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POWER-OPERATED FASTENER DISPENSING AND DRIVING MEANS

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4 Sheets-Sheet 1

Fig. 2

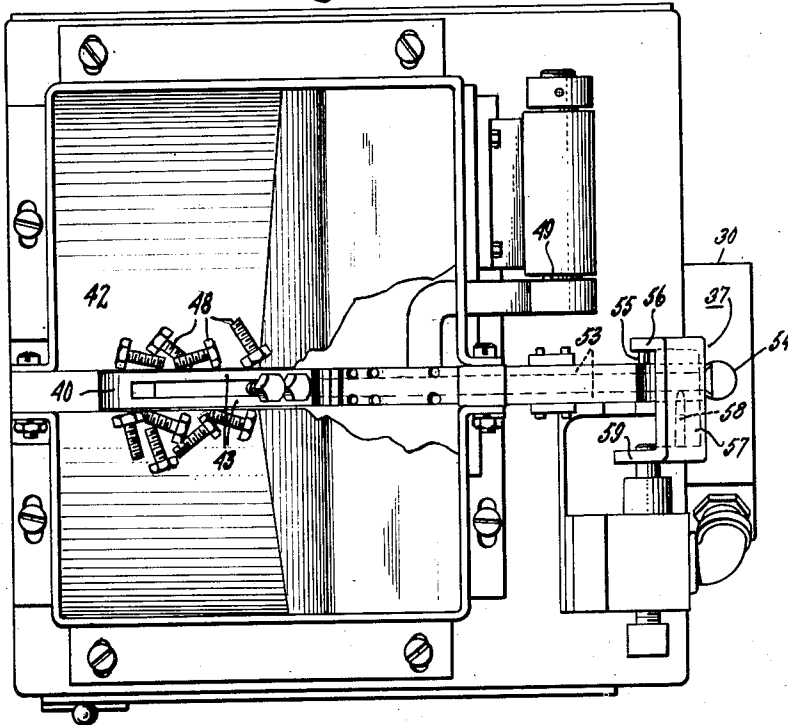
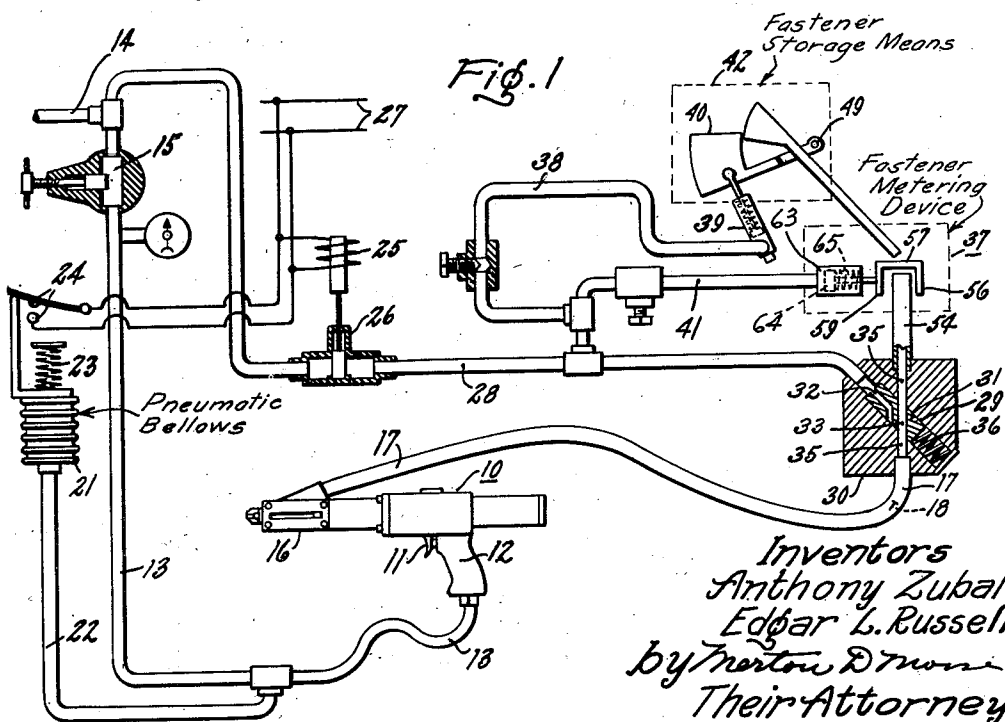


Fig. 1



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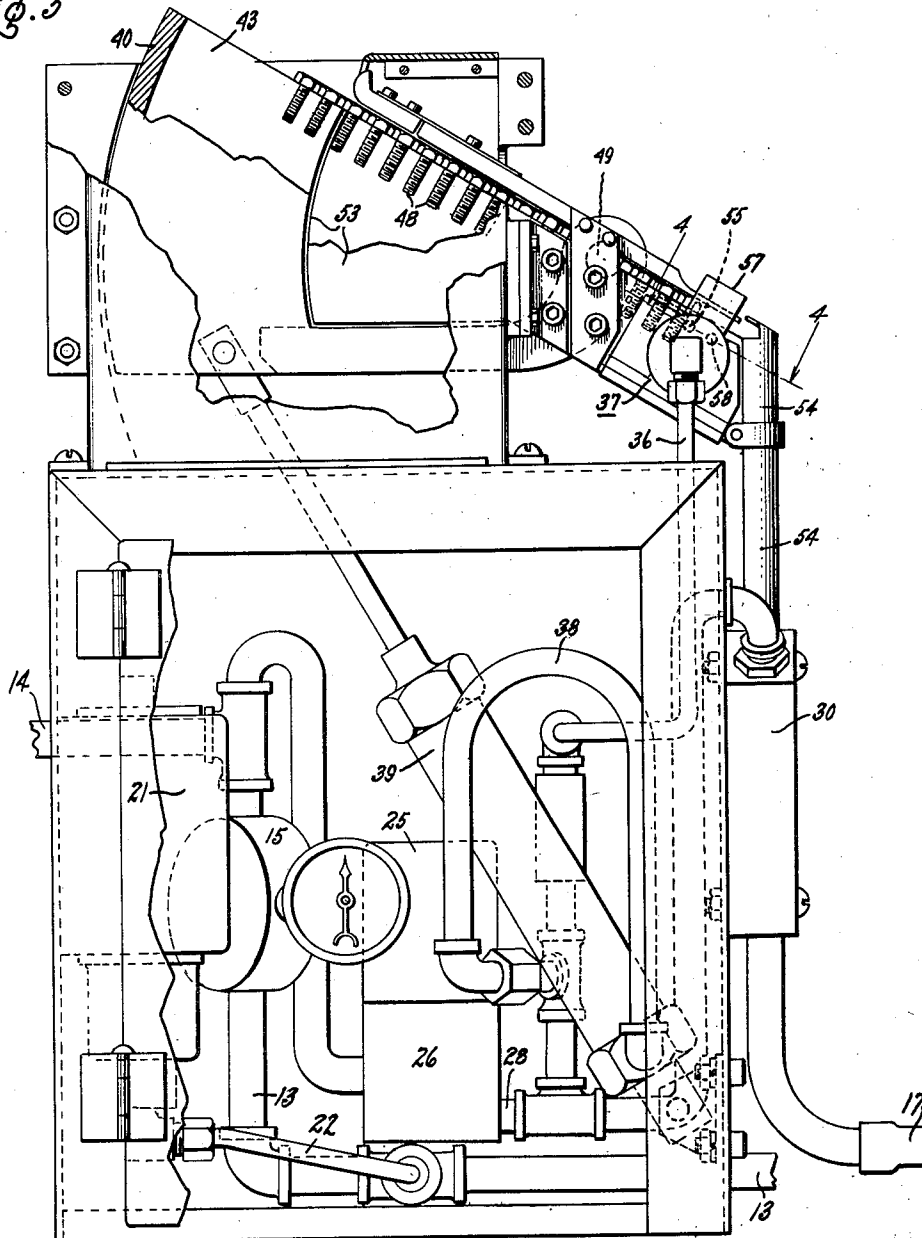
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Fig. 3



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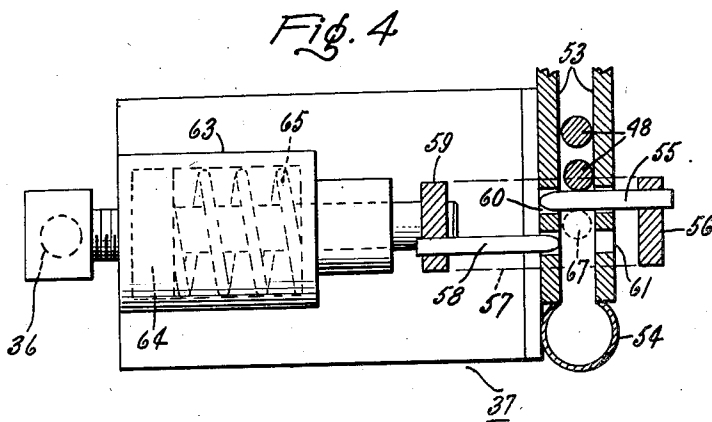
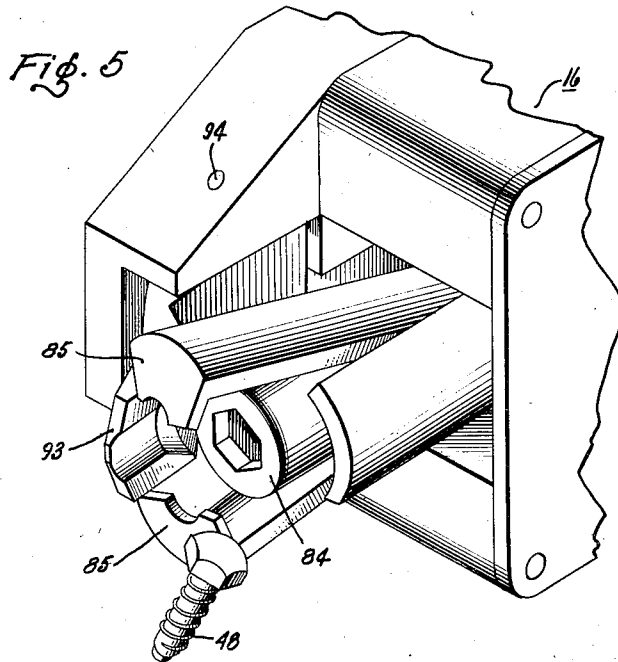
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POWER-OPERATED FASTENER DISPENSING AND DRIVING MEANS

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4 Sheets-Sheet 3



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POWER-OPERATED FASTENER DISPENSING AND DRIVING MEANS

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5 Claims. (Cl. 144—32)

Our invention relates to power-operated fastener dispensing and driving means and, while not limited thereto, we particularly contemplate its use in machine drivers for screws, bolts, nuts, etc.

An object of our invention is to provide such a fastener dispensing and driving means, which is completely fluid operated, and which is capable of repeated operation without jamming or blocking because of defective fasteners.

Another object of our invention is to provide such a means in which the fasteners are fed to the driver by fluid propulsion and in which, in each operation, if the driven fastener is defective so that it does not take to the work, it is automatically discharged from the driver and a new fastener is loaded into the driver in readiness for the next driving operation.

Another object of our invention is to provide such a driver having a driving head in which fasteners are embraced by a pair of jaws during the driving operation and having a wait chamber to which a fastener is fluid driven during each driving operation and in which, upon termination of said driving operation, said jaws are operated to release any fastener between them and a new fastener in said wait chamber is forced between said jaws in readiness for the next drive operation.

The novel features which we believe to be characteristic of our invention are set forth with particularity in the appended claims. Our invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings, in which

Fig. 1 represents the general assembly of equipment embodying our invention;

Fig. 2 is a plan view of the fastener storage or hopper from which fasteners are released one by one through a metering device shown therein;

Fig. 3 is an elevation view of a portion of the equipment showing the storage device partly in section;

Fig. 4 shows in part section details, on line 4—4 of Fig. 3, of the metering device by which screws are released one by one from the hopper;

Fig. 5 is a perspective view of a part of the mechanism of the driver head ejecting a screw not used;

Fig. 6 is a sectional view of the driver head in a plane between the drive chamber and the wait chamber;

Fig. 7 is a sectional view at right angles to Fig. 6 with a screw in place in the drive chamber in readiness to be driven;

Fig. 8 is a sectional view in the same plane as Fig. 7 while a screw is being driven and showing a second screw in the wait chamber;

Fig. 9 is a sectional view through the drive chamber and at right angles to Fig. 7.

In accord with our invention, a driver is provided with two jaws, which define what we refer to as the fastener drive chamber since these jaws, during the driving opera-

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tion, embrace the fastener while it is being driven by the driver member. The driver member and jaws advance during the driving operation and at the same time a second fastener is forced from the fluid fastener supply line into a wait chamber in the driver head in readiness for the next operation. A third fastener is segregated from the fastener storage in preparation for the second succeeding operation. On termination of the driving operation, the jaws are automatically parted to release any fastener still embraced by them and a fastener is forced from the wait chamber into position between the jaws. At the same time, the fastener previously segregated from storage is inserted into the fluid fastener supply line in readiness to be propelled to the wait chamber during the next driving operation.

Referring first to Fig. 1 of the drawings, we have shown at 10 a pneumatically operated screw driver having a control member in the form of a trigger 11 which may be operated from a rest position, which may be that shown, to a depressed, or operate, position in which it is pulled into closer relationship with the handle 12. The screw driver may be adapted for operation by any desired fluid, such as air, supplied through a fluid supply line 13 and a regulating valve 15 from a main air supply conduit 14. The actuating mechanism may be of the type manufactured and sold by Wilson Pneumatic Products Company.

The driver is provided with a head 16 to which fasteners are supplied through a pneumatic fastener supply line 17. The figure shows such a fastener at 18 in the supply line in position to be forced into the driver head 16 upon the next operation of the driver.

When trigger 11 is depressed, air is admitted to the pneumatic motor, or turbine, which drives the driver, and the driver operates to drive a fastener through the driver head 16 into any desired work piece. This operation reduces pressure in the supply line 13 with the result that a bellows 21, which is connected to the supply line through a line 22, retracts due to reduced air pressure within it and under pressure of an external spring 23 to cause the closing of contacts 24. This operation energizes the winding 25 of valve 26 from a power supply line 27. Energization of winding 25 causes the valve 26 to open to admit air from supply line 14 to a line 28. This line 28 is connected to an air cylinder 29 in a cylinder block 30. This cylinder has within it a piston 31 having two channels 32 and 33 through it. When the piston is in the position shown, the channel 32, the left end of which opens into line 28, is blocked at its right end by the wall of the cylinder. Channel 33, on the other hand, aligns with vertical channel 35 in the cylinder block. This channel is connected between a fastener metering device 37 and pneumatic fastener supply line 17 and, when piston 31 is in the position shown, conducts any fastener released from the fastener storage by the metering device 37 into the fastener supply channel 17. A fastener that has been so released is shown at 18 in the channel 17.

When valve 26 opens and air pressure is supplied to air cylinder 29, piston 31 is forced to the right, compressing spring 36, until the right end of channel 32 agrees with the downward portion of channel 35. Air then enters line 17 forcing fastener 18 into the wait chamber of the driver head 16. At this time, the upward portion of channel 35 is blocked to flow of air there-through by the piston wall.

This operation takes place while a screw previously admitted to the head is being driven into the work. At the same time, air is admitted through channel 41 to the metering device 37, presently to be described, which segregates a fastener from the fastener storage in preparation for the next operation.

Also, at the same time, air is admitted through the channel 38 to an air cylinder 39, which elevates an ele-

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vator 40 in a hopper 42 in which fasteners are stored. The structure and operation of this elevator and hopper may best be understood from consideration of Fig. 2 and Fig. 3.

Fig. 2 is a plan view looking downward into the hopper and showing screws 48 lying heterogeneously therein. The elevator 40 compresses a pair of parallel vertical plates 43 having parallel upper adjacent edges positioned just sufficiently far apart to receive between them the shanks of screws as the elevator is elevated through the screws in the hopper whereby some of the screws become suspended by their heads from the upper edges of the plates, as better shown in Fig. 3, during each such operation.

Fig. 3 is a view of the hopper partly in section on a plane between the two parallel plates 43 to show the suspended screws. The plates 43 of the elevator are arcuate in form and pivoted about the point 49 so that as the elevator rises under operation of the air cylinder 39, the screws become suspended from the upper edges of the plates. In the upper position of the elevator, these screws slide by gravity down the upper edges of plates 43 onto the upper edges of a pair of further parallel stationary plates 53, the upper edges of which continue the inclined plan formed by the upper edges of plates 43, upon which the screws are suspended by their heads, down to the metering device 37. This metering device segregates the screws one at a time, and at the proper times, drops them one by one into the fastener supply line 54.

The metering device 37 is better shown in Fig. 4 in which the parallel plates 53 are shown with the shanks of screws 48 positioned between them, these screws being suspended by their heads (not shown in Fig. 4) from the upper edges of the plates 43. The shanks of the screws are spaced apart because the heads of adjacent screws engage each other as shown in Fig. 3. They are prevented from sliding farther down the incline and to the fastener supply line 54 by a pin 55. This pin is carried by one arm 56 of a U-shaped member 57 having a corresponding pin 58 carried by its other arm 59. This U-shaped member 57 is better shown in Fig. 2 with its two pins 55 and 58, which project through holes 60 and 61 (Fig. 4), in the parallel plates 43, respectively.

When the trigger 11 of the screw driver is depressed, causing reduction of pressure in the air supply line and closing the contacts 24, valve 26 opens and admits air to the air cylinder 63 of the metering device shown in Fig. 4. This air is admitted to the left end of the cylinder 63 causing movement to the right of piston 64 against a spring 65. This piston is connected to the U-shaped member 57 carrying the pins 55 and 58 and operates that member to the right. This movement withdraws pin 55 from the holes in the plate 53 sufficiently to release the next fastener and inserts pin 58 into the opposite hole 61 to stop such fastener in its downward movement. The lower screw 48 then drops into the position 67, shown in dotted lines, against the pin 58 where it is held during the driving operation.

When the trigger of the driver is released at completion of a driving operation and pressure is removed from cylinder 63, spring 65 forces the piston back to the left causing pin 55 to return to the position shown but below the next screw 48. At the same time, since pin 58 is withdrawn from the hole 61, the lower screw 48 drops into the fastener supply line 54. Since, at this time, piston 31 in cylinder block 30 of Fig. 1 has returned to the position shown, the released screw falls through channel 35 into the supply line 17 where it is in readiness to be propelled into the wait chamber of the driver head on the next operation of the trigger.

Figs. 6, 7, 8, and 9 show sectional views through the driver head 16.

Fig. 6 shows a section of the driver head in the plane between the wait chamber 66 and the drive chamber. The wait chamber is connected to, and receives fasteners

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from, the supply channel 17. Screws are driven through the channel 17 into the driver head by compressed air, but are stopped in their motion in the wait chamber by two spring pressed pins 68 and 69 positioned in bores 73 and 74, respectively, in the lower and upper walls, respectively, of the driver head. These pins are spring pressed by springs 75 and 76, respectively, in such bores, the compression of which is adjusted by screw threaded members 77 and 78, respectively. The inner ends of these pins are positioned apart by sufficiently less than the diameter of the shank of a screw that they stop motion of the screw under pressure of the air in the channel 54 and thus prevent such screws from entering into the drive chamber of the driver head. The screw, therefore, remains against the pins 68 and 69, as shown in Fig. 8, in what is referred to as the wait chamber of the driver head, until completion of the driving operation.

Upon completion of the driving operation, when the trigger of the screw driver is released, the screw is forced between the pins 68 and 69 (upward in a plane at right angles to the plane of the drawing, Fig. 6) by a U-shaped member 83, better shown in Figs. 7 and 8, and only the ends of which are shown in Fig. 6. The structure and operation of this member will be better explained by reference to Figs. 7 and 8, each of which shows a sectional view in the plane of this member 83.

As previously stated, during the driving operation, a screw is blown from the feed line 17 into the wait chamber and against the pins 68 and 69, as shown in Fig. 8. At this time the driver 84 and associated parts 85, 86, and 87 are in the advanced or driving position shown in Fig. 8. Member 83 occupies the position shown in Fig. 8, being actuated to that position by the spring 90 which bears against the right hand arm 89 of the U-shaped member 83.

Upon completion of the driving operation, and release of trigger 11, the driver 84 and associated parts 85, 86, and 87 return to the position shown in Fig. 7. In so doing, shoulder 88 on jaw retainer 86 engages the inside surface of right hand arm 89 of U-shaped member 83, operating that member to the position shown in Fig. 7, compressing spring 90, and forcing the screw 48 against the pins 68 and 69 with such a force that the pins recede into their respective bores 74 and 75, against their spring biases, due to the cam action of the screw against the ends of the pins, and permit the screw 48 to pass on into the drive chamber 91 as shown in Fig. 7 and Fig. 9. This screw is now in position to be driven into work upon the next operation of trigger 11.

Figs. 7, 8, and 9 show the mechanism by which the screw is gripped in the drive chamber while being driven into the work. This mechanism comprises a pair of jaws 85, one on each side of the screw, which define the drive chamber. These jaws are pivoted at 87 in a cylindrical carrier which serves as a bearing and guide member for the driver 84. This whole assembly normally, with the apparatus at rest, occupies the position shown in Figs. 7 and 9. During the drive operation, this assembly is advanced by the motor actuating mechanism 10 from the position shown in Figs. 7 and 9 to that shown in Fig. 8. During this operation, the driver 84 engages the screw head and rotates it to drive the screw into the work piece 105. Fig. 9 is a sectional view at right angles to the plane of Figs. 7 and 8 and better shows the manner in which the screw is held in the drive chamber by jaws 85.

The driver 84 is shown as a socket wrench type adapted to engage the heads of the particular screws shown, but, of course, may be of blade type to engage a slot in the head of a screw, or of other suitable form.

The right end of jaw members 85 have beveled surfaces 100 which are engaged by cooperating beveled surfaces 101 of a member 103 which, during the driving operation, is forced by a spring 104 to the left to cause

the beveled surfaces to engage and to cause the jaws to grip the screw.

Figs. 6, 7, 8, and 9 all show member 93 attached to the end of the driver head to cooperate with the jaws 85 to release any screw held in the jaws when the jaws retract from the position shown in Fig. 8 to that shown in Fig. 7. This member 93 is pivoted at 94, Fig. 7, and is spring pressed into the outward path of the jaw by the spring 95 in the normal rest position of the apparatus. Adjustment screw 96 engages the right end of the member 93 and may be employed to adjust its position at rest. Jaws 85 have in the upper edges a notch, or recess, 97 (Fig. 7) and these jaws are so shaped that in their outward movement they engage release member 93 pushing it upward against spring 95 and passing underneath it until member 93 drops into the notch 97. In this position when the jaws 85 retract, the member 93 enters between them causing them to part forcing member 103 to the right against spring 104 due to action of the beveled surfaces 109 and 101. This releases any screw remaining in the jaws during the retracting operation.

This operation is better illustrated in Fig. 5 where the jaws 85 are shown parted by the release member 93, thereby permitting the screw 48, which may be defective, to drop from the jaws. This figure also shows the end of the driver 84 between the jaws 85.

In one physical embodiment of the apparatus, it is assembled in a cabinet shown in Fig. 3 on which the hopper 43 with its metering device 37 is mounted. Air line 13 enters from the driver through the cabinet to the air supply line 14. This line 13 is connected by line 22 to a bellows 21, the contacts of which energize the winding 25 of valve 26 to admit air to air cylinder 29, of cylinder block 30, to metering device 37, and to air cylinder 39 for actuating the elevator, all as previously described.

While we have shown a particular embodiment of our invention, it will be understood that we do not wish to be limited thereto and that many modifications and embodiments may be made. We contemplate by the appended claims to cover any such modifications and embodiments as fall within the true spirit and scope of our invention.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. In combination, a fluid operated fastener driver having a fastener supply line, an operating fluid supply line, and having a driver head having a drive chamber and a wait chamber, a control member having a rest position and an operating position, means responsive to operation of said control member to said operating position to admit operating fluid to said driver to operate said driver to drive any fastener in said drive chamber, a fastener storage means, means responsive to reduction in pressure in said operating fluid supply line to segregate one fastener from said fastener storage means and to admit fluid to said fastener supply line to drive any fastener previously admitted to said line into said wait chamber, and means responsive to operation of said control member to its rest position to force said last mentioned fastener from said wait chamber into said drive chamber and to admit said segregated fastener to said fastener supply line.

2. In combination, a fastener driver having a control member having a rest position and an operating position, and having a fastener drive chamber, and a fastener wait chamber, a pneumatic fastener supply line connected to said wait chamber, a fastener storage means, means responsive to operation of said control member to said operating position to drive any fastener in said fastener drive chamber and to admit fluid to said pneumatic fastener supply line to propel any fastener in said supply

line into said wait chamber and to segregate one fastener from said fastener storage means, and means responsive to operation of said control member to said rest position to force said first fastener from said rest chamber into said drive chamber and to admit said segregated fastener to said fastener supply line.

3. In combination, a fastener driver having a control member having a rest position and an operating position, and having a fastener drive chamber and a fastener wait chamber, a fastener storage means having a metering device operable to segregate a single fastener from fasteners in said storage means, a pneumatic fastener supply line between said metering device and said wait chamber, means responsive to operation of said control member to said operating position to drive any fastener in said drive chamber, to admit fluid to said fastener supply line to drive any fastener in said line into said rest chamber, and to operate said metering device all while said fastener in said drive chamber is being driven, and means responsive to operation of said control member to said rest position after completion of the drive of said driven fastener to discharge any defective fastener from said drive chamber, to force a fastener from said rest chamber into said drive chamber, and to release a fastener from said metering device into said pneumatic fastener supply line.

4. In combination, a fastener driver having a control member having a rest position and an operating position, said driver having a drive chamber, a wait chamber, and a drive member, a fastener storage means, a pneumatic fastener supply line connected to said rest chamber, means responsive to operation of said control member to operating position to rotate said drive member and to advance it through said drive chamber to engage a fastener therein to drive it into work, to admit fluid to said fastener supply line to propel a fastener from said line into said wait chamber and to segregate a fastener from said storage means, and means responsive to operation of said control member to rest position to retract said drive member, to discharge a defective fastener from said driver, to force a fastener from said wait chamber into said drive chamber, and to insert said segregated fastener into said fastener supply line.

5. In combination, a fastener driver having a control member having a rest position and an operating position, and having a fastener wait chamber, and a driver member, a pair of jaws adapted to embrace a fastener, said driver being operable in response to operation of said control member to operating position to rotate said drive member and to advance it longitudinally of and between said jaws to engage said fastener and to advance said jaws thereby to drive said fastener into work, and operable in response to operation of said control member to rest position to retract said jaws and driver member, means to part said jaws during said retracting motion to release any fastener between them, and means to force a fastener from said rest chamber into position between said jaws.

References Cited in the file of this patent UNITED STATES PATENTS

2,373,992	Billinghurst	Apr. 17, 1945
2,471,793	Stull	May 31, 1949
2,534,140	Moore	Dec. 12, 1950
2,544,165	Kransnow	Mar. 6, 1951
2,605,792	Havener	Aug. 5, 1952
2,638,945	Austin	May 19, 1953
2,657,721	Shaff	Nov. 3, 1953
2,754,860	Moore et al.	July 17, 1956
2,770,269	Austin	Nov. 13, 1956
2,772,426	Bailey et al.	Dec. 4, 1956