

March 9, 1965

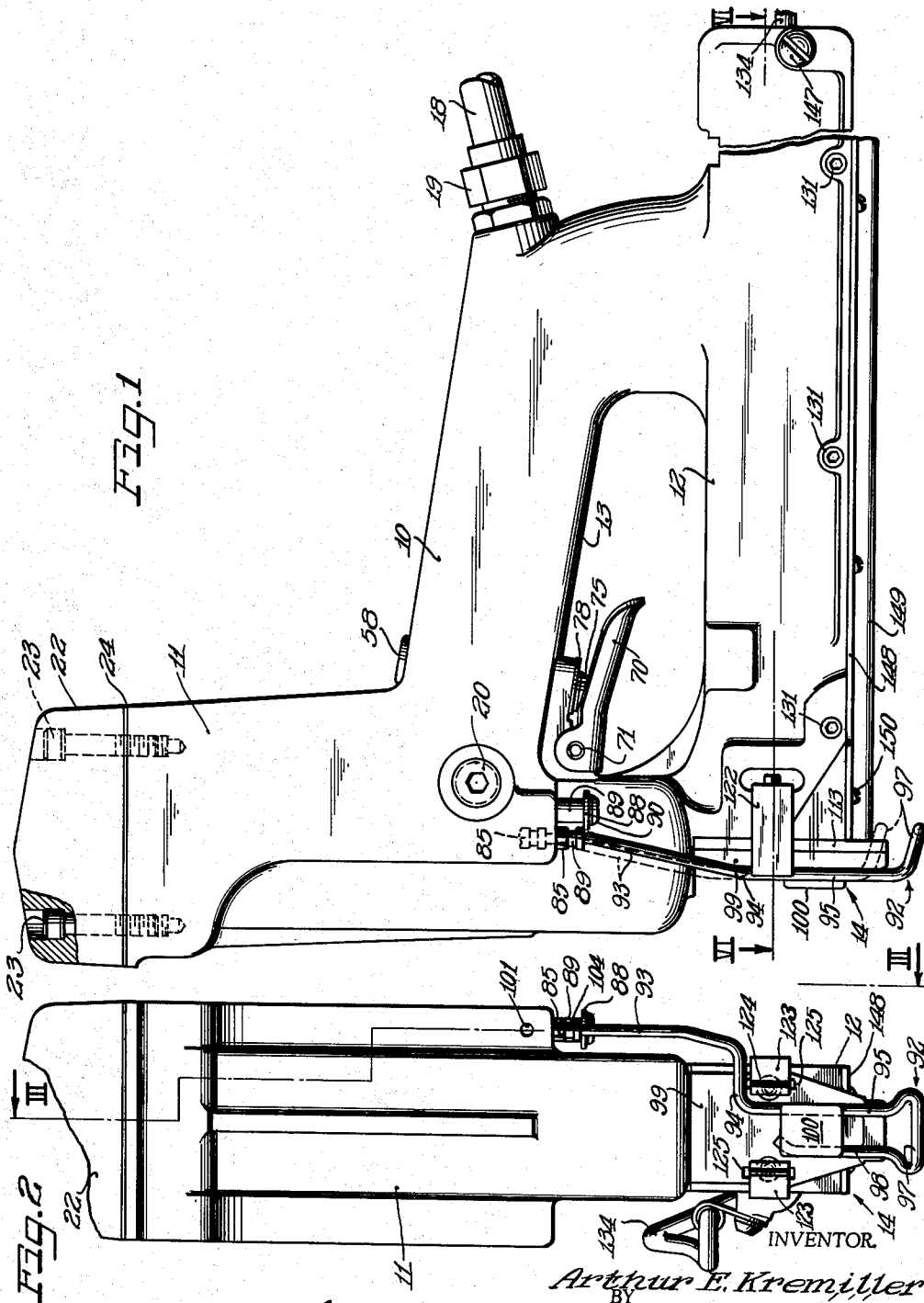
A. E. KREMILLER

3,172,124

PNEUMATICALLY OPERATED FASTENER DRIVING MACHINES

Filed April 1, 1963

4 Sheets-Sheet 1



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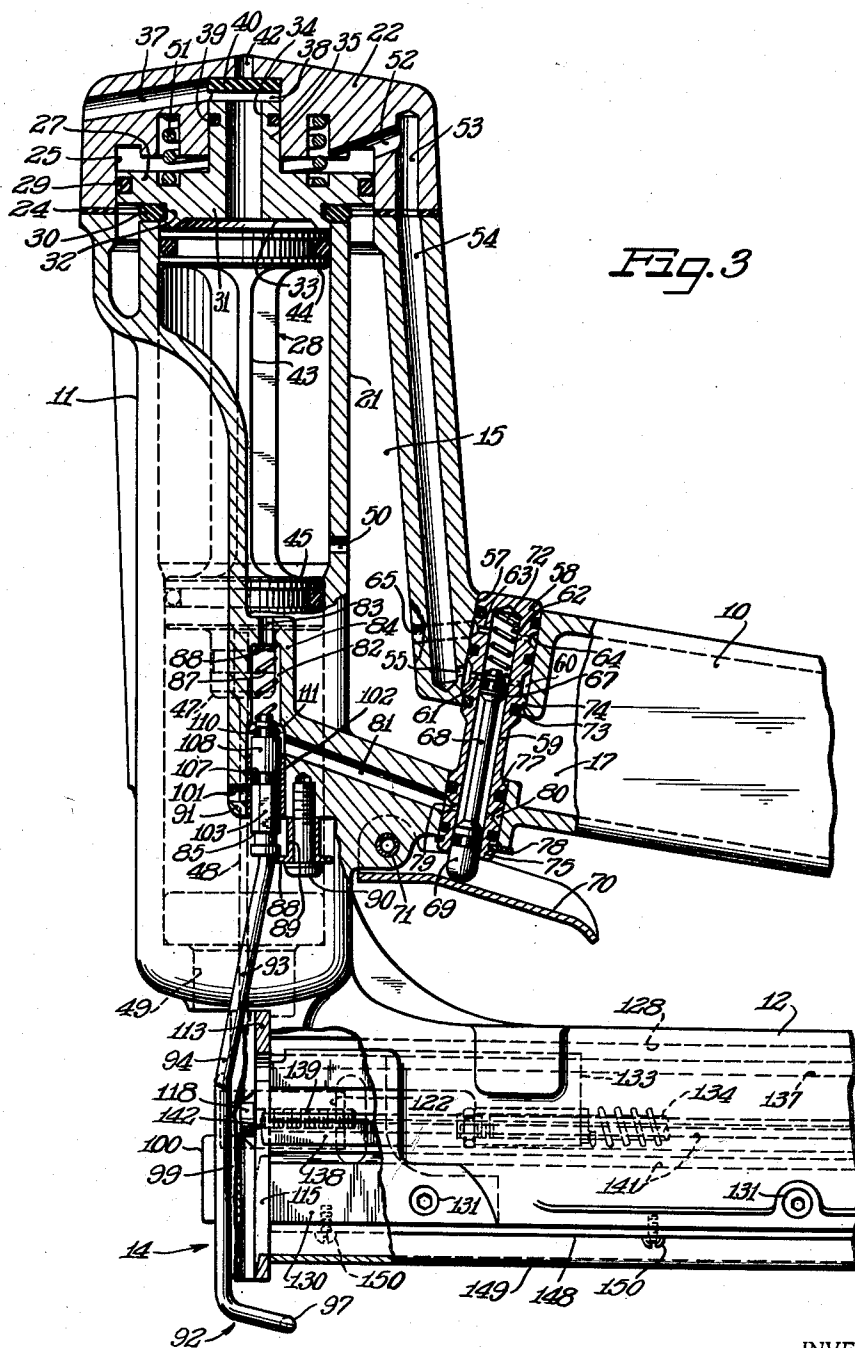


Fig. 3

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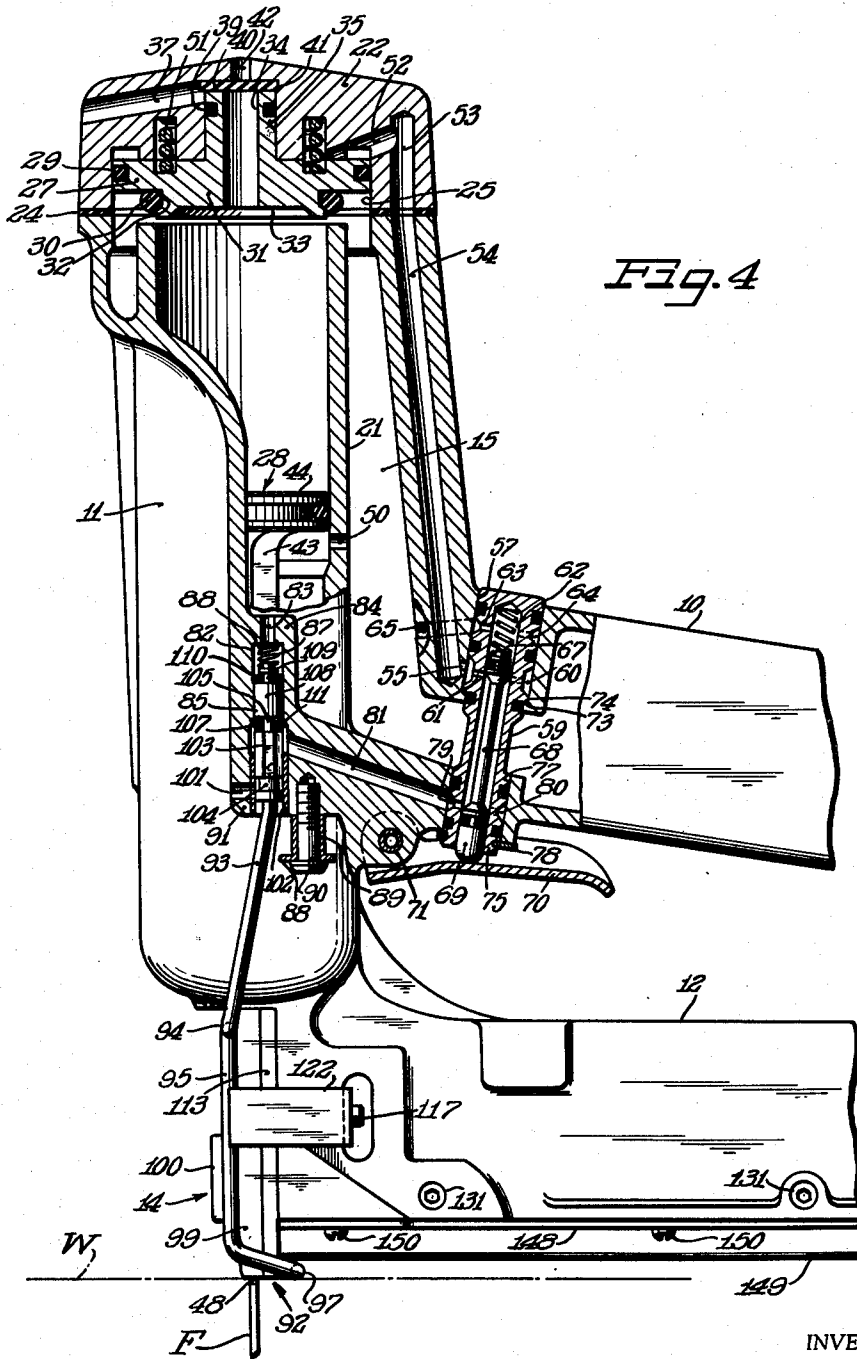


Fig. 4

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Fig. 5

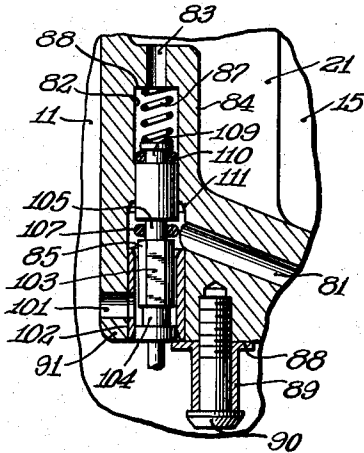


Fig. 7

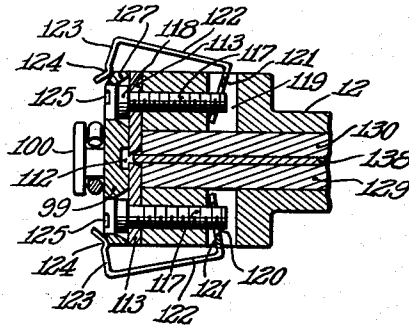


Fig. 6

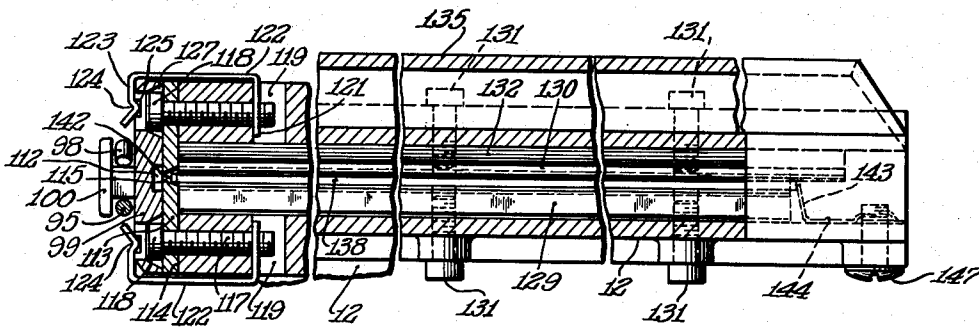


Fig. 9

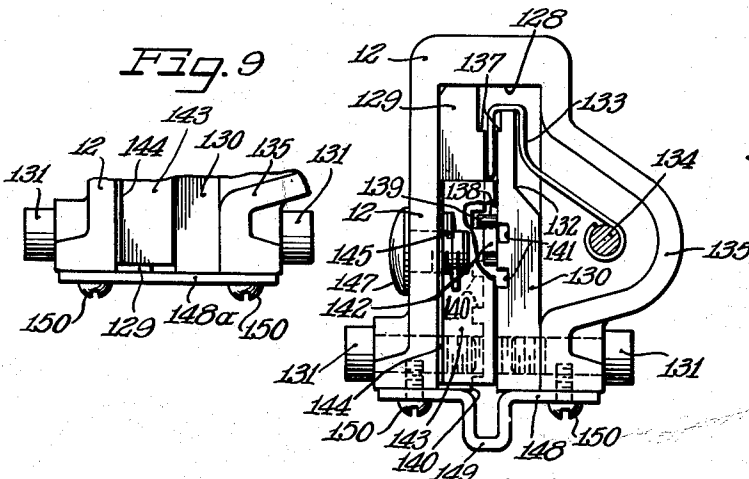
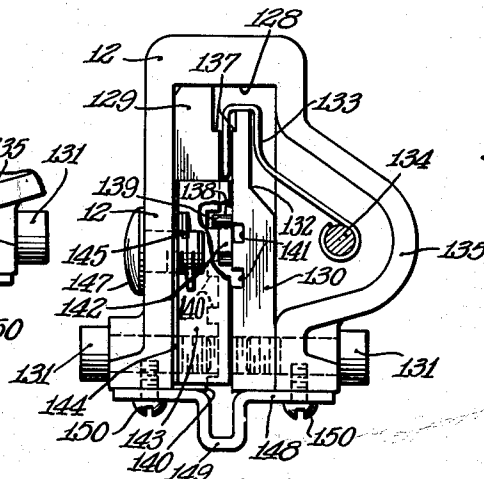


Fig. 8



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3,172,124

PNEUMATICALLY OPERATED FASTENER DRIVING MACHINES

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Filed Apr. 1, 1963, Ser. No. 269,564
14 Claims. (Cl. 227—8)

This invention relates to improvements in pneumatically operated fastener driving machines with which staples, pins, nails, and the like, are driven from a magazine supply in the machine by means of a driving member or blade mounted on a reciprocally movable pneumatically actuated piston under the control of the user of the machine.

In these machines, driving of the fasteners is accomplished at such high acceleration that if the machine, sometimes referred to as an air gun, is free fired, that is, with the fastener-placing nose not contiguous to a workpiece into which a fastener is to be driven, the fastener as propelled from the machine becomes a dangerous missile. While some fairly successful prior safety devices have been provided to prevent unintentional free firing of the machines, some problems have been encountered to the solution of which the present invention has been directed.

For compactness, sturdiness, lightweight and the minimizing of joints that can work loose in service, it is highly desirable to construct the body of the machine including handle, magazine and driving motor head portions as one integral lightweight casting from aluminum or other suitable lightweight material or alloy. This raises a problem because numerous sizes of fasteners are often required to be used in any given trade or industry where the use of pneumatic fastener driving machines is advantageous. One way of solving the problem heretofore has been to provide a separable fastener magazine construction, but that involves separable joints that must be accurately aligned and which are subject to loosening in service, in addition to liability to loss of parts and damage by careless handling.

Accordingly, it is an important object of the present invention to provide new and improved safety means for pneumatically operated fastener driving machines and which will preclude free firing of the machine while the safety device is operational.

Another object of the invention is to provide a new and improved safety device for pneumatically operable fastener driving machines which is characterized by substantial simplification and cost savings as compared to prior similar devices.

A further object of the invention is to provide a new and improved safety device for pneumatically operable driving machines and which includes manual and work-pressure-responsive operating triggers in a control passageway system and wherein exhausting of the passageway system during each actuation of the machine is effected remote from the handle so as to avoid befooling of the handle or manual trigger with air-entrained oil.

Still another object of the invention is to provide improved means for inactivating a work-pressure-responsive control valve of a control system for a pneumatically operated fastener driving machine.

Yet another object of the invention is to provide im-

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proved work-pressure-responsive trigger and guiding structure for a safety device in a pneumatically operable fastener driving machine.

A still further object of the invention is to provide novel means for adapting a fastener driving machine of monolithic body casting construction for driving of various types and lengths of fasteners.

A yet further object of the invention is to provide novel fastener driving machine magazine structure adapting the associated machine for driving a substantial range of different lengths and kinds of fasteners.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description of certain preferred embodiments thereof taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a fragmental side elevational view of a pneumatically operable fastener driving machine embodying features of the invention;

FIGURE 2 is a front elevational view of the machine;

FIGURE 3 is an enlarged fragmentary vertical sectional elevational detail view taken substantially on the irregular section line III—III of FIGURE 2;

FIGURE 4 is a sectional elevational view similar to FIGURE 3 but showing the operating parts of the machine in the fastener driving relationship thereof;

FIGURE 5 is a fragmentary sectional detail view illustrating the manner in which the disabling or safety valve is adapted to be inactivated;

FIGURE 6 is a fragmental sectional detail view taken substantially on the line VI—VI of FIGURE 1;

FIGURE 7 is a fragmentary sectional detail view similar to the left hand portion of FIGURE 6 but showing the retaining clips released;

FIGURE 8 is an enlarged rear end elevational view of the magazine of the machine; and

FIGURE 9 is a fragmentary similar rear end view of the magazine section showing a slight modification.

In a desirable form, as illustrated in FIGURES 1 and 2, a manually operable, portable pneumatically actuated fastener driving machine adapted to drive staple, nail, brad or pin types of fasteners comprises a body casing or housing constructed as a monolithic casting of aluminum alloy, magnesium alloy or other suitable lightweight material and provides a generally front-to-rear handle 10 joined at its forward end to a vertical driving head 11 which at its lower end below the handle 10 joins the forward end portion of a magazine section 12 to which the rear end portion of the handle is also attached and defines therewith a hand hole 13. Under the driving head 11 and on the forward end of the magazine section 12 is a driving nose structure 14.

Within the driving head portion or section 11 of the housing is a substantial volume fluid reservoir space 15 with which an auxiliary reservoir space 17 within the handle 14 freely communicates. Pneumatic pressure fluid such as compressed air under suitable pressures on the order of 100 p.s.i. is adapted to be delivered into the handle reservoir space 17 from a suitable source such as a compressor (not shown) through a conduit 18 such as a flexible hose attached by means of a suitable coupling 19 to a delivery inlet at the rear end of the handle 10. Alternatively, delivery of air may be through a side inlet into the reservoir 15 shown in FIGURE 1 as closed by a plug 20.

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Within the head section 11 is a pneumatic motor including an upright cylinder 21 having its upper end adjacent to the upper end of the head section 11 and from which the reservoir space 15 opens upwardly as best seen in FIGURES 3 and 4. Closing the upper end of the head section 11 is an inverted generally cup-shaped closure cap 22 detachably secured as by means of screws 23 (FIG. 1). An airtight joint is provided by a gasket 24 clamped between the upper end of the housing and the cap 22.

Defined within the cap 22 is a cylinder chamber 25 (FIGS. 3 and 4) providing generally an upward extension of the reservoir space 15 to which the upper end of the cylinder 21 is exposed. This cylinder chamber 25 is of larger diameter than the outside diameter of the upper end portion of the cylinder 21.

Vertically reciprocable within the cylinder chamber 25 is a control valve piston member 27 for controlling operation of a driving piston 28. For this purpose, the control valve piston 27 is of generally disk form having its perimeter in free sliding relation to the cylindrical wall of the chamber 25 and carrying in such perimeter a sealing ring 29. On its lower face, the valve member 27 carries a resilient sealing ring 30 of a diameter to engage sealingly upon the upper end seat surface provided on the cylinder 21 about the opening thereinto for, in the non-operating condition of the machine, sealing the mouth of the cylinder from the reservoir 15. To facilitate carrying the ring 30, the disk head of the valve member 27 has a central downward projection 31 of a diameter to fit freely within the mouth end of the bore within the cylinder 21 and provided with an annular radially opening groove 32 within which the sealing ring 30 is seated and from which it projects radially into overlying relation to the lip of the cylinder 21.

On its lower end, the downward projection 31 has a recess 33 providing a clearance over the underlying driving piston and communicating with a central bore 34 providing a port through the valve member 27 and an upwardly projecting stem 35 thereon to afford a piston return air exhaust passage communicating with an exhaust port 37 to atmosphere from the cap 22 and having its inner end opening from the upper end of a downwardly opening counterbore 38 in the cap into which the stem 35 projects. A sealing ring 39 carried by the perimeter of the stem 35 effects an air seal between the stem and the wall of the bore 38. The length of the stem 35 is such that when the valve member 27 is seated on the cylinder 21, the upper end of the stem clears the adjacent port to the exhaust duct 37 and a resilient valve disk 40 retained in placed on the roof of the counterbore 38 by having its perimeter engaged in an annular retaining groove 41. When the valve member 27 rises to open the cylinder 21, the tip of the stem 35 engages sealingly with the valve disk 40 and thus seals the exhaust bore 34 against escape of air from within the reservoir 15. To facilitate removal of the valve disk 40, a knock-out hole 42 is provided in the cap 22 over the disk.

In this instance the driving piston 28 is of generally spool shape with a small diameter axial body or shank 43 carrying on its upper end a piston head 44 and on its lower end a second piston head 45. Below the lower piston head 45 a concentric connector boss 47 provides means for connecting to the piston a depending fastener driving blade 48 the lower end of which extends down through an opening 49 in the lower end of the head section 11 and into operative relation in the nose structure 14. It will be observed that the lower piston head 45 is of slightly smaller diameter than the upper piston head 44 and the lower portion of the cylinder 21 engaged by the lower piston head 45 is of correspondingly smaller diameter. This differential in diameter is utilized to maintain the piston 28 in the raised up, upper position ready for firing and the driving blade member 48 correspondingly poised in position for driving a fastener, by

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pneumatic pressure entering through one or more unobstructed openings 50 through the wall of the cylinder 21 into the reservoir 15 for constant exposure of the chamber within the cylinder 21 defined between the piston heads 44 and 45 to the compressed air from the reservoir. In such normal upper position, the top of the piston head 44 is marginally engaged against the portion of the control valve downward projection boss 31 at the upper end of the cylinder as a stop maintaining the piston head crown in this instance slightly below the level of the cylinder end.

A normal downward biasing force on the piston valve member 27 to urge it into closing relation to the cylinder 21 is derived primarily from pneumatic pressure fluid from the reservoir 15 and supplemented by means of a suitable compression spring 51 to assure closing, seating of the control piston valve member in the dormant, non-pressurized condition of the machine. As best seen in FIGURE 3, a substantial area differential exists between the crown of the valve member 27 and the annular lower face marginal portion of the valve member about the sealing gasket ring 30 in the seated, cylinder closing position of the valve member, so that in such position the larger crown area exposed to the pneumatic pressure fluid overbalances the valve member toward its cylinder end seat. The thrusting force of the spring 51 is less than the air pressure normally used in the operation of the machine, so that in the absence of pneumatic pressure on the crown of the valve member 27, the biasing force of the spring is overcome by the fluid pressure on the lower face margin for driving the valve member 27 from its seat and thus opening the cylinder 21 to the full force of the pneumatic fluid in the reservoir 15, as shown in FIG. 4, to drive the piston 28 in a faster driving stroke. Upon reimposition of pneumatic fluid onto the crown of the control valve member 27 as supplemented by the biasing spring load, the unbalanced, control valve opening relationship is overcome and the control valve overbalanced into its cylinder closing position.

Pneumatic pressure fluid derived from the reservoir 15 for overbalancing the control valve member 27 into seated position is conducted through a passageway system including a plurality of control valves. In the illustrated example, the passageway system includes (FIGS. 3 and 4) a port 52 opening into the upper end of the control valve chamber 25 in the cap 22 from the upper end portion of a blind end bore 53 communicating at its lower end with a duct bore 54 in the rear portion of the head section 11 of the machine housing, with its lower end blind ended adjacent juncture of the handle 10 with the head section and communicating through a lateral port 55 with the lower end portion of an upwardly opening bore 57 within which is mounted a head portion 58 of a valve body bushing 59. For flow passage purposes, the perimeter of the bushing 58 has an annular groove 60 with which the passageway port 55 communicates, and a plurality of ports 61 extend from the groove 60 inwardly to effect communication with a blind end chamber bore 62 opening downwardly from the bushing 59 and with its closed upper end adjacent the upper end of the head 58. Spaced longitudinally of the head 58 upwardly from the ports 61 is another set of a plurality of ports 63 which open from the bushing bore 62 into a second peripheral annular groove 64 in the perimeter of the head 58 and with which is aligned a passage duct 65 in the upper portion of the handle 10 effecting communication with the reservoir 15. This described portion of the passageway system starting with the port 52 and traced through to the reservoir communication passage duct 65 is normally open for conducting the pneumatic fluid from the reservoir 15 into the control valve cylinder chamber 25 above the control valve member 27 to bias it into cylinder-closing position. It will be observed that suitable seals such as O-rings are appropriately disposed to prevent leakage longitudinally along the pe-

rimeter of the valve body head 58 from and to the annular grooves 60 and 64.

In order to disconnect the control valve 27 from the source of pneumatic fluid within the reservoir 15 through the supply duct 65 when it is desired to actuate the pneumatic motor for driving a fastener, a digitally operable control valve 67 is provided of the plunger type reciprocally mounted within the bore 62 of the handle-mounted valve body bushing 59 and connected by a reduced diameter stem 68 to a button-like lower end terminal 69 slidably engaged in the lower end portion of the bore and projecting a suitable distance from the lower open end of the bore below the handle 10 into engagement with a trigger lever 70 extending longitudinally under the front end portion of the handle and having its front end portion pivotally attached by suitable pivot element 71 to the housing adjacent to the lower end portion of the head section 11. Normally the valve 67 is biased by the force of pneumatic fluid on its head within the bore chamber above the valve and by a supplemental light compression biasing spring 72 in a downward direction clear of the ports 61 whereby pneumatic fluid from the source in the reservoir 15 is freely delivered to the control valve piston 27. In this relationship, the manually operable trigger lever 70 serves as a retaining stop for the valve through the button head 69. In non-pressurized condition of the machine, the biasing spring 72 assures that the valve 67 is positively biased into the normal delivery port clearing relation as shown in FIGURE 3.

In a desirable arrangement, the valve body bushing 59 is mounted by assembling it from the top of the handle 10 through the bore 57 until a shoulder 73 at the lower end of the head 58 and at juncture with a slightly reduced diameter downwardly extending portion of the valve body bushing engages a complementary shoulder 74 at the lower end of the bore and short of the opening of the bore into the reservoir 17 in the handle. A lower end portion 75 of the bushing fits through a bore 77 in the lower side of the handle 10 and aligned with the bore 57. At its lower terminus, the portion 57 projects outwardly beyond the bore 77 and carries a locking ring 78 by which the bushing 59 is retained against displacement upwardly relative to the orientation shoulder 74.

Pulling of the trigger 70, that is digital upward pressing thereof to shift the valve 67 in opposition to its bias elevates the valve into a position above the ports 61 and into shut-off relation between the ports 61 and the ports 63 whereby to disconnect the passageway system from the primary pneumatic fluid source duct 65, as best seen in FIGURE 4. At the same time, the passageway is opened between the port 61 and through the passage in the bushing 59 about the reduced diameter valve stem 68 with laterally opening ports 79 in the lower end portion 75 above the upper end of the button 69 opening into an annular groove 80 with which registers a forwardly extending secondary pneumatic fluid source duct 81 communicating at its forward end with a vertical valve bore 82 in the head 11 of the machine alongside the cylinder 21 and opening at its opposite ends in the same direction as the cylinder. At its upper end, the bore 82 has a port 83 by which it communicates continuously with the reservoir 15 through a boss 84 therein. Through this arrangement, when the valve 67 is shifted to its upper limit to disconnect the primary source duct 65, communication with the reservoir 15 is adapted to be effected immediately and alternatively through the secondary source duct 81. In other words, there is a closed circuit with two branches which are alternatively placed in pressurizing communication with the control valve piston 27 of the pneumatic motor.

Means are provided within the bore 82 comprising a plunger valve member 85 and which is normally biased into a substantial length of the bore 82 below the com-

municating end of the duct 81 to maintain open communication between the upper reservoir communicating end portion of the bore and the duct 81 and thereby the pneumatic fluid passageway to the control valve piston 27. A light gauge coiled compression biasing spring 87 bottomed at its upper end against a downwardly facing shoulder 88 adjacent the inner end of the pressure port 83 thrust against the crown of the plunger valve 85 to assure the biased position of the plunger valve even in the non-pressurized condition of the machine, while the principal biasing force in service is afforded by action of the pressure fluid on the crown area of the valve.

Stop shoulder means are provided engageable with the outer, lower end of the plunger valve 85 to retain it in the pressure passage clearing spring and pressure fluid biased position. Herein the stop shoulder means comprise an annular flange 88 desirably carried on a spacer sleeve 89 and retained in position by a screw 90 secured in an overhanging portion 91 of the machine housing below the internal boss 84 and from which the lower end of the valve bore 82 opens so that the lower end portion of the plunger valve in its spring and pressure fluid biased, protracted relation projects downwardly from the overhanging portion 91 and engages against the stop shoulder flange 88.

According to the present invention, the plunger valve member 85 serves as a disabling or safety valve in the motor control passageway system. That is, in normal operation the disabling-safety valve is so related in the passageway system to the digitally operable valve 67 that operation of the latter valve is ineffective to operate the pneumatic motor for driving a fastener. To recapitulate, this desirable result is attained because while the disabling-safety valve 85 is in its protracted, biased position as shown in FIGURE 3, there is continuous communication with the reservoir 15 either through the pressure delivery duct 65 or the duct 81, respectively, by-passing the valve 67 in its lower protracted position and in its upper retracted position to bias the motor control piston valve 27 into cylinder-closing position. Through this arrangement, unintentional, accidental or careless actuation of the valve 67 will not result in operation or firing of the machine, or as it is sometimes called, air gun, while the disabling-safety valve is in its protracted position.

Means are provided comprising a trigger device 92 secured to the lower end of the stem portion of the disabling plunger valve 85 and engageable with a workpiece toward which the driver 48 of the machine is to be driven by the piston 28. In a desirable form, the trigger device 92 comprises a stirrup-like, heavy gauge spring wire member provided with an upwardly projecting arm 93 suitably connected at its upper end as by means of a pin and socket arrangement, threaded connection or the like into the lower exposed end of the plunger valve 85. In order to accommodate the side disposition of the disabling valve assembly on the head section 11 of the machine, the arm 93 has an angular offsetting portion 94 connecting it to a vertical guide portion 95 joined to a presser foot formation 97 of generally U-shape (FIG. 2) and in the present instance angled generally downwardly and rearwardly so that its horizontal bar portion lies rearwardly from the nose assembly 14 while the vertical guide portion 95 and a spaced parallel upwardly projecting companion vertical guide portion or arm 98 lie at the front of the nose assembly and more particularly along the front of a vertical front plate 99 thereof behind a button-like flange formation 100 integral with the front face of the plate and serving as a vertical guide for the guide arms 95 and 98 (FIGS. 2, 3 and 6).

Normally the presser foot 97 projects a predetermined distance below the lower end or tip of the driving nose assembly 14 as shown in FIGURES 2 and 3 as well as in the full line position of the trigger stirrup member or de-

vice 92 in FIGURE 1. This is in the downwardly spring and air biased position of the disabling or safety valve 85. Upon engaging the stirrup foot 97 against a work surface W (FIG. 4) the safety trigger stirrup member 92 is displaced upwardly relative to the head section 11 and the nose assembly 14 of the machine and correspondingly displaces the disabling-safety valve 85 into a retracted position for disconnecting the secondary pressure fluid source duct 81 from the reservoir 15 while at the same time opening the motor control passageway system through the duct 81 to an exhaust or bleed-off passage 101, preferably comprising a forwardly directed opening, communicating with the lower portion of the disabling-safety valve bore 82 adjacent to the overhanging portion 91 of the housing and extending through a smooth bore guide bushing 102 fixed in the lower end portion of the bore below the communicating end of the duct 81. For this purpose, the lower end portion of the plunger valve member 85 has a plurality of flats 103 extending longitudinally between a groove 104 in its lower end portion and a groove 105 at an intermediate location therein carrying a sealing O-ring 107 under a cylindrical head portion 108 of the valve member having on its head end portion an annular groove 109 carrying a sealing O-ring 110.

In the tripped, retracted position of the disabling-safety valve 85 the intermediate sealing ring 107 enters into sealing engagement with a tapered annular valve seat 111 on the wall of the bore 82 above the entry opening for the duct 81 while the sealing ring 110 engages in sealing relation with the wall defining the upper end portion of the bore whereby effectively to seal off pressure fluid entering through the upper end port 83 from the reservoir 15. As a result, assuming the digitally operated valve 67 to have been displaced in a retractional direction as shown in FIGURE 4 by operation of the trigger 70 so that the primary pressure source duct 65 is closed off from the motor control valve passageway system, air will bleed-off through the passageway system from over the valve piston 27 and past the flattened lower end portion of the valve 85 and by way of the groove 104 out through the bleed-off passage or port 101. As the bleed-off air exhausts through the opening 101, any oil that may be entrained in the air is carried out forwardly and away from the handle and the trigger 70 and away from the operator's hand.

Instantaneously upon bleeding off the pressure air above the control piston valve 27, it is unbalanced to that the pressure in the reservoir 15 drives the control valve off its seat on the upper end of the cylinder 21 whereby to expose the crown of the piston 28 to the full force of air pressure to drive the piston in a fastener driving stroke whereby the driving blade 48 drives a fastener F from the lower end of the nose assembly 14. Return of the piston to starting position occurs virtually instantaneously upon re-establishing over-balancing air pressure on the upper side of the control valve piston 27 to drive it back onto its seat on the upper end of the cylinder 21, accomplished either by protraction of the safety valve 85 upon lifting the nose 14 of the machine from the work W, or by protraction of the digitally operated valve 67, or both. As will be observed in FIGURE 3 in the protracted, disabling position of the valve 85, the sealing ring 107 engages sealingly within the bore of the bushing 102 and the sealing ring 110 is in a depressed position clear of the tapered valve seat 111 so that the secondary pressure source duct 81 is opened to communication with the reservoir 15, while the bleed-off passage 101 is closed off.

By the arrangement shown in FIGURES 3 and 4, so-called "bump firing" of the machine can be effected by holding the trigger 70 in retracting relation to the valve 67 to disconnect the primary source duct 65 and press the safety trigger 92 against the successive places on the work into which a driver is to be fastened. On the other hand, for so-called "stitch firing" the tip of the nose assembly 14 may be maintained in engagement with the work so

that the safety trigger 92 is maintained depressed and thus maintains the bleed-off passage 101 open through the valve 85 while moving the machine relative to the work to orient the driving nose 14 to successive positions wherein a fastener is to be driven and at each such position or location operating the trigger 70 to actuate the valve 67 between control valve pressurizing and bleed-off positions.

Since, as best seen in FIGURE 3, the sealing ring 107, in the fully protracted position of the safety valve 85 is spaced a substantial distance from the port opening from the duct 81, a preliminary safety range is afforded wherein mere touching of the safety trigger 92 against an object will not result in firing of the gun. A deliberate, purposeful safety trigger depressing thrust of the driving nose 14 toward the surface of the object to receive a fastener is thus required.

Another distinct advantage of the disclosed safety valve means resides in minimizing the chance of automatic double firing on hard drives, that is, where due to an impenetrable obstruction or unusually hard substance a fastener fails to penetrate fully into the receiving surface under driving propulsion of the driven blade 48 and as a result the machine recoils and immediately drops back while the safety trigger remains in engagement with the surface. Herein, the elongated valve plunger 85 and its substantially longitudinally spaced sealing rings 107 and 110 are so related to the port of the passageway duct 81 and the annular groove aligned therewith between the inner end of the bearing sleeve 102 and the counter-bore valve seat 111 as to substantially preclude such double firing. On inspection of FIGURE 4, it will be seen that the range of overtravel of the safety device is such that in the firing disposition of the tip of the driving nose 14 and full retraction of the valve 85 by action of the work-engaging trigger 92, the upper sealing means ring 110 slidably engages the bore 82 a substantially spaced distance from the counter-bore seat 111. Hence, during a hard-drive recoil the valve 85 can protract to the extent of that distance before resetting of the motor for firing by admitting pressure air from the reservoir to the duct 81 and thus through the passageway system to the chamber 25 over the control poppet valve 27 to over-balance it into cylinder-closing position. Recoil of greater magnitude enables the operator of the machine to withdraw it before refiring.

Should it be desired to dispense with or at least to inactivate the disabling-safety valve 85 the stop shoulder flange 38 is utilized as interlock means for this purpose. Thus, as shown in FIGURE 5, the shoulder flange 38 is shifted, as by inverting the spacer sleeve 89 of which it is a part to place the flange immediately adjacent to the lower end of the safety valve bore to hold the valve 85 against protraction, whereby the bleed-off passageway exhausting through the port 101 is maintained continuously open. Such reversal of the shoulder flange 38 is easily effected by removal of the retaining screw 90. When the valve 85 is held in the non-operating position, operating control at will of the machine by the digitally operable valve 67 is enabled.

In addition to serving as guiding means for the safety trigger 92, the front plate 99 provides in its rear face a vertical driver blade guide groove and fastener driveway 112 (FIGS. 3, 6 and 7) cooperative with a facing plate 113 interposed in laminar coextensive relation between the back face of the front plate and a flat vertical front face 114 on the magazine portion or section 12 of the machine housing casting. Fasteners are guided into the driveway groove 112 through a suitable aligned vertical doorway slot 115 through the facing plate 113.

Quick-detachable mounting of the front plate 99 and the facing plate 113 is provided for in a simple and efficient manner by having the facing plate secured by means of a pair of horizontally aligned spaced screws 117 each of which has a head 118 clampingly engaging a respective

side marginal front face portion of the facing plate and with the shank of the screw threadedly engaging in the casting, with the tip end portion of the screw extending freely into a respective transverse clearance opening 119 which enables such tip end portion to serve as a retainer extending freely through a hole 120 provided in a leg 121 of a generally U-shape spring clip 122 having a second spring leg 123 provided with a detent 124 engageable under latching tension in a complementary groove 125 formed in the front face of the front plate 99. Primary orientation of the front plate 99 on the facing plate 113 is effected by engagement of the screw heads 118 in respective tapered socket locating recesses 127 provided in the back face of the front plate. Through this arrangement, the facing plate 113 is held fixedly but removably by the screws 117 and the front plate 99 is held accurately in position against any substantial transverse displacement by the screw heads 118, while the spring clamp latches 122 firmly retain the front plate against forward displacement but by springing the detent arms 123 of the spring latches or clips out of engagement with the front plate, namely, from the retaining relationship as shown in FIGURE 6 into the released relationship shown in FIGURE 7, ready removal of the front plate 99 is permitted as for clean-out purposes or replacement.

It will also be observed from FIGURES 1 and 2, that in the latching position of the retaining clip 122 which underlies the offsetting portion 94 of the trigger member 92, it serves as an auxiliary stop which will preclude accidental blowing out of the disabling valve 85 should the retaining stop 88 become dislodged for any reason.

Within the magazine section 12 is provided a longitudinal hollow magazine chamber 128 of generally inverted U-shape opening downwardly and rearwardly as well as forwardly through the face 114 against which the facing plate 113 is attached. Mounted within the chamber 128 are means for supporting a supply of fasteners to be driven. To enable various types of fasteners to be accommodated within the supply magazine chamber 128, the height and width of the chamber are suitably dimensioned to receive the fastener supporting means adjustably and replaceably therein.

In the exemplary arrangement illustrated, the machine is shown as equipped with means within the magazine chamber 128 for supporting brads or headless pins of various lengths selectively herein comprising a pair of opposed complementary longitudinally extending respectively left and right filler bars 129 and 130 (FIGS. 6, 7 and 8) having their front ends in a plane with the front face 114 and having their rear ends extending short of the rear end of the magazine section 12. These bars are secured removably to respectively the right side wall and the left side wall within the chamber 128 by suitable means such as screws 131 and define therebetween a vertical longitudinally extending gap of suitable width to receive therebetween a fastener of predetermined gauge. The left-hand bar 129 may be of a height to extend the full height of the chamber 128 while the bar 130 is of less height and formed with a clearance 132 extending longitudinally thereof on its upper outer side to accommodate a pusher plate member 133, as best seen in FIGURE 8, riding a pusher rod 134 within a right side hollow bulge 135 on the magazine section 12, generally in accordance with the pusher mechanism arrangement disclosed and claimed in Patent 2,837,743 issued June 10, 1958 and assigned to the same assignee as the present application.

Fasteners of the brad type, that is pin-like fasteners with narrow heads are adapted to be accommodated by the bars 129 and 130 serving as supporting tracks, by engagement of the heads of the fasteners on complementary upwardly facing track shoulders 137 provided by rabbet grooves in the upper portions of the opposed faces of the bars. In addition, or alternatively, and especially to accommodate headless pins, a longitudinal sup-

porting bar 138 is provided which is mounted in the gap between the bars 129 and 130 and has a longitudinally extending marginal flange 139 on one side thereof engageable in supporting relation within any selected one of a plurality of longitudinally extending vertically spaced grooves 140 in the inner face of the bar 129 or like grooves 141 in the inner face of the bar 130 and staggered with respect to the grooves 140. Through this arrangement, a substantial range of lengths of pin fasteners can be accommodated in the pin track gap between the bars 129 and 130 by riding of the point ends of the fasteners on the upper edge of the bar 138 serving as a rail.

In order to enable quick readjustment or setting of the supporting rail bar 138, it is freely slidably supported by the filler bars 129 and 130 and is retained against longitudinal displacement forwardly by engagement of the hanger flange 139 thereof at its forward end against the inside face of the facing plate 113 with a nose portion 142 (FIGS. 3 and 6) aligned with and projecting a substantial distance into the doorway slot 115. At its rear end, the rail bar 138 is also provided with a nose projection 142 enabling the bar to be turned end-for-end when utilizing it for certain adjusted dispositions to accommodate selected lengths of fasteners, and retaining means are provided in this instance comprising a spring retainer bracket plate of generally L-shape in cross-section having a retainer flange 143 engaging the rear end of the bar 138 and thrusting it forwardly and an attachment flange 144 having an integral nut formation 145 by which the retainer plate is secured in place removably by a screw 147.

To accommodate pins of maximum length a base closure plate or track cover 148 is provided having a longitudinal depressed groove formation 149 aligned with the gap between the filler bars 129 and 130 and attached to the bottom of the magazine section 12 as by means of screws 150. Where somewhat shorter pins are to be accommodated not requiring the track groove 149, a flat plate 148a as shown in FIGURE 9 may be used.

It is, of course, necessary that the lengths of the vertical doorway slot 115 in the facing plate 113 be at least as long as the length of fasteners to be fed therethrough by the urgings of the pusher 133 under its spring bias. However, the lower edge defining the doorway slot must be at an adequate height relative to the length of fastener to afford adequate guiding of the fastener as it is driven down the driveway by the driving blade after leaving the lateral support afforded by the next adjacent fastener pressing against the fastener being driven. It will thus be appreciated that the quick interchangeability of the nose assembly 14 is a distinct advantage in this respect for quick attachment of replacement facing plates 113. For example, as best illustrated in FIGURE 3, the doorway slot 115 is shown in full lines as of a length to accommodate the maximum length of pin to be driven by the machine. In dash outline the lower edge is shown as alternatively accommodated to driving of pins of a substantially shorter length as supported by the rail bar 138 in the adjusted position shown in the illustrated example.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

1. In a pneumatically operated fastener driving machine including a fastener directing nose structure and a pneumatic motor having a driver actuated thereby for driving fasteners from said nose structure,

means to supply pneumatic fluid to drive said motor, means to control delivery of pneumatic fluid to said

motor including a pneumatic fluid passageway system provided with a digitally controllable valve,

a disabling valve in said passageway system including a safety trigger associated with said nose structure and disposed to be operated by engagement with a workpiece in advance of engagement of the work-

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piece by the nose structure so that said disabling valve will be operated to clear said passageway system for control by said digitally operable valve to effect operation of said pneumatic fluid delivery control means,

the improvement comprising:

- combination stop and interlock means including a shoulder member having interchangeable operative positions and means for fixedly maintaining the shoulder member in either of said positions,
 - said shoulder member being operative in one of said positions to stop the disabling valve in one of a plurality of normally operative positions of the disabling valve,
 - and said shoulder member being operative in the other of its positions to interlock the disabling valve in a non-operating position wherein said passageway system is cleared for control at will by said digitally operable valve.
2. A pneumatically operated fastener driving machine as defined in claim 1, wherein said shoulder member comprises a reversible sleeve having a shoulder flange at one end with which said disabling valve is engageable, and said means for maintaining the shoulder member comprises a screw member engageable through said sleeve.
3. A pneumatic fastener driving machine including a hollow handle and a head with the handle and the head providing pneumatic fluid reservoir,
- a cylinder in the head having an end exposed to the reservoir,
 - means closing said cylinder end,
 - means for controlling such closing of the cylinder end by said closing means including a fluid passageway system,
 - a valve structure carried by the handle and including a bushing extending transversely through the handle with the opposite ends of the bushing exposed at respectively opposite sides of the handle,
 - said bushing having opposite head portions engaging in the opposite side portions of the handle,
 - a duct of said passageway system and a duct leading from the reservoir communicating with the interior of the bushing through longitudinally spaced annular perimeter grooves and radial ports in one of said head portions of the bushing,
 - bleed-off means in communication with the other of said heads of the bushing,
 - said bushing affording communication therethrough between said head portions,
 - a valve member in said bushing and having means for alternatively effecting communication of said passageway duct through said one head portion of the bushing with either said reservoir duct through said one head portion of the bushing or with said bleed-off means by way of said one head portion and the passage through the bushing and said other head portion while closing off communication between said reservoir duct and said one head portion,
 - and means for actuating said valve member from a position externally of the handle.
4. In a power driven fastener driving machine including a head structure having a nose portion providing a fastener driveway and a fastener driver reciprocally operable in said driveway,
- the combination comprising:
- a front nose plate removably mounted on the nose portion,
 - retaining clip means including a retaining clip intermediately engageable retainingly with the plate and providing a shoulder facing toward said head structure,
 - means for reciprocally operating said driver,
 - safety means operable normally to disable said driver operating means,

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said safety means including a work-engaging trigger member normally projecting beyond the tip of the nose portion for engaging work into which a fastener is to be driven in advance of the tip of the nose portion to be shifted into safety means releasing position,

and a shoulder on said trigger member opposing said shoulder of the clip member as a stop to delimit said projecting relationship of the trigger member relative to the nose portion.

5. A fastener driving machine as defined in claim 4, in which said front nose plate has a button-like guide projection in spaced clearance relation to the area of the plate engaged by the retaining clip means, and the trigger member includes guide means thereon with which the projection is in guiding engagement.

6. A power driven fastener driving machine including a head structure providing a reciprocally operating fastener driver operable from one end thereof and having adjacent to said one end a rigid magazine structure for supplying fasteners into position to be driven by the driver, and a nose structure aligned with said driver to provide a fastener driveway and including:

- a facing plate having a fastener doorway therethrough,
- a pair of screws securing said facing plate to said magazine structure and having heads projecting from the face of the plate opposite said magazine structure,

- a front plate complementary to said facing plate and engaging said opposite face,

- said front plate having sockets within which said screw heads are engaged for thereby retaining the front plate against planar displacement relative to the facing plate,

- and releasable clip means retaining the front plate against separation from the facing plate,

- said front plate having a driveway groove aligned with said fastener doorway.

7. In combination in a fastener driving machine including a head having a fastener driver to project from one end thereof and means for actuating the driver,

- a nose structure aligned with said one end of the head and providing a fastener driveway in which said driver is operable,

- a fastener supply magazine aligned with and arranged to feed into said driveway and comprising:

- means defining an elongated fastener supply chamber providing opposed guide surfaces,

- spaced parallel shoulders extending lengthwise of the chamber in at least one of said surfaces,

- an elongated track bar having a flange portion engageable selectively on one of said shoulders to support fasteners of different lengths in the supply chamber,

- and means for releasably retaining the track bar against longitudinal displacement within the chamber between said surfaces.

8. In a machine for driving fasteners at high velocity into a workpiece,

- a housing including a magazine section with a handle thereabove and both connected to a forward head section,

- a nose structure on the forward end of the magazine section and under the head section for receiving fasteners from the magazine section and orienting the fasteners with respect to a workpiece into which the fasteners are to be driven.

- a pneumatic motor in said head section and a fastener driver operatively connected to the pneumatic motor and operative in said nose structure for driving fasteners therefrom into a workpiece,

- means including a reservoir for supplying pneumatic fluid to said head section for actuating said pneumatic motor,

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the improvement comprising:

pneumatically responsive means for controlling operation of said pneumatic motor and including a passageway system having primary and secondary source of pneumatic fluid ducts both of which ducts communicate with said reservoir and through said system with said motor controlling means,

a first trigger valve digitall yoperable adjacent to said handle in control of said primary source duct,

a second trigger valve adjacent to said nose structure in control of said secondary source duct and operable by engagement with a workpiece into which a fastener is to be driven, and means defining a bleed-off opening in said head section and spaced from said handle, said second valve functioning in one operative position to disconnect said bleed-off and to open communication of said secondary source duct with the reservoir and functioning in another position to close such communication and to connect said bleed-off opening with said passageway system of said motor controlling means,

said first valve functioning in one operative position to open communication between said primary source duct and the motor controlling means and functioning in another position to disconnect the primary source duct from the motor controlling means and to connect the motor controlling means with the secondary source duct.

9. In a fastener driving machine including a housing having a pneumatic motor therein and a fastener driver operable by said pneumatic motor for driving fasteners from the housing into a workpiece,

means for supplying pneumatic fluid for driving the motor, pneumatically operable means for controlling actuating delivery of pneumatic fluid to the motor from said means for supplying pneumatic fluid and operable by alternately impressing pneumatic fluid thereagainst and bleeding off the pneumatic fluid therefrom,

the improvement comprising:

a digitally operable valve mechanism for operating said controlling means and including means defining a pneumatic fluid passageway system,

a work actuatable control valve mechanism including a passage connected with said passageway system,

and means including a port opening to atmosphere spaced from both of said valve mechanisms for bleeding off said passageway system but controlled by said work actuatable control valve mechanism.

10. A pneumatic driving machine including a head having a pneumatic fluid reservoir and a cylinder with one end disposed for exposure to the reservoir for driving of a piston reciprocally mounted in the cylinder and having a driver operable from the opposite end of the cylinder,

control valve means mounted reciprocally in respect to said one end of the cylinder and movable in one direction to open it to the effect of pneumatic fluid in the reservoir and movable in the opposite direction to close said one end of the cylinder,

and means for effecting said opening and closing movements of said valve means including:

a valve bore in said head adjacent to said cylinder, one end of said bore extending in substantially the same direction as said one end of the cylinder and communicating with said reservoir,

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a passageway leading from said bore to said control valve means for conducting pneumatic fluid from the reservoir entering said bore though its one end to bias the valve means in one of its reciprocal directions of movement relative to said one end of the cylinder,

a digitally operable valve in control of said passageway and operative in one position to close said passageway and in another position to open said passageway,

said head having a bleed-off passage leading from said bore and opening directly from the head to atmosphere,

the opposite end of the bore extending in substantially the same direction as said opposite end of the cylinder,

and a reciprocable valve member in said bore having a work-engageable trigger device and projecting beyond said opposite end of the bore, said valve member normally being biased in one direction in the bore to close said bleed-off passage and effect reservoir communication with said passageway and being movable in the opposite direction in the bore in opposition to the bias upon engagement of the trigger device with a work surface to open said bleed-off passage and disconnect the passageway from the reservoir.

11. A pneumatic driving machine according to claim 10, wherein said head has a boss in the reservoir and said one end of said valve bore has a port opening through said boss to effect the communication with said reservoir.

12. A pneumatic driving machine according to claim 10, wherein said opposite end of the bore opens through an overhanging portion on said head, said valve member having a stem projecting through said opposite end of the bore outwardly from said shoulder and said trigger device is attached to said stem, and removable stop shoulder means attached to said overhanging portion and engaged by said stem to limit projection of the stem from said overhanging portion.

13. A pneumatically operable fastener driving machine including a housing have a pneumatic motor therein for actuating a fastener driver to drive successive fasteners into the surface of a workpiece, and resettable means for controlling operation of the motor comprising:

a bore in said housing,

a first opening from one end of the bore communicating with a source of pneumatic driving fluid,

a first passage opening into said bore substantially spaced from said first opening,

a plunger valve member in said bore and having a sealing-ring-carrying portion slidably reciprocable in said bore between positions opening communication between said first opening and said first passage and a second position in which communication therebetween is blocked,

an opposite end second opening from said bore, workpiece-engageable trigger means attached to said plunger valve member and projecting a substantial distance therebeyond for engagement with said workpiece to move said plunger valve member through a substantial overtravel distance in said bore from said one position to said blocking position,

said overtravel distance permitting substantial recoil of the machine relative to said workpiece while said trigger means remains in engagement with the workpiece without reestablishing communication between said first opening and said first passage,

and said bore having a second passage between said first passage and said second opening directly and freely open to atmosphere and with which said first passage is maintained in communication while said plunger valve member remains in blocking relation between said first opening and said first passage.

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14. A pneumatically operable fastener driving machine including a pneumatic motor for actuating a fastener driver to drive successive fasteners into the surface of an object, and resettable means for controlling operation of the motor comprising:

a pneumatic passageway system having two branch portions one of which leads directly from the motor and the other of which leads from a source of pneumatic pressure fluid and has a bleed-off opening to atmosphere,

a digitally operable valve which is remote from said motor and said bleed-off and with which each of the branch portions communicates,

said digitally operable valve being operable to control communication between the branch portions whereby to interrupt communication therebetween or effect communication therebetween selectively,

and a workpiece-engageable trigger-controlled valve

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relatively closely adjacent to said motor and controlling communication between said outer branch portion and said pressure source and said bleed-off opening responsive to engagement of the surface of the workpiece into which a fastener is to be driven.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

March 9, 1965

Patent No. 3,172,124

Arthur E. Kremiller

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, lines 56 and 57, for "passaeway" read --
passageway --; column 3, line 23, for "rng" read -- ring --;
column 4, line 7, for "marginallly" read -- marginally --;
column 7, line 47, for "to" read -- so --; column 13, line 9,
for "digitall yoperable" read -- digitally operable --;
column 16, line 2, for "outer" read -- other --.

Signed and sealed this 24th day of August 1965.

(SEAL)

Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents