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Obergfell et al.

[11] **3,858,781**

[45] **Jan. 7, 1975**

[54] **SAFETY MECHANISM FOR FASTENER DRIVING TOOL**

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[52] **U.S. Cl.** **227/8**

[51] **Int. Cl.** **B25c 5/06**

[58] **Field of Search** 227/8

[56] **References Cited**

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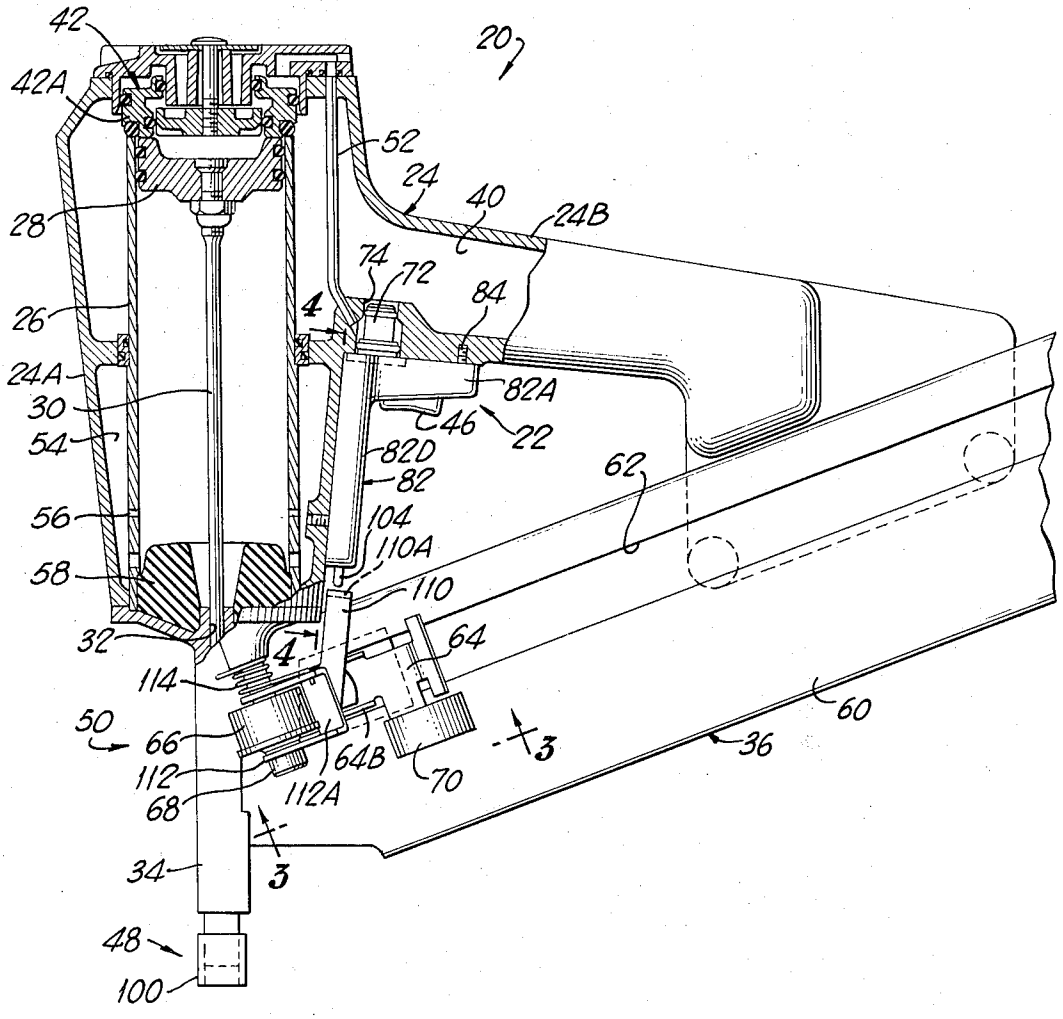
Primary Examiner—Granville Y. Custer, Jr.

Attorney, Agent, or Firm—Mason, Kolenmainen, Rathburn & Wyss

[57] **ABSTRACT**

A safety assembly for a pneumatic fastener applying tool includes a control valve with an operator. A plate for actuating the operator rests on a manual trigger and two slidably mounted rods at three spaced points. One rod is elevated when the tool is against the workpiece, and the other rod is elevated when an adequate supply of fasteners is provided in a tool magazine. The plate is elevated to actuate the valve operator and operate the tool only when both rods are elevated and the manual trigger is actuated.

11 Claims, 10 Drawing Figures



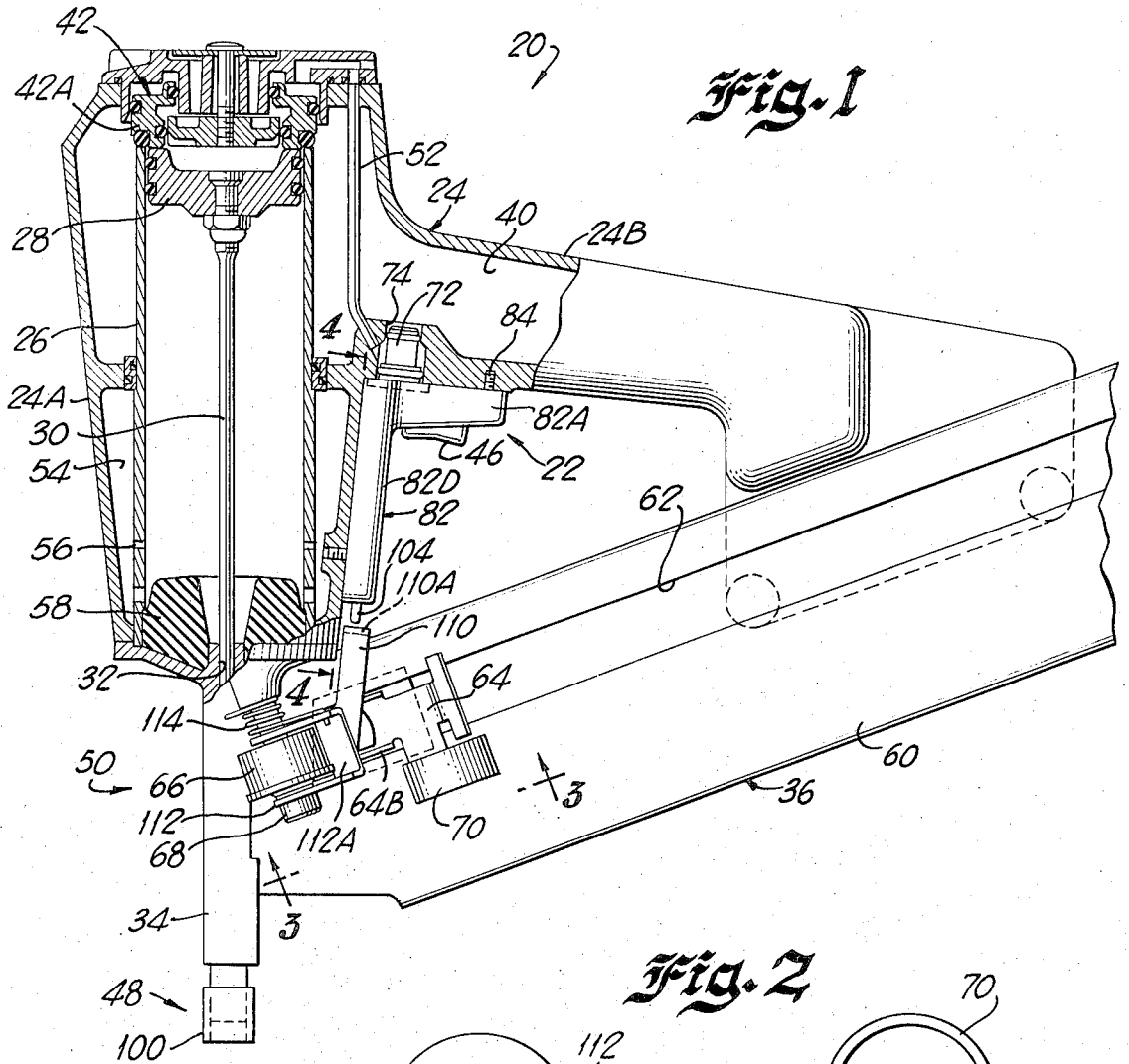


Fig. 1

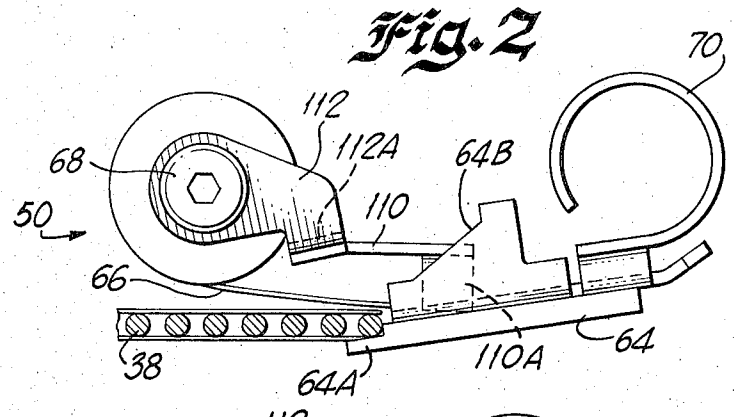


Fig. 2

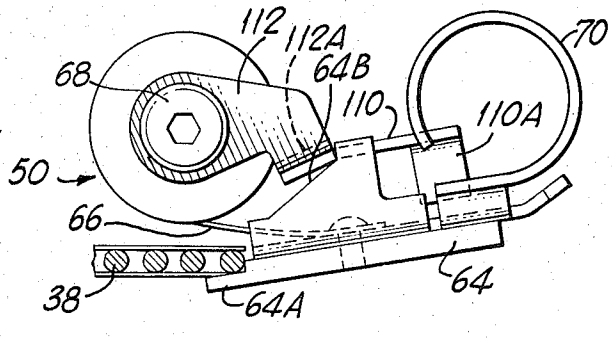


Fig. 3

Fig. 4

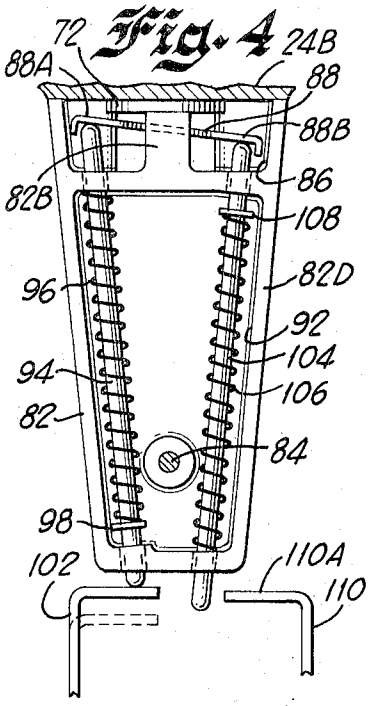


Fig. 5

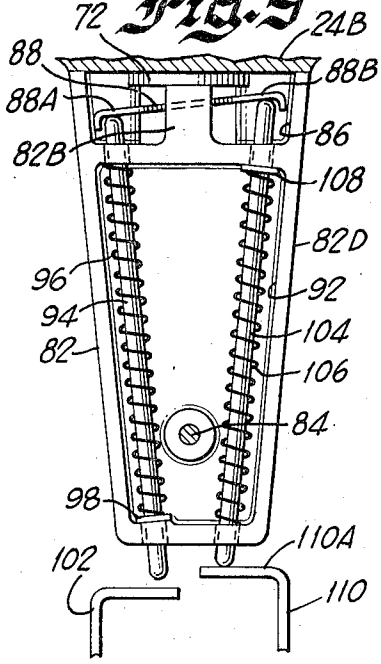


Fig. 6

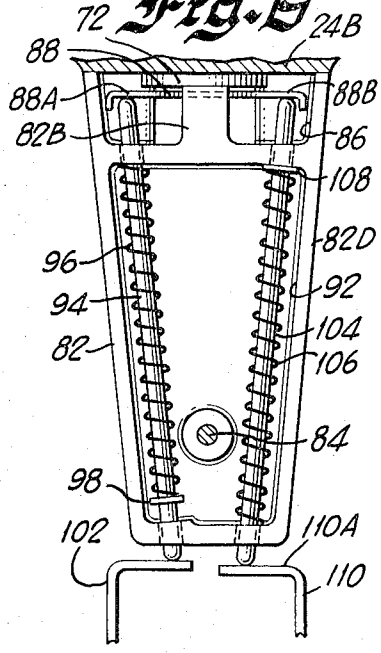


Fig. 7

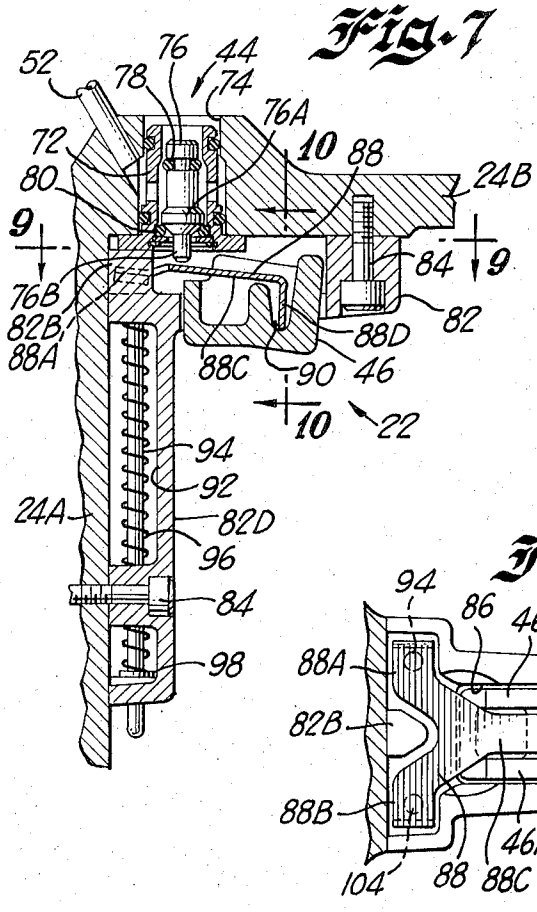


Fig. 8

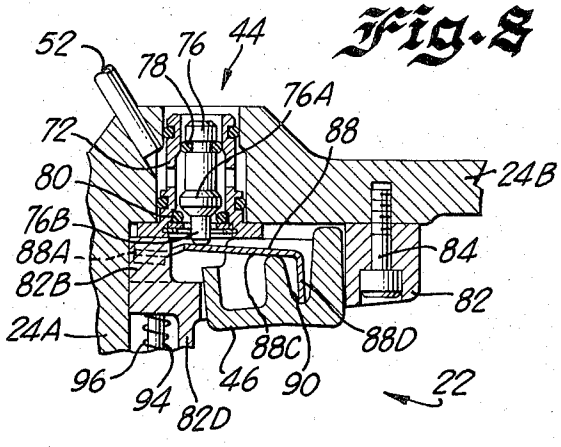
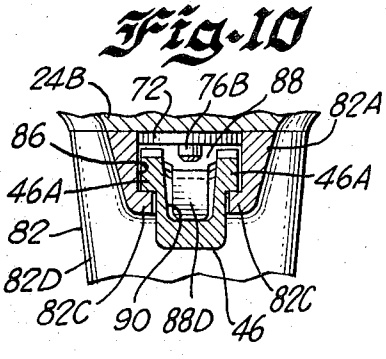


Fig. 9

Fig. 10



SAFETY MECHANISM FOR FASTENER DRIVING TOOL

This invention relates to a fastener driving tool, and, more particularly, to a new and improved safety assembly for a pneumatic tool for applying fasteners to a workpiece.

Pneumatic fastener driving tools have long incorporated safety mechanisms to inhibit trigger controlled tool operation when the tool is not against a workpiece and/or an adequate supply of fasteners is not provided in a magazine. As an example, U.S. Pat. No. 3,615,049 discloses such an arrangement wherein the movement of a workpiece engaging member required for tool operation is locked whenever the supply of fasteners is depleted with the result that the tool cannot be operated. However, this and similar arrangements rely on locking parts against movement in order to disable the tool, and it would be desirable to provide a safety assembly directly responsive to trigger operation, workpiece engagement, and an adequate supply of fasteners to be driven.

Accordingly, one object of the present invention is to provide a new and improved safety assembly for a fastener applying tool.

Another object is to provide a new and improved safety assembly for a fastener applying tool directly responsive to manual actuation, the position of the tool adjacent a workpiece, and the presence of an adequate supply of fasteners.

A further object is to provide a safety assembly having a control valve operator independently coupled to a manual control or trigger, a workpiece engaging means, and a mechanism responsive to the presence of an adequate supply of fasteners to be driven by the tool.

In accordance with these and many other objects, an embodiment of the present invention comprises a conventional fastener driving tool including a cylinder containing a slidably mounted piston for actuating a driver blade and the driver blade, on successive power strokes of the piston, engages and drives successive fasteners supplied to a nosepiece structure by a magazine assembly. Selective connection of the upper interior of the cylinder to compressed air or to the atmosphere is controlled by a piston actuated main valve-exhaust assembly, and the positioning of the main valve is in turn controlled by a pilot or auxiliary valve which selectively connects the piston to compressed air or the atmosphere. This pilot or auxiliary valve is controlled by a safety assembly that cannot be actuated to effect operation of the tool unless an adequate supply of fasteners is provided in the magazine, the nosepiece structure of the tool is disposed adjacent a workpiece, and the manual control such as a trigger is actuated.

This safety assembly includes a plate individually bearing against or resting on at three spaced points: a trigger, a rod controlled by a workpiece engaging assembly, and another rod controlled by a quantity of fasteners provided in the magazine. Unless the plate is elevated at all three points of contact, and operator for the pilot valve cannot be actuated to effect operation of the pilot valve and in turn the fastener driving tool.

Many other objects and advantages of the present invention will become apparent from considering the following detailed description in conjunction with the drawings in which:

FIG. 1 is an elevational view in partial section illustrating a pneumatically operated fastener driving tool using a safety assembly embodying the present invention;

FIG. 2 is a bottom plan view taken generally in the direction of line 3—3 in FIG. 1 illustrating an assembly for detecting the presence of adequate fasteners to be driven by the tool and shown in the normal position;

FIG. 3 is a bottom plan view taken in the direction of line 3—3 in FIG. 1 illustrating the assembly of FIG. 2 in an actuated condition indicating the absence of sufficient fasteners to be driven;

FIG. 4 is an enlarged view taken along line 4—4 in FIG. 1 showing a portion of the safety assembly in a condition in which the tool is rendered inoperative because of an absence of a sufficient supply of fasteners;

FIG. 5 is a view similar to FIG. 4 illustrating a portion of the safety assembly in aninoperative state due to failure to place the tool against an inoperative workpiece;

FIG. 6 is a view similar to FIGS. 4 and 5 illustrating the safety assembly in a condition in which the tool can be placed in operation;

FIG. 7 is an enlarged sectional view of the safety assembly embodying the present invention shown in a normal or inoperative state;

FIG. 8 is a fragmentary sectional view similar to FIG. 7 showing the safety assembly in a fully actuated position;

FIG. 9 is a sectional view taken along line 9—9 in FIG. 7; and

FIG. 10 is a sectional view taken along line 10—10 in FIG. 7.

Referring now more specifically to FIG. 1 of the drawings, therein is illustrated a fastener driving tool which is indicated generally as 20 and which includes a safety assembly embodying the present invention and indicated generally as 22. The fastener driving tool 20 includes a housing 24 with a forward head portion 24A in which is disposed a cylinder 26. Slidably mounted within the cylinder 26 is a piston 28 to which the upper end of a driver blade 30 is connected. The lower end of the driver blade is slidably received within a drive track 32 extending through a nosepiece structure 34. A magazine assembly indicated generally as 36 supplies successive fasteners such as nails 38 (FIG. 2) to the drive track 32 to be driven on successive power strokes of the piston 28 and the fastener driver 30. Compressed air from a reservoir 40 formed in the head portion 24A and a hollow rearwardly extending handle 24B of the housing is selectively admitted to and exhausted from the upper interior of the cylinder 26 under the control of a combined main and exhaust valve assembly which is indicated generally as 42.

The opening and closing of the main valve assembly 42 is controlled by the safety assembly 22. This assembly includes a pilot or auxiliary valve indicated generally as 44 (FIG. 7) which can be operated only when a manual trigger 46 is actuated, when a workpiece engaging assembly indicated generally as 48 is actuated to indicate that the tool 20 is adjacent a workpiece, and when a fastener supply detecting assembly indicated generally as 50 (FIGS. 2 and 3) is in a normal setting indicating the presence of an adequate number of fasteners or nails 38 contained in the magazine assembly 36. If any of these conditions is not met, the safety assembly 22 inhibits operation of the tool 20.

The construction of the tool **20** can be of any of a number well known in the art. As an example, the pneumatic piston-cylinder motor including the cylinder **26**, the piston **28**, and the driver blade **30** as well as the nosepiece structure **34** and the main valve assembly **42** can be of the type shown and described in detail in U.S. Pat. No. 3,638,532. In general, the construction is such that when pressurized fluid is supplied above a piston **42A** in the main valve assembly **42** over a conduit or passageway **52** by the pilot valve assembly **44**, the tool **20** is held in its normal state shown in FIG. **1** in which the main valve assembly **42** closes off communication between the reservoir **40** and the upper interior of the cylinder **26**. When the pilot valve assembly **44** is operated to connect the conduit **52** to the atmosphere, the piston portion **42A** actuates the main valve **42** by moving it upwardly, and compressed air is admitted to the upper end of the interior of the cylinder **26** from the reservoir **40**. When the control valve **44** returns pressurized fluid or compressed air from the reservoir **40** to the conduit **52**, the piston portion **42A** closes the main valve assembly **42** and permits the piston **28** to be returned under the control of pressurized fluid stored in a piston return chamber **54** through a plurality of ports **56** when the piston **28** is at the end of its power stroke in engagement with a resilient bumper **58** disposed in the lower end of the cylinder **26**.

The magazine assembly **36** for feeding successive nails **38** from a strip thereof into the drive track **32** in the nosepiece structure **34** can also be of any suitable construction known in the art. The magazine assembly **36** illustrated in the drawings can be, for example, the magazine assembly shown and described in detail in U.S. Pat. No. 3,615,049. In general, this magazine assembly includes a sheet metal magazine housing **60** having a slot **62** in the side wall thereof in which a pusher assembly **64** is movable. A portion **64A** on the pusher **64** engages the last nail **38** in the strip. One end of a coiled flat or constant force spring **66** is connected to the pusher, and the constant force spring coil is rotatably mounted on a shaft **68** carried on the nosepiece structure **34**. The constant force spring **66** continuously biases the pusher assembly **64** to the left so as to feed successive nails **38** from the strip into the drive track **32**. The pusher assembly **64** includes a ring **70** for retracting the pusher against the bias of the spring **66**.

The pilot or control valve assembly **44** included in the safety assembly **22** (FIGS. **7** and **8**) includes a sleeve **72** secured within an opening **74** in the handle portion **24B** of the housing and open at its inner end to the reservoir **40**. Slidably disposed within the sleeve **72** is a valve stem or element **76** carrying an O-ring **78** at its upper end and having an enlarged portion **76A** normally resting on an O-ring **80** mounted within the sleeve **72**. Thus, pressurized fluid from the reservoir **40** normally passes through the sleeve **72** and around the O-ring **78** to enter the conduit **52**. This pressurized fluid holds the main valve assembly **42** in its normally closed condition.

When the control valve assembly **44** is operated to the position shown in FIG. **8**, the valve piston **76** is moved upwardly so that the O-ring **78** seats on the inner wall of the sleeve **72** to close off communication between the conduit **52** and the reservoir. When the valve piston **76** is moved to the position shown in FIG. **8**, the enlarged portion **76A** moves out of engagement with the O-ring **80**, and the pressurized fluid from the conduit **52** is discharged to the atmosphere. This permits the main valve **42** to be opened. To provide means for controlling shifting movement of the valve piston **76**, the lower end of the valve body or stem **76** is provided with a projecting operator portion **76B**.

To provide means for controlling the operation of the control or pilot valve assembly **44**, the safety assembly **22** includes a generally L-shaped housing indicated generally as **82** which is secured to the housing **24** by a plurality of cap or machine screws **84**. An upper portion **82A** of the housing **82** is provided with a recess, chamber, or opening **86** (FIG. **9**) in which is disposed a generally Y-shaped operator plate **88** which, when elevated, engages the operator **76B** for the valve stem **76** and moves this valve stem upwardly to the position shown in FIG. **8** to operate the control valve assembly **44**. The plate **88** includes three legs **88A**, **88B**, and **88C**, each of which is adapted to be actuated by or to bear against a separate operator element, and each of these three operator elements must be elevated in order to elevate the plate **88** sufficiently to actuate the control valve **44**. A projection **82B** on the housing is located in the bifurcation between the legs **88A** and **88B** to aid in locating the operator plate **88** within the opening **86** with the operator **76B** above the center of the plate **88**.

As noted above, the safety assembly **22** is controlled by the trigger **46**. This trigger is mounted within the opening **86** in the upper portion **82A** of the housing **82** (FIGS. **7–10**) and includes a pair of opposite shoulder portions **46A** resting on inwardly turned edges **82C** of the upper portion **82A** of the housing **82**. A pocket **90** in the trigger **46** receives a downwardly turned end portion **88D** on the outer free end of the arm **88C** of the plate **88**. The normal state of the trigger **46** is shown in FIG. **7**. When the trigger **46** is manually depressed, its upward movement is limited by engagement with the bottom wall of the handle portion **24B** of the housing, and the leg **88C** of the operator plate **88** is elevated to the position shown in FIG. **8**.

The position of the leg **88A** of the plate is controlled by the workpiece engaging assembly **48**. More specifically, the housing **82** includes a long or generally vertically extending housing portion **82D** defining a cavity **92** between its outer wall and the outer wall of the head portion **24A** of the housing. Disposed within the cavity **92** is an operator rod **94** whose upper end is disposed immediately beneath the leg portion **88A** so that this leg portion rests on the upper end of the rod **94**. The leg **88A** is provided with a flange portion to insure proper location relative to the upper end of the rod **94**. A compression spring **96** interposed between a wall portion of the housing part **82D** and a washer **98** secured to the rod **94** normally biases the rod **94** to the position shown in FIG. **5** in which the leg **88A** of the operator plate **88** is in its lower or ineffective position.

To provide means for elevating the rod **94** and thus elevating the leg **88A** of the operator plate **88**, there is provided the workpiece engaging assembly **48** (FIG. **1**). This assembly can be of any suitable construction such as that shown in U.S. Pat. No. 3,615,049. In general, this assembly includes a workpiece engaging element **100** resiliently biased to the position shown in FIG. **1** in which it projects beyond the lower end of the nosepiece structure **34**. A linkage slidably mounted on the nosepiece structure **34** extends to an upper generally L-shaped linkage element **102** (FIGS. **4–6**). When

the workpiece engaging element 100 is not disposed against a workpiece, the element 102 occupies the position shown in FIG. 5. Alternatively, when the tool 20 is pressed against a workpiece so that the workpiece engaging member 100 moves upwardly (FIG. 1), the element 102 moves upwardly to the position shown in FIGS. 4 and 6. In this position, the element 102 engages the lower end of the rod 94 and moves it upwardly against the bias of the compression spring 96 so that the leg 88A of the operator plate 88 is elevated. Whenever the tool 20 is moved away from the workpiece, the linkage element 102 drops to the position shown in FIG. 5.

To provide means for controlling the elevation of the leg 88B of the operator plate 88, another rod 104 is slidably mounted on the housing portion 82D with its upper end disposed beneath the leg 88B. A compression spring 106 is interposed between a lower wall of the housing portion 82D and a washer 108 secured toward the upper end of the push rod 104. The spring 106 is a very light spring and merely serves to normally hold the rod 104 in the position shown in FIGS. 5 and 6 of the drawings. In this position, the upper end of the rod 104 bears against the under surface of the leg 88B of the actuator plate 88 and serves to elevate this leg of the plate.

The positioning of the push rod 104 is controlled by the supply of fasteners or nails 38 in the magazine assembly 36. More specifically, there is provided an arm 110 with an offset upper end portion 110A that normally lies just below and perhaps slightly spaced from the lower end of the rod 104 when the magazine assembly 36 has an adequate supply of fasteners. The arm 110 is connected to a U-shaped yoke 112 (FIGS. 1–3) pivotally mounted on the stud or shaft 68. A torsion spring 114 coupled to the U-shaped bracket 112 (FIG. 1) normally biases the bracket 112 and the connected arm 110 to the position shown in FIGS. 2, 5, and 6 in which the off turned end portion 110A on the arm 110 underlies the lower end of the push rod 104.

When, however, the pusher assembly 64 advances toward the nosepiece structure 34 to the extent shown in FIGS. 1 and 3, a cam surface 64B on the pusher engages a bight portion 112A and pivots the bracket 112 in a counterclockwise direction around the shaft 68 against the bias of the torsion spring 114 from the position shown in FIG. 2 to the position shown in FIG. 3. This moves the end portion 110A of the arm from the position shown in FIGS. 2, 5, and 6 to the position shown in FIGS. 3 and 4 in which the end portion 110A no longer underlies the lower end of the push rod 104. When the pusher assembly 64 is retracted, as by apprehending the ring 70 incident to the insertion of a new strip of nails, the torsion spring 114 returns the arm 110 to the position shown in FIGS. 5 and 6.

Assuming that an adequate supply of fasteners is provided in the magazine assembly 36, the arm 110 occupies the position shown in FIGS. 5 and 6. When the tool 20 is thereafter placed against a workpiece, the arm 102 moves from the position shown in dashed outline to the position shown in solid outline in FIG. 4 and to the position shown in FIG. 6. If the trigger 46 is then actuated or moved upwardly, all three legs 88A, 88B, and 88C are elevated, and the central portion of the actuator plate 88 which underlies the valve operator 76B moves upwardly to engage and move the operator 76B so that the control valve assembly 44 is changed from the position shown in FIG. 7 to the position shown in FIG. 8. This causes the operation of the tool 20. The release of either the trigger 46 or the workpiece engaging assembly 48 releases the control valve assembly 44. The arrangement of the safety valve assembly 22 is such that the control valve 44 is actuated by the operator plate 88 whenever the last of the three legs 88A, 88B, or 88C is elevated. Thus, if the trigger 46 is not actuated to elevate the leg 88C or if the workpiece engaging assembly 48 is not actuated to elevate the leg 88A, the tool 20 cannot be operated. This tool will be operated whenever the last of the above-identified instrumentalities is actuated.

Assuming that during the driving of a given nail 38 by the tool, the pusher assembly 64 moves to the position shown in FIG. 3. The end portion 110A of the leg 110 is moved out from beneath the lower end of the push rod 104. This does not affect the position of the rod 104 because the bias spring 106 maintains the upper end of the rod 104 in engagement with the leg 88B, and this leg of the operator plate 88 remains elevated. If, thereafter, the tool 20 is placed against the workpiece so that the linkage element 102 moves from the position shown in dashed outline in FIG. 4 to the position shown in solid outline therein, the rod 94 is elevated to elevate the leg 88A of the plate. If thereafter the trigger 46 is operated, the plate 88 will move upwardly to engage the lower end of the operator portion 76B for the valve stem 76 and the control valve assembly 44. The pneumatic bias applied to the valve stem 76 provides a force greater than the force of the spring 106. Thus, continuing deflection or operation of the trigger 46 cocks the plate 88 to the position shown in FIG. 4 and forces the leg 88B downwardly against the bias of the spring 106. This downward movement of the push rod 104 is permitted because the free end 110A of the arm 110 is no longer beneath the lower end of this rod to block its downward movement. Thus, the tool 20 cannot be operated until such time as a supply of nails 38 in the magazine 36 has been replenished.

Although the present invention has been described with reference to a single illustrative embodiment thereof, it should be understood that numerous other modifications and embodiments may be devised by those skilled in the art that will fail within the spirit and scope of the principles of this invention.

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

1. In combination with a tool for driving fasteners into a workpiece of the type including a fluid powered drive means including a nosepiece structure through which fasteners are driven into a workpiece, a driver movable in the nosepiece, and a fluid motor for operating the driver; a magazine assembly for feeding fasteners into the nosepiece structure; and a fluid valve assembly for controlling the operation of the fluid motor; a safety assembly comprising

a workpiece engaging means, a detecting means for determining the presence of a certain minimum quantity of fasteners in the magazine assembly,

first and second control means each movable between effective and ineffective positions and each disposed in an effective position by one of the workpiece engaging means and detecting means,

third control means comprising a trigger means and movable between effective and ineffective positions,

and a control member for controlling operation of the fluid valve assembly and adapted to be engaged by the three control means, said control member being actuated by the three control means to operate the fluid valve assembly only when all three control means are in their effective positions.

2. The combination set forth in claim **1** in which the control member is movable relative to all of the three control means and is adapted to be engaged by the three control means at three spaced points.

3. The combination set forth in claim **1** including means mounting the three control means to engage the control member at three points in a generally triangular relation to each other.

4. The combination set forth in claim **3** in which the fluid valve assembly includes an operator disposed for actuation by the control member in an area on the control member disposed generally intermediate the three points of engagement of the control member by the three control means.

5. A tool for driving fasteners into a workpiece comprising

a fluid powered drive means including a nosepiece structure through which fasteners are driven into a workpiece, a driver movable in the nosepiece, and a fluid motor for operating the driver,

a magazine assembly for feeding fasteners into the nosepiece structure,

a fluid valve assembly for controlling the operation of the fluid motor,

a control member for controlling operation of the fluid valve assembly,

three mechanical elements engageable with the control member for rendering the control member effective to control operation of the fluid valve assembly, each of the three mechanical elements being movable between effective and ineffective positions and all of the elements being in their respective effective positions to render the control member effective, a first one of the elements being manually operable to an effective position,

a workpiece engaging means for controlling the position of a second one of the elements in an effective position when the nosepiece structure is adjacent the workpiece,

and a fastener supply responsive means responsive to the supply of fasteners in the magazine and placing a third one of the elements in an effective position only when an adequate supply of fasteners is provided in the magazine assembly.

6. The tool set forth in claim **5** in which the fluid valve assembly includes an operator actuated by the control member,

and the control member includes three spaced portions mechanically engaging the three elements.

7. The tool set forth in claim **5** including means mounting the first one of the three elements for pivoting movement.

8. The tool set forth in claim **5** including means mounting the second of the elements for sliding movement.

9. The tool set forth in claim **8** including resilient means biasing the third of the elements in a direction toward its effective position.

10. The tool set forth in claim **8** including resilient means biasing the second of the elements in a direction away from its effective position.

11. The tool set forth in claim **5** in which the first element includes a pivotally mounted trigger engaging the control member.

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