in Fig. 1.

In moving downwardly, the main valve assembly 26 opens the exhaust valve assembly 30 so that the pressure of the air trapped in the cylinder 18 between the upper surface of the piston 20 and the lower surface of the main valve assembly 26 is quickly vented to atmosphere. In order to return the piston 20 to its normal position (Fig. 1) from the position illustrated in Fig. 2, the compressed air admitted into the lower portion of the interior of the cylinder 18 under the control of the valve assembly 32 is permitted to build up during the upward movement of the cylinder 18 inasmuch as the exhaust connection for this portion of the interior of the cylinder 18 has now been closed by the upward movement of this cylinder. This compressed air acts on the lower surface of the piston 20 to move it upwardly to the position illustrated in Fig. 1, this upward movement serving to close the valve 32 when the piston 20 and the blade 22 are returned to their normal position. If the control valve 28 is again operated, the compressed air trapped in the lower portion of the cylinder 18 is adequate to hold the piston 20 in its normal or released position until the reoperation of the control valve 28. If, however, the tacker 10 remains idle, the entrapped air in the lower end of the cylinder 18 is dissipated and the piston 20 may begin to move downwardly so that the end of the driver blade 22 again operates the control valve 32 to admit air to the cylinder 18 to return the piston 20 to its normal or released position.

In view of the foregoing general description and since the construction and operation of the pneumatic tacker 10 is set forth in detail in the above identified and latter filed copending Wandel and Doyle application, a detailed description of the construction and operation of only the improvements in the construction disclosed in this prior application is set forth herein.

More specifically, in order to provide a control valve means for selectively exhausting the lower portion of the interior of the cylinder 18, a lower reduced diameter portion 18b thereof is provided with a pair of apertures 40. These apertures are normally disposed adjacent contiguous wall surfaces of the housing 12 when the tacker 10 is in the released position illustrated in Fig. 1 of the drawings so as to close off communication between the atmosphere and the lower portion of the interior of the cylinder 18. However, when the control valve 28 is operated to cause downward movement of the cylinder 18, the openings 40 move into alignment with a pair of openings 42 formed in the housing 12, thereby to place the lower portion of the interior of the cylinder 18 in communication with the atmosphere. Since the cylinder 18 moves downwardly prior to downward movement of the piston 20, the openings 40 and 42 exhaust the lower portion of the interior of the cylinder 18 to prevent an entrapment of air therein which would retard downward movement of the piston 20. Alternatively, when the control valve 28 is released to cause upward movement of the cylinder 18 to the position illustrated in Fig. 1, the openings 40 and 42 are moved out of alignment so as to seal off the lower portion of the interior of the cylinder 18. Sealing this portion of the cylinder 18 at this time permits the compressed air admitted under the control of the valve assembly 32 to return the piston 20 to its normal position.

The control valve assembly 32 is selectively operated under the control of the piston 20 and the driving blade 22 to selectively admit compressed air to the lower por-

tion of the interior of the cylinder 18 both for returning the piston 20 to its normal position and for retaining the piston in this normal or released position. The control valve assembly 32 comprises a valve head 44 which is disposed within a counterbore 46 in the nosepiece 12a of the housing 12 and which is connected to a valve operating stem 48 slidably mounted on the nosepiece 12a. The counterbore 46 is closed by a threaded plug 50 so that compressed air, which is continuously supplied to the counterbore 46 from the reservoir 14 through a passageway 52, acts on the enlarged valve head 44 to seat it on a resilient O-ring 54 disposed in the counterbore 46, thereby to prevent the flow of compressed air into the lower portion of the cylinder 18 when the tacker 10 is in the released position illustrated in Fig. 1. When the valve assembly 32 is displaced to the open position illustrated in Fig. 2, compressed air flows directly from the reservoir 14 through the passageway 52, the counterbore 46, a bore 56, and a passageway 58 into the cylinder 18. When the control valve 32 is released, the compressed air supplied by the passageway 52 forces the head 44 of the valve into seating engagement with the resilient O-ring 54, thereby to again seal off communication between the counterbore 46 and the bore 56.

To provide a means for selectively operating the control valve assembly 32, the driving blade 22 is provided with a pair of upstanding or flanged edge portions 22a and 22b which are slidably received within offset portions 24a and 24b of the drive track 24, the drive track 24 extending through both the nosepiece 12a and a resilient bumper 60 disposed within the lower portion of the interior of the cylinder 18. The ends of the flanged edge portions 22a and 22b are provided with tapered or inclined portions, as indicated at 22c on the flanged edge 22a. This tapered portion 22c is disposed immediately adjacent a rounded end portion 48a of the valve stem 48 which extends into the offset portion 24a of the drive track 24.

When the piston 20 and the drive blade 22 move downwardly under the control of the compressed air admitted into the upper portion of the cylinder 18, the inclined portion 22c cams the valve stem 48 and the valve head 44 to the right from the position illustrated in Fig. 1 to the position illustrated in Fig. 2 so that the control valve 32 is operated to admit air into the lower portion of the cylinder 18. The rounded end 48a of the valve stem 48 rides over a flat upper surface of the flanged edge 22a to maintain the valve 32 in an open condition during the entire downward working stroke of the piston 20, during the entire upward return stroke of this piston, and until such time as the piston 20 is restored to its normal position as illustrated in Fig. 1 of the drawings. In this manner, the valve 32 is opened in response to the first downward movement of the piston 20 and is retained in its open position to continuously supply compressed air to the lower portion of the cylinder 18 until such time as the piston 20 is returned to its normal or released position.

In operation, the control valve 28 is first actuated to cause downward movement of the cylinder 18 and upward movement of the main valve assembly 26, as described in detail in the above identified and latter filed copending application, to simultaneously close the exhaust valve 30 and to admit compressed air to the upper portion of the cylinder 18. This downward movement of the cylinder 18 moves the openings 40 and 42 into alignment so that, when the piston 20 moves downwardly, the air trapped beneath the piston 20 is exhausted to the atmosphere through the aligned openings 40 and 42. Further, the initial downward movement of the piston 20 and the driving blade 22 moves the cammed portion 22c of the flanged edge 22a into engagement with the rounded end 48a of the valve stem 48 so that the valve head 44 is displaced from the O-ring 54 to admit compressed air through the passageways 52, 46, 56, and 58 into the lower portion of the cylinder 18. However, this compressed

air, which passes through a plurality of somewhat restricted orifices, does not build up in the lower portion of the cylinder 18 but rather is exhausted to the atmosphere through the aligned openings 40 and 42. The continuing downward movement of the piston 20 and the blade 22 holds the valve head 44 in the position illustrated in Fig. 2 and also causes a fastener to be engaged and driven by the blade 22.

When the control valve 28 is released, the cylinder 18 moves upwardly to engage the main valve assembly 26 immediately adjacent the upper end of the chamber 16, as described in detail in the above identified copending application, so that the openings 40 and 42 are moved out of alignment to seal off communication between the lower portion of the interior of the cylinder 18 and the atmosphere. Accordingly, the compressed air supplied from the reservoir 14 under the control of the valve assembly 32 begins to accumulate in the lower portion of the cylinder 18, but is not sufficient at this time to displace the piston 20 upwardly. Further, in moving upwardly, a plurality of grooves 70 formed on the inner surface of the cylinder 18 are moved past a sealing O-ring 72 carried on the piston 20 so that the compressed air entrapped in the upper portion of the cylinder 18 between the upper surface of the piston 20 and the lower surface of the main valve assembly 26 is partially exhausted to the lower portion of the interior of the cylinder 18, thereby to provide a pressure differential across the main valve assembly 26 which causes the engaged main valve assembly 26 and the cylinder 18 to move downwardly to the position illustrated in Fig. 1 of the drawings. It is possible for the compressed air disposed above the upper surface of the piston 20 to be exhausted to the lower portion of the cylinder 18 even though compressed air is being admitted to the lower portion of this cylinder inasmuch as the pressure within the lower portion, which is being gradually increased by the air supplied by the control valve 32, is less than the pressure of the air entrapped between the main valve element 26 and the upper surface of the piston 20.

When the engaged work cylinder 18 and main valve assembly 26 move downwardly to the position illustrated in Fig. 1 of the drawings, the exhaust valve 30 is again opened to exhaust the compressed air remaining within the upper portion of the cylinder 18. Returning the upper portion of the interior of the cylinder 18 to atmospheric pressure together with the progressive build-up of compressed air within the lower portion of the cylinder 18 produces a differential across the piston 20 so that the compressed air supplied by the control valve assembly 32 quickly moves the piston 20 and the driving blade 22 upwardly to the normal position illustrated in Fig. 1 of the drawings. When the piston 20 reaches its uppermost position, as determined by engagement of the piston with the main valve element 26 and a portion of the exhaust valve construction 30, the rounded end 48a of the valve stem 48 moves out of engagement with the flanged edge 22a of the driving blade 20. This permits the compressed air supplied by the passageway 52 to act upon the enlarged end surface of the valve head 44 to displace it to the left and into seating engagement with the resilient O-ring 54, thereby closing off communication between the cylinder 18 and the compressed air reservoir 14.

The compressed air trapped beneath the piston 20 and the frictional engagement of the sealing O-ring 72 with the inner surface of the cylinder 18 is sufficient to retain the piston 20 in its normal or released position. However, the compressed air in the lower portion of the cylinder 18 soon becomes dissipated due to the lack of a sealing element between the openings 42 and the end of the reduced diameter portion 18b of the cylinder 18 and, if the frictional engagement of the O-ring 72 is not sufficient to retain the piston 20 in its normal position, the piston 20 and the blade 22 move slightly downwardly so

that the tapered portion 22c of the flanged edge 22a again engages and operates the valve stem 48 to open the valve 32. Compressed air is again supplied to the lower portion of the cylinder 18 to return the piston 20 and the blade 22 to their normal home position. In this manner, the piston 20 is retained in its normal or released position under the control of the valve assembly 32.

Referring now to Figs. 4 and 5 of the drawings, therein is disclosed a modified valve construction, indicated generally as 80, for controlling the supply of compressed air from the reservoir 14 to the lower extremity of the interior of the cylinder 18. This valve construction comprises a housing 82 which is substantially rectangular in configuration and which is mounted in a suitably formed opening in the nosepiece 12a of the housing 12 of the tackler 10. The housing element or insert 82 is provided with a bore 84 and with a counterbore 86. An opening 88 in the counterbore 86 is in communication with the passageway 52 and the open end of the counterbore is closed by a threaded plug 90 having a resilient sealing O-ring 92. The compressed air supplied through the passageway 52 seats a valve head 94 on a resilient O-ring 96 to prevent the admission of compressed air to the lower portion of the cylinder 18. The valve head 94 is connected to a valve operating element 97, which is slidably mounted in the bore 84, by means of a reduced diameter shank portion 98. The end of the operating element or stem 97 is pneumatically biased into engagement with a pin 100 which is movably mounted between bifurcated end portions 82a and 82b of the housing element 82 with the ends of the pin 100 disposed within a pair of similarly formed and opposite slots 102 and 104 provided in the nosepiece structure 12a. The slots 102 and 104 are in communication with the offset portions 24a and 24b of the drive track 24.

In the normal position of the control valve 80, the compressed air acting on the valve head 94 displaces the operator element 97 to the left, so that the pin 100 is disposed beneath the inclined portions 22c of the driver blade 22 and within the offset portions 24a and 24b of the drive track 24. When the control valve 80 is operated to initiate downward movement of the piston 20, as described above, the inclined portions 22c on the offset portions 22a and 22b of the driver blade 22 engage the end portions of the pin 100 and displace this pin to the right within the slot defined by the bifurcated end portions 82a and 82b so that the valve operating element 97 is displaced to the right to move the valve head 94 out of sealing engagement with the O-ring 96. This permits the compressed air supplied by the passageway 52 to flow through the counterbore 86, the bore 84, and an opening 108 in the wall defining the bore 84 to be supplied to the passageway 48. In this manner, downward movement of the piston 20 and the driver blade 22 operates the piston return control valve 80 to supply compressed air to the lower portion of the interior of the cylinder 18.

When the piston 20 is returned to its normal or released position under the control of the valve 28, as described above, the driver blade 22 is moved upwardly so that the offset portions 22a and 22b of the driver blade no longer engage the ends of the pin 100 and, accordingly, the compressed air acting on the enlarged end of the valve head 94 displaces the valve stem 97 to the right so that the ends of the pin 100 again move into the offset portions 24a and 24b of the drive track 24 and so that the valve head 94 again moves into sealing engagement with the O-ring 96 to cut off communication between the interior of the cylinder 18 and the passageway 52.

Accordingly, the piston return control valve assembly 80, by providing the pin 100 which is engaged by both of the offset edges 22a and 22b of the driver blade 22, avoids any tendency to unequally stress the driver blade 22 during downward movement and thereby prevents any tendency for this blade to bind within the drive track 24 due to unequal loading on the edges thereof. Further,

by providing the operating pin 100, which is engaged by both edges of the driver blade 22, the control valve 80 can be centrally located relative to the nosepiece 12a of the tackler 10, as contrasted with the control valve 32 which is displaced on the nosepiece 12a with respect to a center line or diameter passing therethrough.

In summary, the pneumatically operated fastener driving device 10 of the present invention, although embodying the general construction and operational technique described and shown in the above identified and later filed copending Wandel and Doyle application, includes new and improved means for returning the piston 20 to normal or released position including control valve assemblies 32 or 80 which are directly operated by the driving blade 22. These control valve assemblies, in obviating the need for a piston return spring, not only serve to return the piston 20 and the driver blade 22 to their normal position at the end of each fastener driving stroke but also provide convenient pneumatic means for retaining these elements of the construction 10 in their released position between successive operations of the tackler 10.

Although the present invention has been described in conjunction with specific embodiments thereof, it should be understood that numerous other modifications and embodiments may be provided by those skilled in the art which will fall within the spirit and scope of the present invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. In a fastener driving device, structure defining a drive track lying within a single plane and adapted to receive fasteners to be driven, said structure also defining an opening offset relative to said plane, a fastener driving element slidable in said drive track and including a member slidable in said offset opening, valve means, and valve operator means projecting into said offset opening and adapted to be engaged by said member.

2. The device set forth in claim 1 in which said member projects substantially perpendicularly outward from said driving element and includes an inclined end portion.

3. In a fastener driving device, structure defining a drive track adapted to receive fasteners and including a pair of spaced offset portions, a fastener driving element having offset members and slidable in said drive track with said offset members in said offset portions, a valve, and a valve operator having portions disposed in said offset portions and adapted to be engaged by said offset members for operating said valve.

4. In a fastener driving device, structure defining a drive track having a pair of offset portions, a fastener driving blade slidable in said drive track and having offset elements slidable in said offset portions, a valve carried on said structure, and means for operating said valve including an element disposed substantially parallel to said drive track and extending into said offset portions to be actuated by said offset elements.

5. A fastener driving device comprising a housing defining a chamber, a cylinder movably mounted in said chamber, a piston movably mounted in said cylinder, said cylinder including means defining an exhaust passageway in communication with the interior of said cylinder at a point disposed at one side of said piston, and means for moving said cylinder relative to said housing to open and close said exhaust passageway.

6. A fastener driving apparatus comprising a housing defining a chamber, a cylinder movably mounted in said chamber, fastener driving means including a piston slidably mounted in said cylinder, control means for moving said cylinder relative to said housing and away from a normal position to admit a compressed medium into said cylinder at one side of said piston to operate said fastener driving means, and means controlled by movement of said piston for supplying compressed medium to

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said cylinder at the other side of said piston to restore said fastener driving means.

7. The fastener driving device set forth in claim 6 wherein said control means includes means for moving said cylinder back to said normal position to prevent the admission of said compressed medium to said one side of said piston and including means for exhausting the compressed medium from the cylinder on said one side of the piston so that the compressed medium on the other side of said piston is effective to restore said fastener driving means.

8. A fastener driving device using a compressed medium comprising a housing defining a chamber supplied with said compressed medium, a cylinder movably mounted in said chamber, a piston movably mounted in said cylinder, first valve means controlling communication between said chamber and the interior of said cylinder at one side of said piston, second valve means controlling communication between the interior of said cylinder at the other side of said piston and the atmosphere, and control means for selectively shifting the position of said cylinder relative to said housing to selectively open and close said first and second valve means whereby said piston is displaced relative to said cylinder by said compressed medium.

9. The fastener driving device set forth in claim 8 including a piston connected to said cylinder and in which said control means includes means for selectively supplying said compressed medium to said piston.

10. A fastener driving apparatus using a compressed medium comprising a housing defining a chamber supplied with said compressed medium, a cylinder movably mounted in said chamber, fastener driving means including a piston slidably mounted in said cylinder, first control means for shifting said cylinder relative to said housing selectively to admit said compressed medium to and to exhaust said compressed medium from the interior of said cylinder for moving said piston, and second control means controlled by movement of said piston for admitting compressed medium to the interior of said cylinder.

11. A fastener driving apparatus using a compressed medium comprising a housing defining a chamber supplied with said compressed medium, a cylinder movably mounted in said chamber, a piston movably mounted in said cylinder, said cylinder and said housing having openings forming valve means, first control means for shifting said cylinder between normal and displaced positions to admit compressed medium into said cylinder for moving said piston, movement of said cylinder to said displaced position opening said valve means to provide an exhaust for the interior of said cylinder and movement of said cylinder to said normal position closing said valve means, and second control means for supplying compressed medium to said cylinder.

12. The fastener driving apparatus set forth in claim 11 including a blade for driving fasteners operated by said piston and in which said second control means includes a valve actuated by said blade.

13. A fastener driving apparatus comprising a cylinder, a piston movably mounted in said cylinder, a fastener driving element operated by said piston, first valve means for exhausting air from the portion of said cylinder disposed at one side of said piston, second valve means for admitting compressed air to said portion of said cylinder, means for moving said piston including means for opening and closing said first valve means, and control means for opening said second valve means as said first valve means is opened and for closing said second valve means after said first valve means is closed.

14. The apparatus set forth in claim 13 in which said piston has a normal position from which it is moved by said moving means and in which said control means includes means actuated by said fastener driving element to open said second valve means when said piston is dis-

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placed from said normal position and to maintain said second valve means in an open condition until said piston returns to said normal position.

15. In a fastener driving apparatus, a cylinder, a piston slidably mounted in said cylinder, fastener driving means operated by said piston, first valve means for exhausting air from the portion of the interior of said cylinder disposed at one side of said piston, control means for moving said piston away from a normal position to operate said driving means to drive a fastener, means for opening said first valve means during said movement of said piston away from said normal position, means for supplying compressed air to said portion of the interior of said cylinder to move said piston to said normal position, and means for closing said first valve means during said movement of said piston to said normal position to retain the compressed air in said portion of the interior of said cylinder to hold said piston in said normal position.

16. The fastener driving device set forth in claim 15 in which the means for supplying compressed air to said portion of the interior of said cylinder includes second valve means operated by movement of said fastener driving means.

17. A fastener driving apparatus comprising a housing defining a chamber for receiving compressed air, said chamber having a cylindrical recess, a cylinder element having a piston structure, said cylinder element being disposed in said chamber with said piston structure slidably mounted in said recess with one surface of said piston structure in communication with said compressed air, a valve seat carried on said housing, fastener driving means including a drive piston slidably mounted in the interior of said cylinder element, first valve means for selectively controlling the application of compressed air to the other surface of said piston structure so that said cylinder element is moved away from said valve seat to place one end of said cylinder element in communication with said reservoir and is moved into engagement with said valve seat to close off communication between said reservoir and said one end of said cylinder element, said cylinder defining an exhaust passageway which is opened by said movement of said cylinder element away from said valve seat to exhaust the other end of the cylinder element and which is closed by said movement of said cylinder element into engagement with said valve seat, and second valve means operated by said fastener driving means for admitting compressed air into said other end of said cylinder element.

18. A piston construction for a fastener driving apparatus comprising a piston, a uniplanar fastener driving blade secured to said piston, and a projecting portion projecting perpendicularly outward from the plane of said blade and extending longitudinally along virtually the entire length thereof.

19. A fastener driving apparatus comprising a structure including a cylinder, a piston slidably mounted in said cylinder for movement between a normal position and a displaced position, a fastener driving blade actuated by said piston, first valve means carried on said structure for controlling communication between the atmosphere and one portion of the interior of said cylinder, second valve means carried on said structure for supplying compressed air to said one portion of the cylinder, control means for admitting compressed air to a second portion of the interior of said cylinder to drive said piston from said normal position to said displaced position and for exhausting compressed air from said second portion of the cylinder to permit said piston to be returned to said normal position from said displaced position, said control means including means for opening said first valve means as said piston moves from said normal position to said displaced position and for closing said first valve means as said piston moves from said displaced position to said normal position, and means actuated by said fastener driving blade for holding said second valve means in an

open condition whenever said piston is displaced from said normal position.

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