Sept. 9, 1958 W. M. HOUGHTON 2,850,736

FASTENER INSERTING DEVICES

Filed July 26, 1956 4 Sheets-Sheet 1

Fig. 1

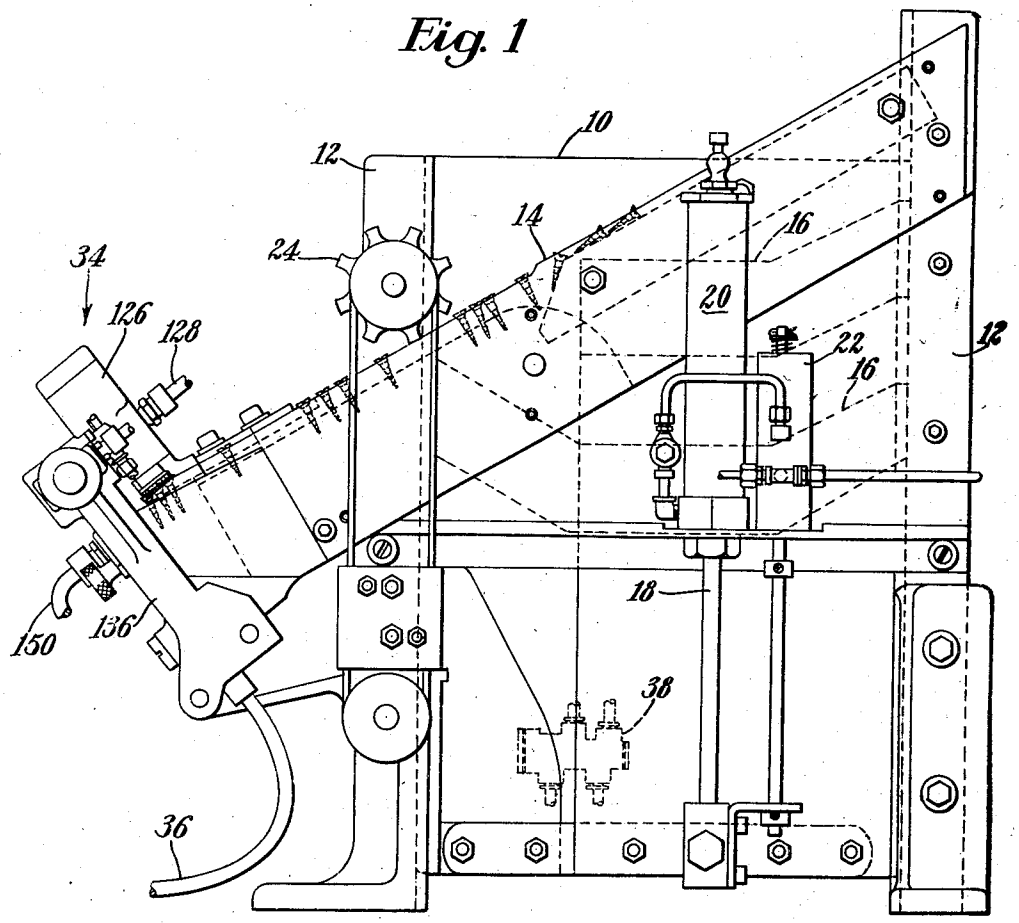
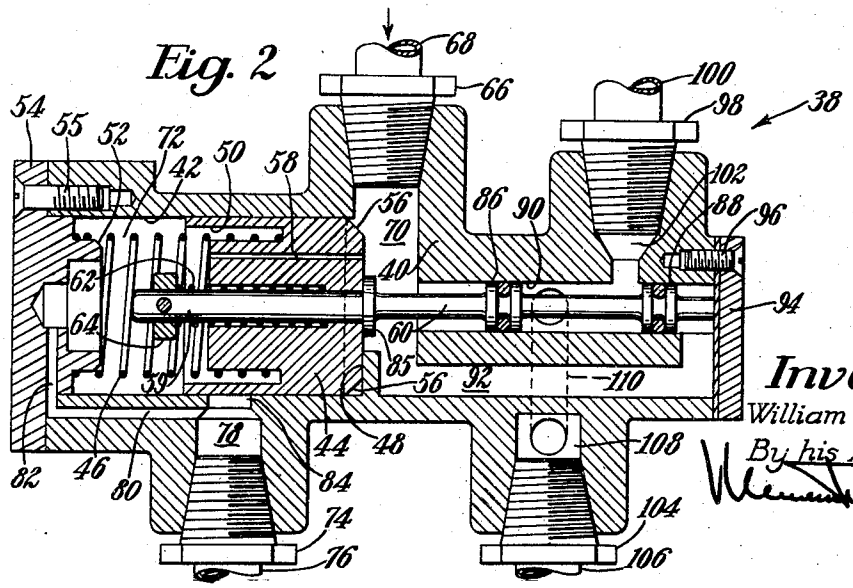


Fig. 2



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Fig. 3

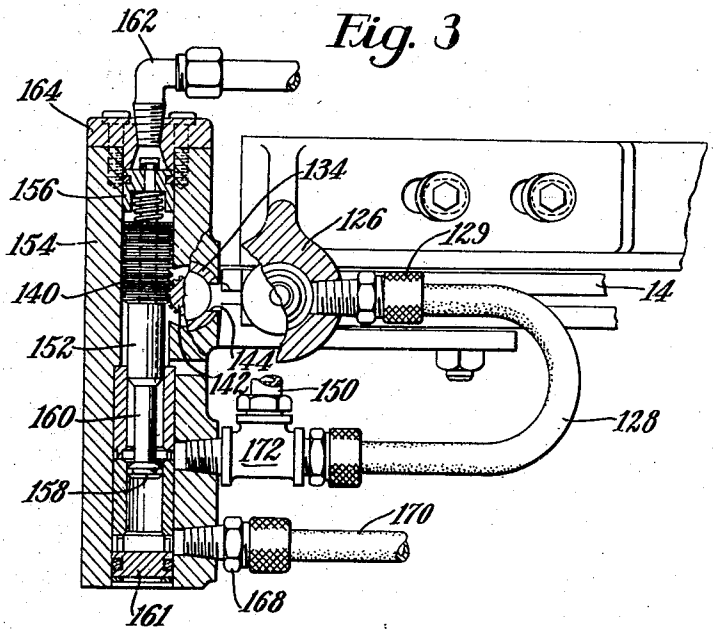
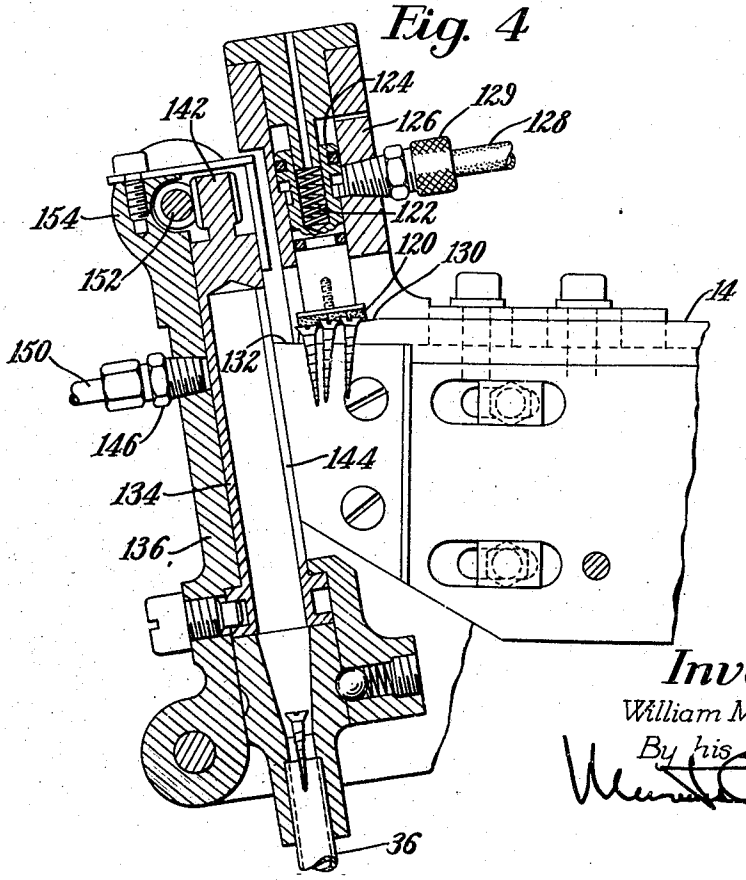


Fig. 4



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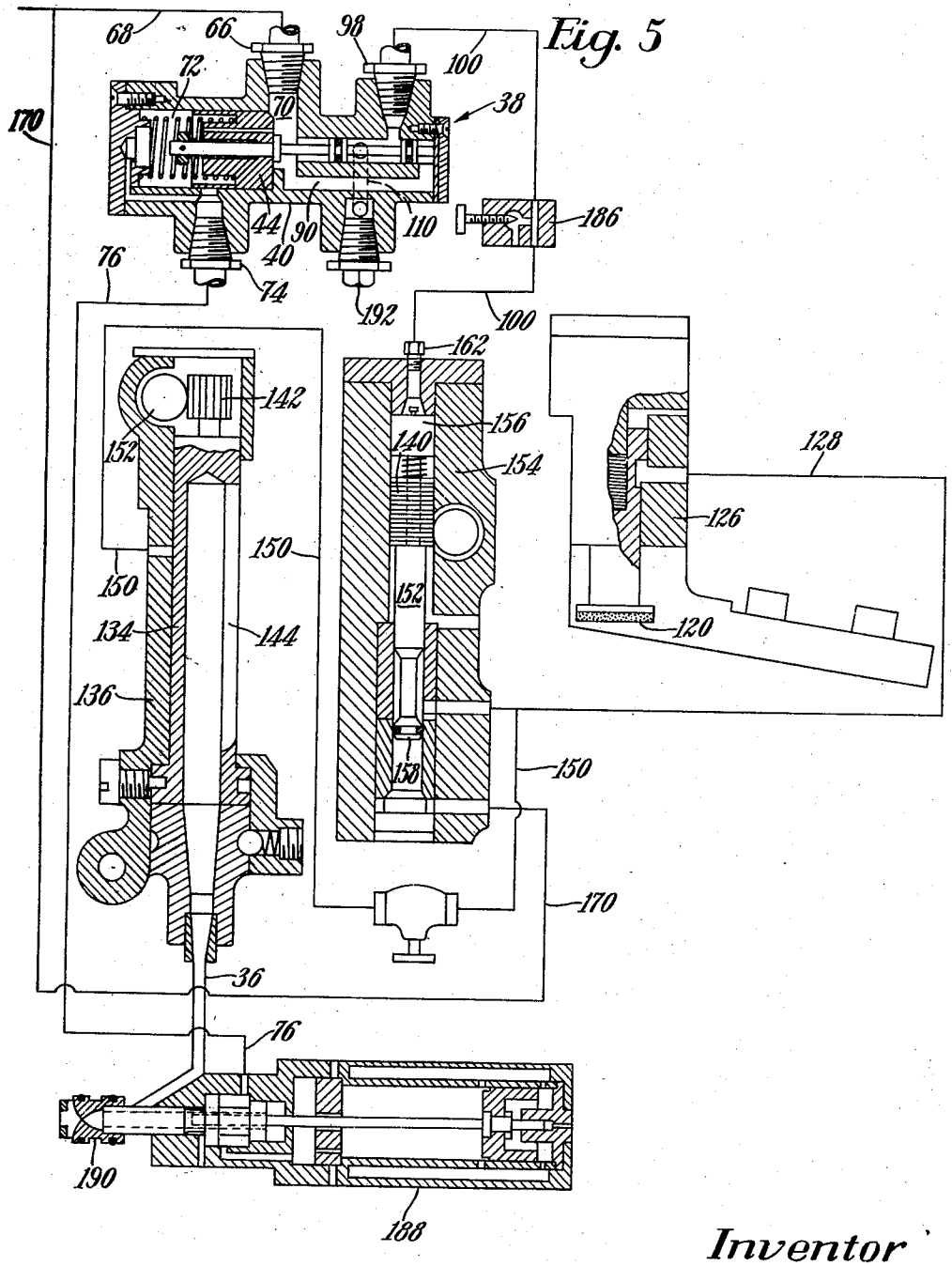
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Fig. 5



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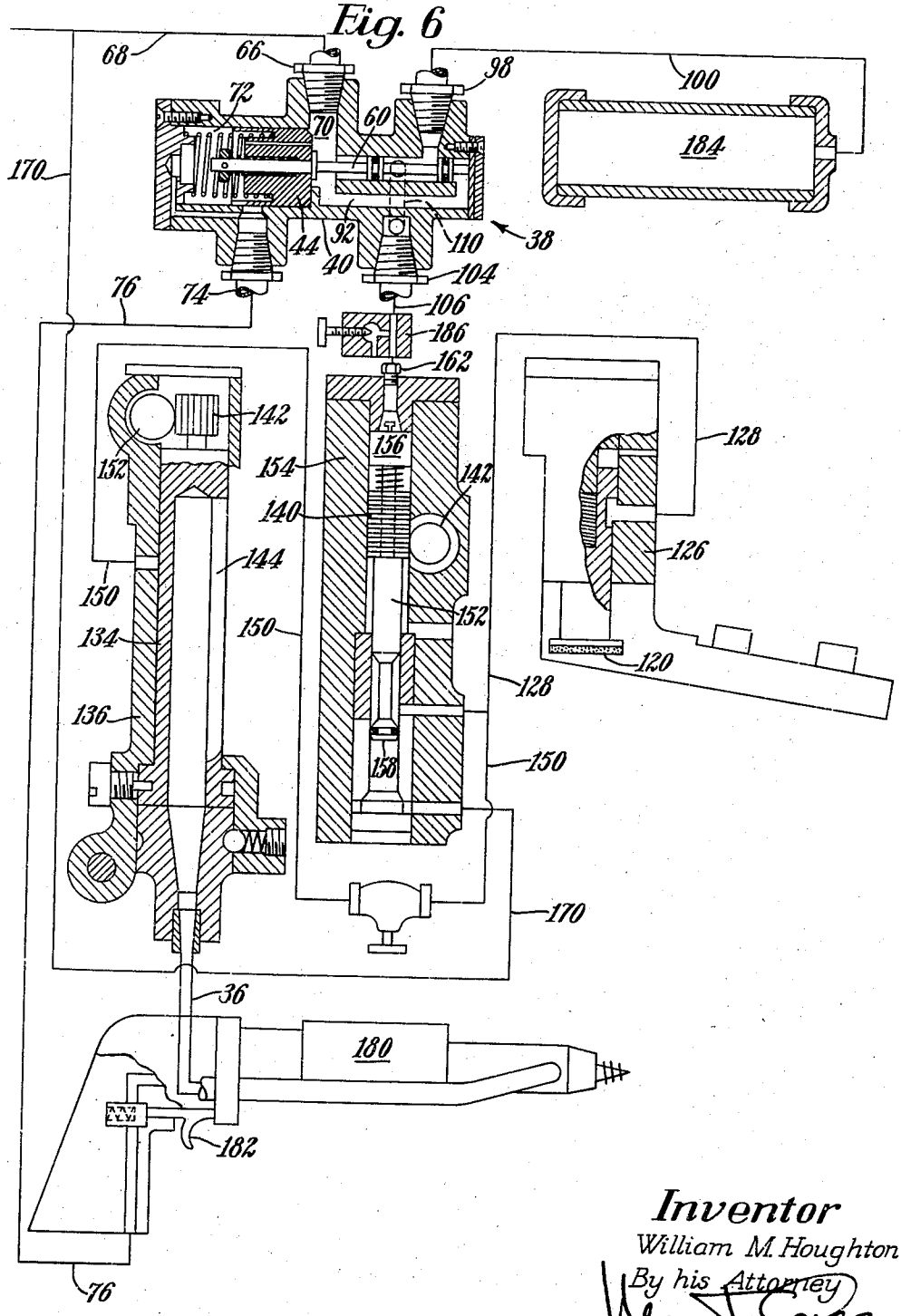
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FASTENER INSERTING DEVICES

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Fig. 6



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United States Patent Office 2,850,736
Patented Sept. 9, 1958

2,850,736

FASTENER INSERTING DEVICES

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Application July 26, 1956, Serial No. 600,326

10 Claims. (Cl. 1—1)

This invention relates to fastener inserting and more particularly to fluid-operated automatic-feed devices for inserting fasteners, such as, nails, screws and tacks, etc. Most inserting devices of this type comprise a portable driving tool connected to a remotely located feeding mechanism which automatically orients and feeds fasteners one at a time upon receipt of a signal emanating from the tool. Generally, there are three lines or conduits attached to the driving tool. The first is a fluid supply line, and since these tools are usually operated by compressed air, the supply line is an airtight conduit. The second line is a fastener delivery tube through which fasteners are propelled from the feeding mechanism and the third is a signal line to transmit a pneumatic signal to the feeding mechanism to deliver a fastener. The weight and freedom of movement of the driving tool are important factors influencing operator fatigue and consequently his production, thus an obvious advantage results from reducing the weight and increasing freedom of movement by eliminating one or more of the lines attached to the tool.

An object, therefore, of this invention is to provide a fastener inserting device having a light weight portable driving tool with a minimum of separate lines or conduits attached thereto.

Attempts have been made to combine the air supply line and the fastener delivery tube in a single conduit but this requires complex valve mechanism on the driving tool which adds to, rather than subtracts from, its weight. However, since the signal line must also be connected to the driving tool by an appropriate valve, the elimination of the signal line obviates the necessity for this valve and thereby not only reduces the weight of the tool but its cost as well.

Another object of this invention, therefore, is to provide a fluid-operated fastener inserting device having an automatic feeding mechanism and a portable driving tool which device does not require a separate signal line connecting the driving tool to the feeding mechanism.

Because the rate of operation of the driving tool is determined for the most part by the nature of the work, the rate of fastener consumption is not always constant but more often is irregular or intermittent. Thus, the feeding rate cannot be maintained constant but must be responsive to the requirements of the tool, otherwise a fastener could reach the tool before the preceding one has been inserted and jamming might result. However, to assure that no unnecessary delay takes place between driving cycles, the feeding mechanism should be actuated in timed sequence with the operation of the driving tool, and preferably in immediate response thereto.

Accordingly, it is still another object of this invention to provide a fastener inserting device having a feeding mechanism connected to a remote portable driving tool which device does not require a separate signal line but which has means for detecting accurately each driving cycle and for actuating the feeding mechanism to feed a fastener in immediate response thereto.

Some of the more frequently used driving tools of the portable pneumatic type are single or multiple blow nail drivers and rotary screw drivers, etc., which are connected by means of supply lines to substantially constant pressure sources of compressed air, such as, large capacity storage tanks or factory air systems. Each time one of these tools is operated to insert a fastener it consumes a quantity of compressed air resulting in a flow of air through the supply line. Applicant has found that by the use of appropriate flow detection mechanism in the supply line it is possible to determine with extreme accuracy when the driving operation of the driving tool begins and when it ceases. Furthermore, by triggering the feeding mechanism by the flow detection mechanism a fastener may be delivered in response to the operation of the driving tool without the need for a separate signal line.

In accordance with the above objects and as a feature of this invention there is provided a fluid operated fastener inserting device having a light weight portable driving tool connected to a remotely located feeding mechanism with a flow responsive valve positioned in a line which supplies compressed fluid to operate the driving tool, the valve being operable to detect fluid flow in the line caused by the operation of the tool, and in response thereto, to actuate the feeding mechanism to supply a fastener to the driving tool.

The above and other features of the invention including various novel details of construction and combination of parts will now be more particularly described with reference to the accompanying drawings and pointed out in the claims.

In the drawings,

Fig. 1 is a side elevation of a device embodying the invention for aligning fasteners with respect to their ends and for feeding them one at a time under pressure through a delivery conduit to a remotely located portable driving tool;

Fig. 2 is a vertical section through a flow responsive valve used to actuate the feeding mechanism shown in Fig. 1;

Fig. 3 is a plan view partly in section of a portion of the feeding mechanism shown in Fig. 1 for separating a single fastener, transferring it to a delivery conduit and propelling it therethrough under pressure to the inserting tool;

Fig. 4 is a side elevation partly in section of the mechanism shown in Fig. 3; and

Figs. 5 and 6 are diagrammatical views of the device shown in Fig. 1 including its pneumatic circuit, Fig. 5 showing the apparatus as employed with a single-blow nail driving gun and Fig. 6 showing it as employed with a rotary screw driver.

Applicant's flow responsive valve may be used in combination with any pneumatically operated fastener feeding mechanism and driving tool. By way of example only, it is herein illustrated in combination with a totally pneumatic type fastener separating and feeding mechanism identical to that disclosed in an application for United States Letters Patent Serial No. 550,324, filed December 1, 1955 in the name of Donald B. McIlvin et al. The McIlvin device, hereinafter referred to also as the feeder-separator, is best seen in Fig. 1 and comprises a hopper **10** for holding a supply of randomly oriented fasteners, such as nails or screws. The hopper is secured to a main frame **12** which may be mounted on a bench or other suitable support. Forming one side of the hopper is an elevating mechanism for lifting fasteners from the hopper and delivering them to a downwardly inclined, slotted raceway **14** along which the fasteners slide in uniformly alined relationship suspended by their heads. The elevating mechanism comprises a plurality of lift slides **16** connected by a piston rod **18** to an air motor **20** which is controlled by a valve **22** for reciprocating the

slides. Associated with the raceway **14**, which is adjustable widthwise to accommodate various types and sizes of fasteners, is a rotary rejector **24** to expel any misalined fasteners from the raceway. Secured to the frame **12** and mounted on the lower end of the downwardly inclined raceway **14** is a separating and feeding element **34** which separates the endmost fastener from those in the raceway and feeds it under pressure through a delivery tube **36** to a driving tool, such as a pneumatic nail or screw driving gun, not shown in Fig. 1. The separating and feeding element **34** is pneumatically operated, being connected to the same source of pressurized air as are the driving tool and the motor **20** which operates the lift slides **16**. A flow responsive control valve **38** is mounted on the frame **12** in any convenient position and is connected to the feeding and separating element **34** and the driving tool as shown in Figs. 5 and 6 as described in detail hereinafter.

The flow responsive valve **38** is best seen in Fig. 2 and has a valve casing **40** of irregular configuration which forms a valve chamber. In one end of the casing **40** is a cylinder **42** in which slides a piston **44**. The piston normally is urged by a compression spring **46** to a first position against an internal shoulder **48** formed in the casing **40**. The spring **46** fits within an annular recess **50** in the piston **44** and around a collar **52** formed on a plug **54** which is secured to the casing **40** by screws **55**, only one of which is seen in Fig. 2. The plug **54** forms an airtight seal on one end of the cylinder **42**. On the end of the piston **44** remote from the plug **54** there is an annular chamfered area **56**. Extending lengthwise through the piston **44** are a small diameter or restricted passageway **58** and the stem **59** of a control valve having the form of a spool valve **60**. The valve **60** is movable relative to the piston **44** and is urged to the left relative to the piston, as seen in Fig. 2, by means of a light spring **62** compressed between the piston and a collar **64** fixed to the stem **59**. In the upper portion of the casing **40** is threaded an air inlet fitting **66** to provide an inlet opening from an air supply line **68** to a main chamber **70** forming part of the valve chamber within the casing **40**. The main chamber **70** communicates with the open end of the cylinder **42** and by means of the restricted passageway **58**, with a chamber **72** comprising the closed end of the cylinder **42** which is the portion of the cylinder located on the left-hand side of the piston **44**. Threaded in a lower part of the casing **40** is a fitting **74** to provide an exit opening between an air line **76** and an exit chamber **78** which communicates with the chamber **72** of the cylinder **42** by means of interconnecting small diameter passageways **80** and **82** formed in the casing **40** and the plug **54** respectively. A port **84** connects the chamber **78** directly with the cylinder **42**.

The spool valve **60** comprises the above-mentioned stem **59**, a flange **85** and a pair of spools **86** and **88**. The spools **86** and **88** are provided with O rings of conventional type to form airtight seals with a cylinder **90** in which the valve **60** is slidable. One end of the cylinder **90** communicates directly with the main chamber **70** and the opposite end communicates with a passageway **92** connected to the main chamber **70**. Enclosing the right-hand end of the cylinder **90** and the passageway **92** is a cap **94** secured to the casing **40** by screws **96**, only one of which is seen in Fig. 2. Threaded in the casing **40** is a fitting **98** to provide a connection between an air line **100** and a passageway **102** which is a secondary exit opening communicating with the cylinder **90**. Also threaded in the casing **40** is still another fitting **104** forming a connection between an air line **106** and a chamber **108** which communicates with the cylinder **90** by means of a passageway **110**. The passageway **110**, which may be considered another secondary exit opening, bypasses and does not communicate directly with the passageway **92**.

The flow responsive valve **38** operates in the following manner. The air supply line **68** is connected to a substantially constant pressure source of compressed air, thus pressurizing the main chamber **70** by means of the air inlet **66** and the chamber **72** by way of the small diameter or restricted passageway **58** in the piston **44**. By means of the passageway **82**, the passageway **80**, the exit chamber **78**, and the air exit fitting **77**, the air line **76** is also pressurized. The air line **76** is connected to any device which is to consume compressed air. When there is no flow of air through the line **76**, the chamber **72** is maintained at the same pressure as the main chamber **70** and the piston **44** is maintained in its first position against the shoulder **48** by the spring **46**. When air is drawn from the line **76**, flow takes place through this line as well as through the exit chamber **78** and the passageways **80** and **82**. The passageway **58** is sufficiently small to restrict the flow of air to the chamber **72** to a quantity less than that which flows from the exit chamber **78** through the line **76**, resulting in an immediate small pressure drop in the chambers **72** and **78**. The greater air pressure then in the chamber **70**, acting on the right-hand face of the piston **44**, causes it to be displaced to the left to a second position compressing the spring **46** and moving the valve **60** to the left therewith.

The movement of the piston **44** to the second position uncovers the port **84** leading to the exit chamber **78** whereby air then flows directly from the chamber **70** into the exit chamber **78** and the line **76**. The port **84** in cooperation with the piston **44** acts as a control or throttling valve which in cooperation with the force of the spring **46** maintains the pressure in the exit chamber **78** lower than the pressure in the main chamber **70** during flow through the line **76**. Fluctuations in flow through the line **76** caused, for example, by an increase or decrease in the rate of operation of the driving tool will result in fluctuations in pressure in the exit chamber **78**. If the pressure in the exit chamber **78** decreases slightly because of a greater flow, more of the port **84** will be exposed by the piston **44** since the lowered pressure also in the chamber **72** will permit the pressure within the main chamber **70** to displace the piston **44** a somewhat greater amount to the left. Conversely, a small increase in pressure in the line **76** and thus in the exit chamber **78** caused by less flow will effect a throttling action, to wit, a slight movement of the piston **44** to the right making the effective size of the port **84** somewhat smaller. Thus, the piston **44** may tend to float varying the size of the port **84** maintaining the pressure within the chamber **78** lower than the pressure in the chamber **70** during flow through the line **76**.

In order to prevent any floating or oscillating motion of the piston **44** from being transmitted to the valve **60**, the piston is movable, within a limited range relative to the valve. The above-mentioned O rings in the spools **86** and **88** maintain a sufficiently close fit with the cylinder **90** to prevent the valve **60** from moving as a result of slight movement of the piston **44**. Any floating or oscillating motion of the piston **44** causes the spring **62** to become compressed or expanded to a greater or lesser degree but the force of the spring **62** alone is insufficient to move the valve **60** relative to the cylinder **90**. The valve friction does not impede the floating action of the piston **44**.

The initial displacement of the piston **44** to the left, to the second position as stated above, moves the valve **60** to the left, the piston abutting the collar **64** on the valve. This movement positions the spool **88** to the left of the secondary exit opening **102** placing the line **100** in communication with the pressurized passageway **92** to permit air to flow through the line **100** for purposes, such as actuating a feeder-separator, as hereinafter to be described.

When the flow through the line **76** stops, the chambers **78** and **72** again become pressurized at the same pressure

as the main chamber 70 and the piston 44 is returned to its right-hand position against the shoulder 48 by the spring 46. The valve 60 is moved to the right by the piston 44 engaging the collar 85, the spool 88 shutting off the line 100 from the pressurized passageway 92 and placing the line 100 in communication with the line 106 through the passageway 102, the cylinder 90, the secondary exit opening 110 and the chamber 108. Whether the line 106 is employed or the chamber 108 closed by a plug is determined by the use to which the flow responsive valve 38 is placed as will become more evident hereinafter.

The separating and feeding element 34 will now be described briefly. For a more detailed explanation of its structure and operation the above-mentioned McIlvin application may be referred to. Referring to Fig. 4, there is provided a presser foot 120 of rubber or similar material arranged to be moved toward and away from the lower end of the raceway 14 to engage and then release the heads of fasteners, herein illustrated as screws, as they slide down the raceway. The presser foot 120 is urged downwardly toward the raceway by means of a spring 122 and is movable away from the raceway by an air operated piston 124 mounted within a cylinder 126. The air for elevating the piston 124 and hence the presser foot 120 is supplied through a conduit 128 attached to a fittting 129 threaded in the cylinder 126. As seen in Fig. 4, the lower end of the raceway 14, all of which slopes downwardly (see Fig. 1), is further sloped along a portion 130 substantially parallel to the bottom of the presser foot 120. The portion 130 terminates abruptly exposing a fastener receiving area 132 extending beyond the presser foot and spaced slightly below the portion 130. When the presser foot is elevated, the endmost fastener is released onto the receiving area 132, its shank engaging the closed wall of a sleeve 134 which is rotatably mounted within a housing 136. The lower end of the sleeve is attached to the flexible delivery conduit 36 for conducting fasteners to the inserting tool. Rotary motion is imparted to the sleeve 134 by means of a slidable rack 140 (Fig. 3) which engages a pinion 142 secured to the top of the sleeve 134. In one position of rotation a slot 144 in the sleeve 134 faces the receiving area 132 and in another position of rotation faces a fitting 146 (Fig. 4) threaded into the housing 136 and connected to an air line 150. The rack 140 is attached to a piston 152 slidable within a cylinder 154 which forms the upper portion of the housing 136. On one end of the piston 152 is a head 156 and on the opposite end is a head 158 separated from the main portion of the piston by a necked area 160. A cap 161 closes one end of the cylinder 154 and an air inlet fitting 162 is threaded in a cap 164 secured to the opposite end of the cylinder 154. Through the fitting 162 high pressure air is admitted into the cylinder 154 to displace the piston in a downward direction as viewed in Fig. 3 to rotate the sleeve 134. In the lower end, Fig. 3, of the cylinder 154 is threaded a fitting 168 to which is connected an air line 170 which communicates with a constant pressure source of compressed air. Also threaded in the cylinder 154 is a fitting 172 which is in the form of a T connection having one end connected to the fitting 129 in the presser foot cylinder 126 by means of the line 128. The other branch of the T is connected to the fitting 146 by means of the conduit 150. The piston 152 and consequently the sleeve 134 are normally maintained by air pressure acting against the head 158 in the positions shown in Figs. 3 and 4 with the slot 144 in the sleeve facing the receiving area 132. The presser foot 120 is held downwardly by the spring 122 against the heads of fasteners located on the sloped portion 130 of the raceway 14. When a blast of air is admitted through the fitting 162 to the upper end of the cylinder 154, as seen in Fig. 3, the piston 152 moves downwardly, the head 156, being of greater diameter than the head 158, displacing the rack 140 which causes the sleeve to be rotated to a position wherein the slot 144 faces the air inlet fitting 146 and the closed wall faces the receiving area 132. The piston head 158 moves toward the cap 161 permitting the pressurized air in the line 170 to flow into the lower end of the cylinder 154, past the necked area 160 and into the T fitting 172. A portion of this air passes through the conduit 128 into the cylinder 126 and elevates the presser foot 120, permitting the endmost fastener to fall onto the receiving area 132 with its shank against the then closed wall of the sleeve 134. Another portion of the air also passes from the T fitting 172 through the line 150 and enters the sleeve 134 through the slot 144 which has become alined with the fitting 146. The fastener which entered the sleeve and fell into the conduit 36 during the preceding operating cycle is propelled by this air blast to the inserting tool.

Upon the release of pressure in the fitting 162 the piston 152 is returned to its upper position as seen in Fig. 3 by the air pressure on the lower face of the head 158, the air above the piston head 156 escaping through a bleeder valve 186 (Figs. 5 and 6). The pressure in the line 128 is reduced and the presser foot 120 descends under the force of the spring 122 into engagement with the heads of fasteners located on the sloped area 130. The sleeve 134 is rotated whereby its slot 144 again faces the receiving area 132 and the fastener then located thereon falls through the slot 144 downwardly into the conduit 36 coming to rest at a bend therein ready to be propelled to the inserting gun during the next operating cycle.

It will be noted that the above described McIlvin feeding mechanism is operated by a blast of air entering the cylinder 154 through a fitting 162 and by the constant pressure in the line 170, no other operating mechanism being required.

The more common portable pneumatic inserting devices may be classified in two general categories, (1) those in which the actual fastener driving operation is substantially instantaneous, for example, a single-blow nail or tack driver, and (2) those in which the driving operation requires a somewhat longer or sustained period of time, for example, multiple-blow nail drivers and rotary screw drivers. Feeding mechanisms used with the tools in the first category may deliver the next fastener immediately upon the tool being fired since the tools' driving periods are sufficiently short so as to be completed before the next fastener can be propelled through the delivery conduit thereby substantially eliminating the possibility of a jam at the tool. However, with tools of the second category having longer or sustained driving periods, the actual feeding of a subsequent fastener must be delayed until the driving operation ceases otherwise a jam will occur at the inserting tool.

The operation of the fastener inserting device employing applicant's flow responsive valve 38 for supplying fasteners to tools having a sustained driving period, herein illustrated as a pneumatically operated rotary screw driver, will now be described with reference to Fig. 6. The screw driver 180 is of a well-known commercial type, not shown in detail, in which a screw is rotatably driven by means of a pneumatic motor actuated by a trigger 182. The compressed air for operating the gun comes from the line 76 which is attached to the fitting 74 threaded in the casing 40 of the flow responsive valve 38. The line 100 which is attached to the fitting 98 in the flow responsive valve is connected to an air accumulator 184 which is part of the feeder-separator or feeding mechanism. The line 68 which is attached to the fitting 66 in the flow responsive valve is connected to a constant pressure source of compressed air. The combination of lines 68 and 76 through which air flows to the inserting tool may also be referred to as the first line for the purpose of this invention. The line 106 which is attached to the fitting 104 of the flow responsive valve is attached to the upper end of the cylinder 154 by means of the

fitting **162**. The lines **100** and **106** may be considered the second line for the purposes of this invention.

When the trigger **182** of the screw driver **180** is depressed, air flows through the line **76** to operate the screw driver. This flow, as stated above, causes the piston **44** of the flow responsive valve **38** to move to the left wherein the control or spool valve **60** is moved to a position wherein the pressurized air in the main chamber **70** may flow by means of the passageway **92**, through the line **100** into the air accumulator **184**. During this time, the air within the line **106** connected to the cylinder **154** of the feeder-separator remains at atmospheric pressure and the feeder-separator is not actuated. Releasing the trigger **182** of the screw driver after a screw has been driven cuts off the flow of air through the line **76** permitting the air in the chamber **72** again to reach the same pressure as that in the main chamber **70**, the piston **44** and the spool valve **60** again moving to their right-hand positions. At this time, the line **100** is placed in communication with the line **106** by means of the passageway **110** and the compressed air within the accumulator **184** flows into the line **106**. The pressurized air in the line **106** upon reaching the cylinder **154** of the separating and feeding element **34** displaces the piston **152** to actuate the element **34** in the manner described briefly above and in more detail in the above-mentioned McIlvin et al. application, whereby a fastener is propelled through the conduit **36** to the screw driver.

An alternative method of supplying fasteners to a substantially instantaneously operated inserting tool illustrated as a single-blow nail driver will now be described with reference to Fig. 5. The inserting gun **188** illustrated in Fig. 5 is identical with that disclosed in an application for United States Letters Patent Serial No. 535,365, filed September 20, 1955, in the names of Fred F. Chellis et al. Without describing the gun in detail it is sufficient to say that a nail is driven from the nosepiece **190** thereof when the gun is pressed against a work piece. The gun is operated pneumatically, being connected to the line **76** leading from the flow responsive valve **38**. In the same manner as the screw driver, the operation of the gun **188** causes a flow through the line **76** but because the driving operation is almost instantaneous it is unnecessary to delay the feeding of the next fastener. Accordingly, it is not necessary to employ an air accumulator as part of the feeding mechanism, such as the accumulator **184** illustrated in Fig. 6. The line **100**, now alone considered the second line, is connected directly to the cylinder **154** and the fitting **104** threaded in the flow responsive valve casing **40** is replaced by a plug **192**. Accordingly, when the piston **44** of the flow responsive valve is displaced by the pressure in the main chamber **70**, compressed air flows through the passageway **92** into the line **100** directly to the cylinder **154** of the feeding element **34** causing it to operate immediately as above described. Upon release of the nail driving gun **188** from the work piece, its nosepiece **190** is returned to its original position as explained in the above-mentioned Chellis et al. application and the line **76** again reaches full line pressure, the piston **44** of the flow responsive valve returning to its right-hand position as shown in Figs. 2 and 5, ready for another operating cycle.

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

1. A fastener inserting device having, in combination, a fluid operated driving tool, a line connected to the driving tool for supplying operating fluid thereto, means for feeding fasteners to said driving tool, and means in said line operative in response to the flow of fluid therethrough for controlling the operation of said feeding means.

2. A fastener inserting device having, in combination, a fluid operated driving tool, a line connected to the driving tool for supplying operating fluid thereto, means for feeding fasteners to said driving tool, and fluid responsive means in said line for causing operation of said feeding means in timed relation to the operation of said driving tool.

3. A fastener inserting device having, in combination, a fluid operated driving tool, a line connected to the driving tool for supplying operating fluid thereto, means for feeding fasteners to said driving tool, a member interposed in said line movable from a first position to a second position in response to flow of fluid through said line, means acting on said member to maintain it in the first position when there is no flow through said line, and means controlled by the movement of said member for causing operation of said feeding means in timed relation to the operation of said driving tool.

4. A fastener inserting device having, in combination, a fluid operated driving tool, a line connected to the driving tool for supplying operating fluid thereto, fluid pressure means for feeding fasteners to said driving tool, a valve for controlling the operation of said fluid pressure means, and flow responsive means in said line for moving said valve to operate said fluid pressure means in timed relation to the operation of said driving tool.

5. A fastener inserting device having; in combination, a fluid operated driving tool, a line connected to the driving tool for supplying operating fluid thereto, means for feeding fasteners to the driving tool, a flow responsive valve interposed in said line, a piston in said valve movable from a first to a second position in response to flow of fluid through said line, resilient means acting on said piston to maintain it in the first position when there is no flow through said line, and means controlled by the movement of said piston for causing operation of said feeding means in timed relation to the operation of said driving tool.

6. A fastener inserting device having, in combination, a fluid operated driving tool, fluid pressure means for feeding fasteners to the driving tool, a flow responsive valve, a first line connecting said valve to the driving tool for supplying operating fluid thereto, a second line connecting said valve to the feeding means for supplying operating fluid thereto, a supply line connecting said valve to a source of pressurized fluid, a chamber within said valve communicating with the supply line, a piston within said valve movable in response to a flow of fluid from said chamber through the first line, and a control member movable with said piston to permit fluid to flow from said chamber through the second line to the feeding means only when flow takes place from the chamber through the first line.

7. A fastener inserting device having, in combination, a fluid operated driving tool, fluid pressure means for feeding fasteners to the driving tool, a flow responsive valve, a first line connecting said valve to the driving tool for supplying operating fluid thereto, a second line connecting said valve to the feeding means for supplying operating fluid thereto, a supply line connecting said valve to a source of pressurized fluid, a chamber within said valve in open communication with the supply line, a piston within said valve movable in response to a flow of fluid from said chamber to the first line, a passageway from said chamber to the second line, and means for controlling flow of fluid through said passageway, said means for controlling being movable with said piston to permit fluid to flow from said chamber through the second line to the feeding means only when flow takes place from the chamber through the first line.

8. A fastener inserting device having, in combination, a fluid operated driving tool, fluid pressure means for feeding fasteners to the driving tool, said feeding means comprising a fastener handling mechanism and a fluid accumulator, a flow responsive valve, a first line connecting said valve to the driving tool for supplying operating fluid thereto, a second line passing through said valve and connecting the fastener handling mechanism to the fluid accumulator, a supply line connecting said

valve to a source of pressurized fluid, a chamber within said valve in open communication with the supply line, a piston within said valve movable in response to a flow of fluid from said chamber to said first line, and a control member movable with said piston to permit fluid to flow from said chamber through said second line to the accumulator only when flow takes place from said chamber to said first line and to permit fluid in the accumulator to flow through said second line to the fastener handling mechanism only after the flow from said chamber to the first line terminates.

9. A fastener inserting device having, in combination, a fluid operated driving tool, a fluid pressure means for feeding fasteners to the driving tool, said feeding means comprising a fastener handling mechanism and a fluid accumulator, a flow responsive valve, a first line connecting said valve to the driving tool for supplying operating fluid thereto, a second line passing through said valve and connecting the fastener handling mechanism to the fluid accumulator, a supply line connecting said valve to a source of pressurized fluid, a chamber within said valve in open communication with the supply line, a piston within said valve movable in response to a flow of fluid from said chamber to said first line, a passageway from said chamber to the second line and a spool valve for controlling flow of fluid through said passageway and through said second line, said spool valve being movable with the piston to permit fluid to flow from said chamber through said second line to the accumulator only when flow takes place from said chamber to the first line and to permit fluid in the accumulator to flow through said second line to the fastener handling mechanism only after the flow from said chamber to said first line terminates.

10. A flow responsive valve comprising a valve casing having an inlet opening adapted to be connected to a source of pressurized fluid and first and second exit openings, the first exit opening being at all times in communication with the inlet opening, means normally restricting the flow of fluid from the inlet opening to the first exit opening comprising a piston having a restricted passageway therethrough, means normally maintaining said piston in a position in which fluid must pass through said restricted passageway to the first exit opening, means responsive to movement of said piston for permitting direct flow from the inlet opening to the first exit opening, one face of said piston being exposed to the pressure of the fluid at said inlet opening and the other face being exposed to the pressure of the fluid at said first exit opening, said piston being movable in a direction to permit direct flow from the inlet opening to the first exit opening in response to a drop in pressure on the face exposed to the first exit opening occasioned by a flow of fluid through said first exit opening, valve means movable with said piston for controlling the flow of fluid through said second exit opening, and means to permit limited relative movement between the piston and said valve means whereby only a substantial movement of the piston results in movement of said valve means.

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