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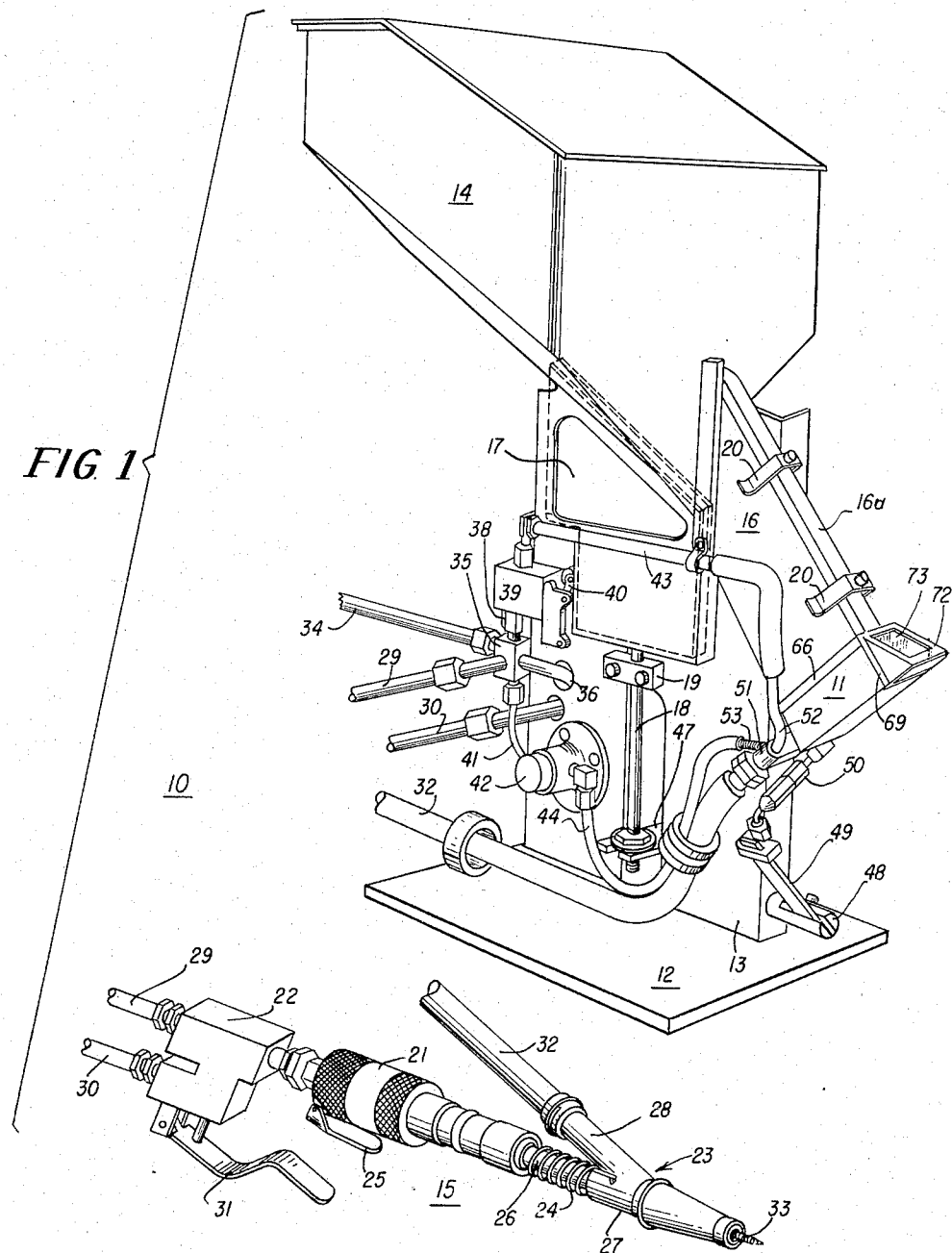
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FASTENER FEEDING AND DRIVING MACHINES

Filed March 11, 1958

3 Sheets-Sheet 1

FIG 1



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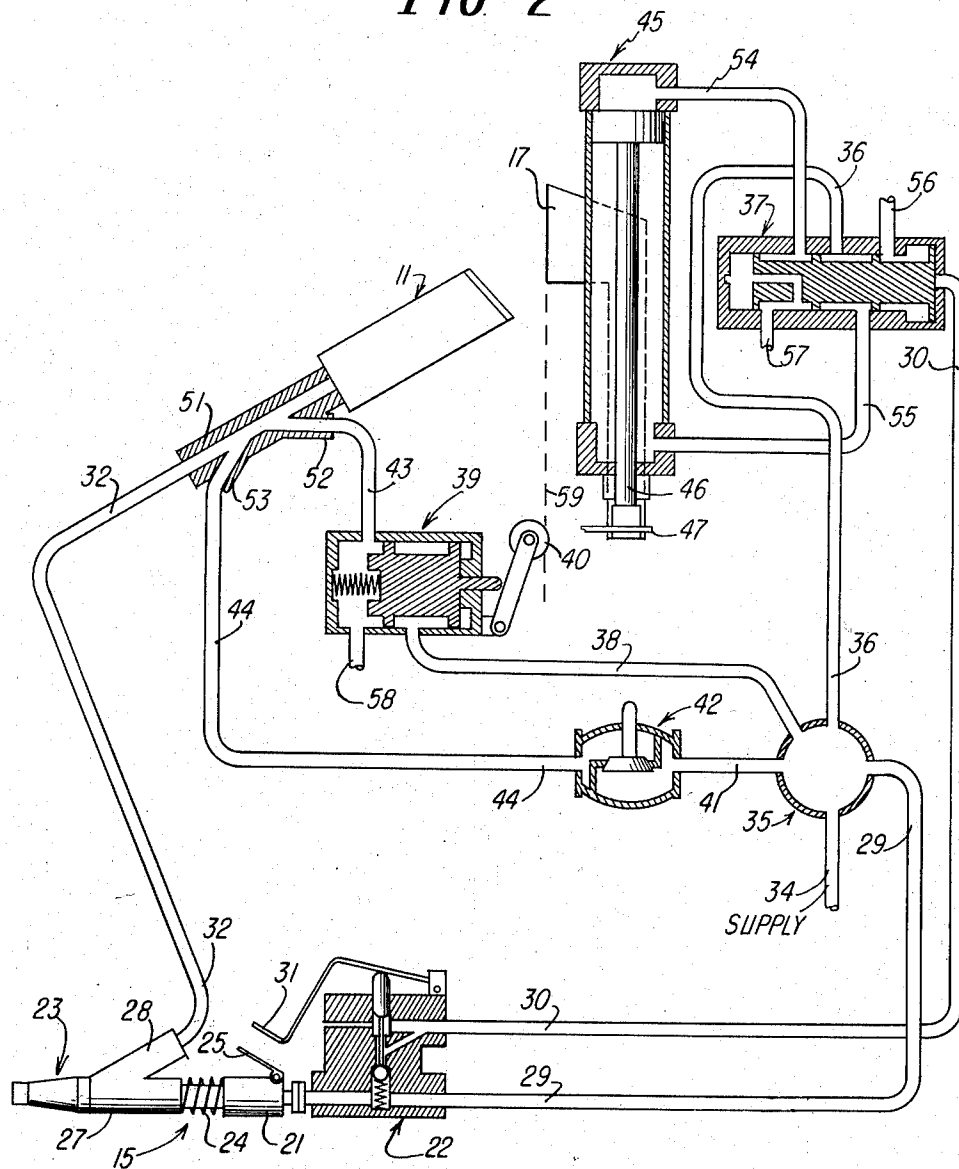
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3 Sheets-Sheet 2

FIG 2



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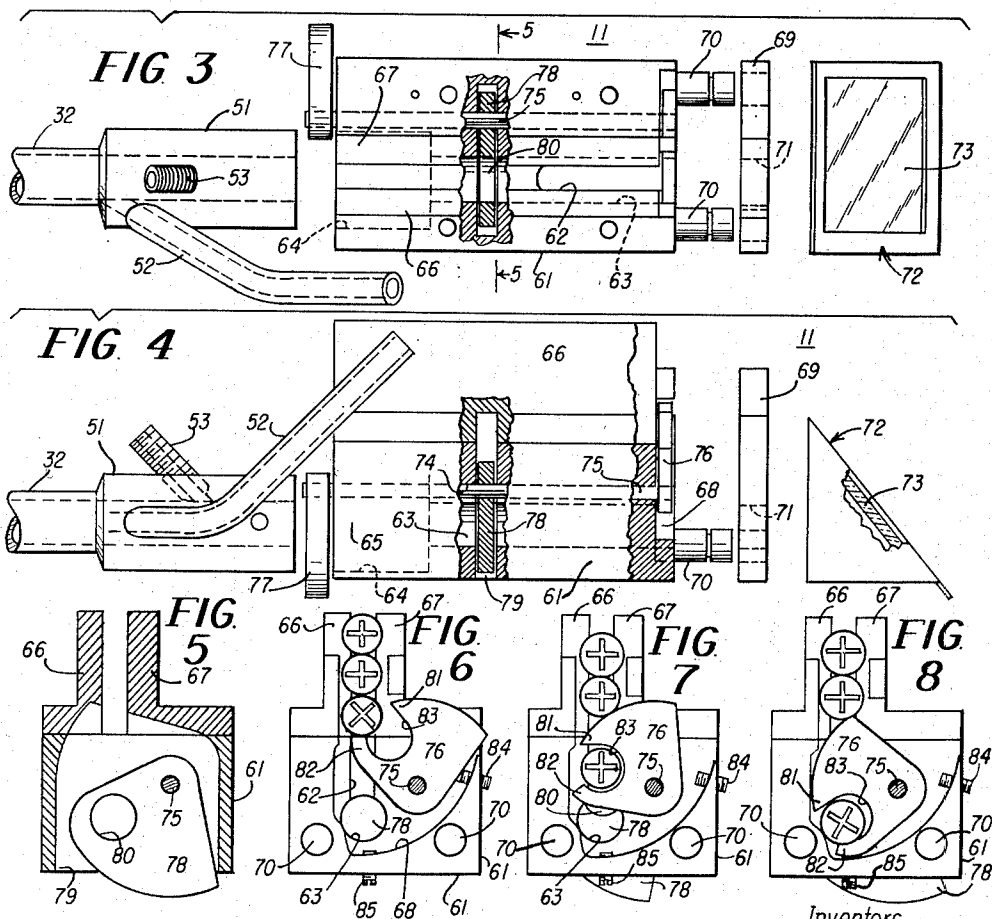
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FASTENER FEEDING AND DRIVING MACHINES

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3 Sheets-Sheet 3



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FASTENER FEEDING AND DRIVING MACHINES

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14 Claims. (Cl. 144—32)

The present invention relates to fastener feeding and driving machines, and more particularly to improvements in such machines of the character disclosed in U.S. Patent No. 2,754,860, granted on July 17, 1956 to Edgar S. Moore, Oswald S. Neill and Roy W. Emery.

It is a general object of the invention to provide in a machine of the type noted, including a fastener container and a fastener driving head, an improved mechanism for supplying the fasteners successively and one by one from the container to the driving head.

Another object of the invention is to provide in a machine of the character described, an improved and exceedingly simple mechanism for feeding the fasteners from the container to the driving head in a positive and entirely reliable manner.

A further object of the invention is to provide in a machine of the character described, a mechanism operative to receive fasteners from the container and then selectively to feed received fasteners that are properly formed therefrom to the driving head and to reject received fasteners that are malformed therefrom to the exterior.

Further features of the invention pertain to the particular arrangement of the elements of the machine, whereby the above-outlined and additional operating features thereof are attained.

The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following specification taken in connection with the accompanying drawings, in which:

Figure 1 is a front perspective view, partly broken away, of a machine, embodying the present invention, for supplying and for driving a plurality of substantially identical fasteners;

Fig. 2 is as schematic diagram of the pneumatic control system incorporated in the machine of Fig. 1;

Fig. 3 is an enlarged exploded plan view, partly broken away and partly in section, of the fastener feeding mechanism incorporated in the machine of Fig. 1;

Fig. 4 is an enlarged exploded side elevational view, partly broken away and partly in section, of the fastener feeding mechanism of Fig. 3;

Fig. 5 is an enlarged vertical sectional view of the fastener feeding mechanism, taken in the direction of the arrows along the line 5—5 in Fig. 3, and illustrating a valve element incorporated therein; and

Figs. 6, 7 and 8 are three corresponding enlarged end elevational views of the fastener feeding mechanism, with the cap removed, and respectively illustrating three successive operating positions of a cam element incorporated therein.

Referring now to Fig. 1 of the drawings, there is shown a machine 10 for supplying and for driving successively a plurality of substantially identical fasteners; which machine 10 is of the general construction and arrangement of that disclosed in the previously-mentioned Moore et al. patent, and incorporating fastener feeding mechanism

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11 embodying the features of the present invention. While the invention is described for use in connection with screws, it should be understood that it is applicable to various other types of fasteners, such as nails, rivets and pins.

More particularly, the machine 10 comprises a base 12 carrying a standard 13 supporting hopper structure 14 in which the screws are stored and from which the screws are supplied successively to the driving head of an associated manually operable and applied fastener driving gun 15. In the arrangement, the screws are substantially identical, each being of the type including a threaded shank provided with an enlarged cross-slotted head at one end thereof; and the lower front end of the hopper 14 is connected to the adjacent upper end of a downwardly inclined and forwardly directed magazine 16, also carried by the standard 13; and the feeding mechanism 11, in turn, is removably secured and supported by the lower end of the magazine 16.

An elevator 17 is carried by the upper end of a rod 18 that is mounted in a bearing 19 carried by the standard 13 for vertical reciprocatory movements; which elevator 17 extends upwardly through a cooperating slot formed in the front portion of the bottom wall of the hopper 14, and is arranged in cooperating relation with the upper end of the magazine 16. More particularly, the elevator 17 is movable from its lower position illustrated into an upper position, not illustrated, wherein it provides a continuation within the hopper 14 of the magazine 16. Specifically, the elevator 17 is moved into its lower position illustrated in order to cause a plurality of the screws contained in the front of the hopper 14 to fall upon the top of the elevator 17; and the elevator 17 is moved into its upper position in order to cause a number of the screws to become oriented in an elongated slot formed in the top of the elevator 17; which slot formed in the top of the elevator 17 is disposed in cooperating relation, when the elevator 17 occupies its upper position, with a similar slot formed in the top of the magazine 16. Accordingly, the screws are transferred by gravity from the slot formed in the top of the elevator 17 into the cooperating slot formed in the top of the magazine 16, when the elevator 17 is operated into its upper position. Accordingly, a downwardly extending oriented row of the screws arranged in stacked sidewise relation are carried by the magazine 16 and supplied to the feeding mechanism 11, as explained more fully hereinafter. The row of screws mentioned are arranged with the heads thereof disposed adjacent to the upper edge of the magazine 16, and in order to effect guiding of the screws in their downward movement through the magazine 16 into the feeding magazine 11, an elongated cover 16a is removably carried by the upper edge of the magazine 16. The cover 16a is substantially channel-shaped in cross-section and is removably secured in place upon the upper edge of the magazine 16 by a pair of resilient clips 20, thereby permitting ready inspection of the supply of screws from the magazine 16 into the feeding mechanism 11.

The gun 15 essentially comprises a body portion 21 carrying control valve mechanism 22 at the rear end thereof and a driving head 23 at the front end thereof; which driving head 23 is mounted for relative longitudinal movements with respect to the body 21 between an extended position, as illustrated, and a retracted position, not illustrated, the driving head 23 being biased into its extended position by an associated compression coil spring 24. More particularly, the body 21 houses a pneumatic motor, not shown, as well as valve mechanism for controlling the operation or rotation of the motor, which valve mechanism is governed by a manually operable lever 25; and further, the pneumatic motor mentioned

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carries a forwardly projecting and rotatably mounted bit 26 that extends through the coil spring 24 into the rear of the driving head 23. The driving head 23 is substantially Y-shaped, including a longitudinally extending tubular body portion 27, into which the front end of the bit 26 projects, and an angularly disposed tubular arm 28 communicating with the rear of the body portion 27.

The control valve mechanism 22 is connected to a compressed air supply conduit 29 and is also connected to a control air conduit 30. Also the control valve mechanism 22 comprises valve elements, not shown, that are selectively governed by a manually operable lever 31; which lever 31 is also arranged in operative relation with the manually operable lever 25, as explained more fully below. Further, the tubular arm 28 of the driving head 23 communicates with a fastener supply conduit 32. In the arrangement, the conduits 29, 30 and 32 are formed of flexible tubing and extend from the gun 15 back to the standard 13 and are connected and arranged in a manner more fully explained hereinafter.

In the operation of the gun 15, a screw to be driven is supplied from the mechanism 11 into the conduit 32 and chased therethrough by compressed air to the driving head 23, the screw passing from the conduit 32 through the tubular arm 28 and thence into the front of the tubular body portion 27, when the driving head 23 occupies its projected position with respect to the associated bit 26. The extreme front end of the tubular body portion 27 of the driving head 23 comprises a collet or chuck for receiving and supporting the screw in a position projecting from the front end of the driving head 23, as indicated by the projecting shank of the screw 33, as illustrated. The head of the supported screw 33 is arranged within the driving head 23 and in alignment with the extreme front end of the bit 26.

When the manual lever 25 is depressed, compressed air from the supply conduit 29 is supplied via the control valve mechanism 22 into the pneumatic motor effecting rotation of the bit 26. At this time, the screw 33 may be brought into cooperative relation with the work-piece, not shown; whereby the operator presses the body portion of the gun 15 forwardly causing the bit 26 to move forwardly with respect to the driving head 23 against the bias of the coil spring 24; whereby the driving head 23 is then disposed in retracted position with respect to the body portion 21 of the gun 15. At this time, the extreme front end of the bit 26 engages the cross-slotted head of the screw 33, driving it from the collet into the work-piece.

In the pneumatic control arrangement, the operator depresses the lever 31 so that compressed air from the supply conduit 29 is supplied via the control valve mechanism 22 into the control air conduit 30 for a purpose more fully explained hereinafter, and further depression of the lever 31 causes the front end thereof to engage the lever 25, so as to depress the same in order to effect operation of the pneumatic motor, in the manner described above. Subsequently, the operator releases the lever 31, so that the outer end thereof disengages the lever 25 in order that the lever 25 is returned into its normal position effecting arresting of the operation of the pneumatic motor mentioned. Also the further return movement of the lever 31 governs the control valve mechanism 22 so that the communication between the supply conduit 29 and the control conduit 30 is cut off, as explained more fully hereinafter, so that the mechanism 11 is governed subsequently to supply another screw to the conduit 32 and thence to the driving head 23. Also, after driving the screw, the operator releases the pressure upon the body portion 21 of the gun 15 so that the coil spring 24 effects the return of the driving head 23 into its extended position with respect to the body portion 21.

Returning now to the portion of the machine 10 carried by the standard 13, a main compressed air supply

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conduit 34 is provided that communicates with a manifold 35, which manifold 35 communicates directly with the compressed air supply conduit 29 extending to the gun 15. Also the manifold 35 communicates with a conduit 36 that extends to a main control valve mechanism 37, not shown in Fig. 1, but diagrammatically illustrated in Fig. 2; which mechanism 37 is carried by the standard 13 and disposed on the opposite side thereof from that illustrated. Further, the manifold 35 communicates with a conduit 38 that extends to a control valve mechanism 39; which control valve mechanism 39 is provided with a control element 40 that is operatively associated with the elevator 17 and selectively governed by the position thereof. Further, the manifold 35 communicates with a conduit 41 that extends to a manually operable valve 42 of the pushbutton type carried by the standard 13. In turn, the control valve mechanism 39 communicates with a conduit 43 that extends to the mechanism 11; and likewise, the manually operable valve 42 communicates with a conduit 44 that also extends to the mechanism 11. Further, the machine 10 comprises a main operating cylinder or motor 45, not shown in Fig. 1, but diagrammatically illustrated in Fig. 2; which main motor 45 is carried by the standard 13 and disposed on the opposite side thereof from that illustrated. The main motor 45 is provided with a piston that is connected to a piston rod 46, as illustrated in Fig. 2; which piston rod 46 is operatively connected to a movable member 47, to which the lower end of the rod 18 carrying the elevator 17 is connected. Also, the movable member 47 is operatively connected to a rock shaft 48 carried by the flange of the standard 13 adjacent to the base 12; which rock shaft 48 is connected to a strap 49, that, in turn, is connected by a toggle link 50 to an operating element of the mechanism 11, as described more fully hereinafter.

Referring now more particularly to Fig. 2, and considering the general mode of operation of the pneumatic control system for the machine 10, it is pointed out that the mechanism 11 comprises a tubular member 51 that communicates with two tubular elements 52 and 53; the tubular element 52, in turn, communicates with the conduit 43, and the tubular element 53, in turn, communicates with the conduit 44. Also, the main control valve mechanism 37 communicates with two conduits 54 and 55 that respectively communicate with the upper and lower ends of the main motor 45; and further, the mechanism 37 comprises two exhaust conduits 56 and 57. Moreover, the control valve mechanism 39 is provided with an exhaust conduit 58, and the control element 40 thereof is normally arranged in the path of movement of the elevator 17, as previously noted, and as indicated by the associated dotted line 59 in Fig. 2.

Considering now the general mode of operation of the pneumatic control system of Fig. 2, the compressed air from the main supply conduit 34 is normally supplied into the manifold 35 and therefrom into the conduits 29, 36, 38 and 41. The compressed air supplied into the conduit 36 is supplied to the main control valve 37 and therefrom into the conduit 55 and thence into the lower end of the main motor 45; whereby the elevator 17 normally occupies its upper position. At this time, the conduit 54 extending from the top of the main motor 45 communicates with the exhaust conduit 57. With the elevator 17 in its upper position, it communicates with the adjacent upper end of the magazine 16 forming a continuation thereof within the hopper 14; whereby the control element 40 of the control valve mechanism 39 is disengaged, so that the conduit 43 is connected to the exhaust conduit 58.

At this time, it may be assumed that the operator depresses the lever 31 causing the lever 31 to depress the lever 25. When the lever 31 is depressed, the control valve mechanism 22 is governed so that the conduit 29 is connected to the conduit 30, with the result that the compressed air supplied into the conduit 30 actuates the main

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control valve mechanism 37, so that the conduit 36 is connected to the conduit 54, and the conduit 55 is connected to the exhaust conduit 57; whereby the main motor 45 is operated to move the elevator 17 from its upper position into its lower position. The initial movement of the elevator 17 toward its lower position effects actuation of the rock shaft 48 so that the mechanism 11 is operated through the strap 49 and the toggle connection 50 into its closed position, as explained more fully hereinafter; and the final movement of the elevator 17 into its lower position effects cooperation thereof with the operating element 40, with the result that the control valve mechanism 39 is operated to interconnect the conduit 38 and the conduit 43. Accordingly, the air supplied to the conduit 43 enters the tubular element 52 and passes into the tubular member 51, with the result that a screw previously supplied into the connected conduit 32 is chased downwardly therethrough to the driving head 23 of the gun 15.

The continued depression of the lever 31 effects depression of the lever 25 so that the compressed air in the conduit 29 is supplied to the pneumatic motor housed in the body 21 of the gun 15 so as to effect rotation of the associated bit 26, in the manner previously explained. At this time, the operator applies the gun 15 to the work-piece to effect movement of the driving head 23 into its retracted position with respect to the body 21 and the consequent driving of the screw, in the manner previously explained.

Subsequently, the operator releases the gun 15 so that the driving head 23 is moved back into its extended position with respect to the body 21; and also the lever 31 is released effecting the release of the lever 25. The release of the lever 25 brings about the cutoff of the supply of compressed air to the pneumatic motor housed in the body 21 of the gun 15 so as to arrest operation thereof. Moreover, the release of the lever 31 again disconnects the conduit 29 from the conduit 30, with the result that the main control valve 37 is returned into its normal position so that the conduit 36 is disconnected from the conduit 54, and the conduit 36 is reconnected to the conduit 55, the conduit 54 being again connected to the exhaust conduit 57. Hence, the main motor 45 is again returned into its normal upper position effecting movement of the elevator 17 back into its upper position, so that the control valve mechanism 39 is governed to disconnect the conduit 38 from the conduit 43 so as to remove the supply of air from the tubular member 51 and consequently via the conduit 32 to the gun 15.

Also, the return movement of the elevator 17 back into its upper position effects actuation of the rock shaft 48, so that the mechanism 11 is operated through the strap 49 and the toggle connection 50 into its open position and to deliver a screw into the tubular member 51; which screw falls by gravity through the tubular member 51 into the connected conduit 32 to be supplied subsequently to the gun 15, in the manner previously explained.

In view of the foregoing, it will be understood that the repeated operation of the lever 31 effects recycling of the pneumatic control system for the machine 10, so that the screws are supplied successively and one by one from the hopper 14 via the mechanism 11 to the gun 15.

In the event that it is desirable to eject a screw from the tubular member 51 that has been supplied thereto from the mechanism 11, the manually operable push-button valve 42 may be momentarily operated to effect the connection of the conduit 41 to the conduit 44, and the consequent supply of compressed air via the tubular element 53 into the tubular member 51; whereby the screw in the tubular member 51 is ejected through the mechanism 11 and out of the upper end thereof, as explained more fully hereinafter. The last-mentioned facility is normally utilized when a malformed screw is fed from the mechanism 11 into the tubular member 51

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and becomes caught therein so that it will not feed forwardly into the conduit 32.

Recapitulating: when the compressed air is supplied to the tubular element 52, it is supplied into the tubular member 51 and behind the screw in the conduit 32 so as to chase the screw downwardly therethrough to the driving head 23. On the other hand, when the compressed air is supplied to the tubular element 53, it is supplied in front of the screw caught in the tubular member 51 tending to chase the screw up the mechanism 11 and thence to the exterior. These arrangements will be best understood by the detailed description of the mechanism 11, appearing below.

Referring now to Figs. 3 to 8, inclusive, the mechanism 11 essentially comprises a block 61 that is removably supported by the lower end of the magazine 16 in a downwardly inclined position, which block 61 is provided with both a downwardly and forwardly extending slot 62 formed in the upper end thereof and a downwardly and rearwardly extending bore 63 formed therethrough between the ends thereof. The rear end of the bore 63 terminates in a counterbore 64 into which the upper end of the tubular member 51 is arranged and normally secured in place by an associated set screw 65, the lower end of the tubular member 51 terminates in the conduit 32, as previously noted; and also the tubular member 51 carries the previously mentioned tubular elements 52 and 53 communicating with the central opening therethrough. In the construction, the tubular element 52 may be rigidly secured at the lower end thereof to the barrel of the tubular member 51 and the tubular element 53 may be arranged in a threaded opening provided in the barrel of the tubular member 51. As previously explained, the outer ends of the tubular elements 52 and 53 respectively communicate with the conduits 43 and 44. In the arrangement, it will be understood that the bore 63 provided through the block 61 is arranged in longitudinal alignment with the opening through the tubular member 51.

The top of the block 61 carries two substantially L-shaped elements 66 and 67 arranged in laterally spaced-apart relation and defining the upper portion of the slot 62; which elements 66 and 67 are directly detachably secured to the lower end of the magazine 16. Also, a recess 68 is formed in the upper end of the block 61 and communicating with both the slot 62 and the bore 63; and further, the upper end of the block 61 carries a detachable cap 69 disposed in covering relation with respect to the recess 68 and secured in place by an arrangement including a pair of upwardly and outwardly projecting pins 70. The pins 70 are secured to the upper end of the block 61 and project through corresponding holes provided in the cap 69. Also a hole 71 is formed through the cap 69 and disposed in alignment with the bore 63 formed in the block 61; and further, a deflector 72 is detachably secured in covering relation with the upper surface of the cap 69 by the pins 70; which deflector 72 is provided with a forwardly and downwardly sloping glass pane 73 permitting inspection through the hole 71 formed in the cap 69 of the adjacent portion of the recess 68, as well as the bore 63 formed in the block 61.

Also a longitudinally extending hole 74 is formed through the block 61 from end to end thereof and in which a rock shaft 75 is mounted. The upper end of the rock shaft 75 carries a cam element 76 disposed in the recess 68; and the lower end of the rock shaft 75 carries an operating arm 77 that is operatively connected to the previously mentioned toggle link 50. Also the intermediate portion of the rock shaft 75 carries a valve element 78 that is disposed in a cross-slot 79 formed in the block 61 and communicating between the bore 63 and the hole 74; which valve element 78 has a valve port 80 formed therethrough that is adapted to be brought selectively into registry with the opposite ends of the bore 63 formed in the block 61. More particularly, when the rock shaft

75 occupies one of its positions, the valve port 80 formed in the valve element 78 is arranged in registry with the opposite ends of the bore 63, as illustrated in Fig. 3; and when the rock shaft 75 occupies the other of its positions, the valve port 80 formed in the valve element 78 is arranged out of registry with the opposite ends of the bore 63, as illustrated in Fig. 4. Accordingly, it will be understood that the valve element 78 is movable into open and closed positions respectively illustrated in Figs. 3 and 4, and for a purpose more fully explained hereinafter.

Referring now more particularly to Figs. 6 to 8, inclusive, the cam element 76 that is carried on the upper end of the rock shaft 75 is provided with two radially extending fingers 81 and 82 defined by a recess 83 therebetween; which recess 83 is adapted to receive the head of a co-operating screw disposed in the slot 62 and that is employed for the purpose of transferring the lowermost screw in the stack arranged in the slot 62 into the bore 63. More particularly, when the rock shaft 75 occupies its position of Fig. 6, the lower finger 82 engages the head of the lowermost screw in the stack disposed in the slot 62; as the rock shaft 75 is moved from its position of Fig. 6 into its position of Fig. 7, the lower finger 82 is depressed so as to lower the lowermost screw so that the head thereof enters the recess 83 and so that the finger 81 enters between the lowermost screw in the stack and the next adjacent screw thereabove; as the rock shaft 75 is moved from its position of Fig. 7 into its position of Fig. 8, the recess 83 formed in the cam 76 is brought into alignment with the bore 63 formed in the block 61, so that the lowermost screw is moved into alignment with the bore 63 and falls by gravity through the slot 63 and thence through the tubular member 51 into the conduit 32, since the block 61 is supported in a downwardly and forwardly inclined position by the lower head of the magazine 16, as previously explained. Also, in this connection, it is pointed out that when the cam element 76 occupies its position of Fig. 6, the valve element 78 occupies its closed position in the bore 63; when the cam element 76 occupies its position of Fig. 8, the valve element 78 occupies its open position in the bore; and when the cam element 76 occupies its position of Fig. 7, the valve port 80 formed through the valve element 78 occupies an intermediate position with respect to its closed position of Fig. 6 and its open position of Fig. 8 with respect to the bore 63. In passing, it is noted that the required position of the cam element 76 illustrated in Fig. 6 is established by an associated adjustable set screw 84, while the required position of the cam element 76 illustrated in Fig. 8 is established by an associated adjustable set screw 85.

Considering now the mode of operation of the mechanism 11, in conjunction with the operation of the other elements of the machine 10, it is pointed out that when the elevator 17 is moved into its down position illustrated in Fig. 1 by the main motor 45, the rock shaft 48 is operated into its position of Fig. 1, so as to operate the toggle link 50 thereby to actuate the rock shaft 75 into its position of Fig. 6; whereby the valve element 78 is operated into its closed position of Figs. 4 and 6, so that when the compressed air is supplied by the control valve mechanism 39 from the conduit 38 into the conduit 43, compressed air is further supplied via the tubular member 52 into the tubular member 51 and thus into the conduit 32 so as to chase a previously deposited screw downwardly through the conduit 32 to the driving head 23 of the gun 15, in the manner previously explained. Subsequently, when the elevator 17 is moved into its upper position, not illustrated, by the main motor 45, the rock shaft 48 is operated into its position, not shown, so as to operate the toggle link 50 thereby to actuate the rock shaft 75 into its position of Fig. 8; whereby the valve element 78 is operated into its open position of Figs. 3 and 8 so that the screw that is transferred by the cam element 76 into the upper end of the bore 63 can fall by gravity through the

bore 63 and thence through the tubular member 51 into the conduit 32. Of course, still subsequently, when the elevator 17 is again moved into its lower position of Fig. 1, the last-mentioned screw is chased by the compressed air through the conduit 32 to the driving head 23 of the gun 15. Recapitulating: when the cam element 76 is operated into its position of Fig. 6, with the elevator 17 in its lower position, the valve element 78 occupies its closed position so that the compressed air introduced through the tubular element 52 into the tubular member 51 does not escape through the upper end of the bore 63 and through the adjacent hole 71 in the cap 69. On the other hand, when the cam element 76 is operated into its position of Fig. 8, with the elevator 17 in its upper position, the valve element 78 occupies its open position so that the lowermost screw that is transferred by the cam element 76 from the slot 62 into the bore 63 may fall by gravity through the bore 63 and the tubular member 51 into the conduit 32.

Now in the event a malformed screw is fed by the cam element 76 from the slot 62 into the bore 63, it may not proceed downwardly through the bore 63 and the malformed screw may thus become caught in the bore 63; whereby the subsequent opening of the control valve element 39 does not effect the chasing of a screw through the conduit 32 to the driving head 23 of the gun 15, in the manner previously explained. When the operator observes that no screw has been fed to the driving head 23 of the gun 15, he may effect the ejection of the malformed screw from the bore 63 by momentarily operating the manually operable valve 42 into its open position, as previously explained; whereby the compressed air from the conduit 41 is supplied into the conduit 44 and thus into the tubular element 53 and consequently into the tubular member 51 and thus into the bore 63, so that the malformed screw in the bore 63 is forced upwardly through the upper end of the bore 63 and through the hole 71 formed in the cap 69 and ultimately into the deflector 72 in order that the deflector 72 may deflect the rejected screw downwardly and to the exterior. Recapitulating: when a properly formed screw is supplied into the bore 63, it slides by gravity downwardly through the tubular member 51 into the conduit 32 so that subsequently when the compressed air is supplied into the tubular element 52 and thus into the tubular member 51 and the conduit 32, the screw is chased downwardly through the conduit 32 into the driving head 23 of the gun 15. On the other hand, in the event the malformed screw is caught in the bore 63, the subsequent operation of the manually operable valve 42 brings about the supply of compressed air through the tubular element 53 into the tubular member 51 and thence into the bore 63 so that the malformed screw is chased upwardly through the bore 63 and thence through the hole 71 formed in the cap 69 and deflected by the deflector to the exterior.

The construction and arrangement of the mechanism 11 for feeding the screws from the hopper 14 to the driving head 23 of the gun 15 is very advantageous, as it is particularly well-suited to the feeding of Sems type screws that comprise preassemblies of washers upon the shanks of the screws adjacent to the enlarged heads thereof, which washers on the Sems screws tend to interlock with each other and thus to prevent proper feeding thereof with mechanisms that have been employed heretofore. However, the improved construction and arrangement of the mechanism 11 obviate the difficulty mentioned by virtue of the fact that the cam 76 is arranged positively to grasp the head of the lowermost screw in the stack and to force this grasped screw out of interlocking relation with the next adjacent screw disposed thereabove in the stack; whereby the tendency of a washer carried by the grasped Sems screw to interlock with the washer carried by the next adjacent Sems screw disposed thereabove in the stack is of no consequence, particularly since the upper finger 81 carried by the cam element 76

is forceably driven between the head of the lowermost screw in the stack and the next adjacent screw disposed thereabove, thereby positively separating the lowermost screw from the next adjacent screw in the stack and preceding the transfer of the lowermost screw from the stack into the bore 63. When Sems type screws are utilized, it will be understood that the operation of the mechanism 11 is the same as that previously described; whereby the Sems type screws carrying the preassembled washers are fed in succession and one by one in the manner described, from the magazine 16 into the conduit 32 and thence chased to the driving head 23 of the gun 15.

In view of the foregoing, it is apparent that there has been provided in a machine for supplying and for driving successively a plurality of substantially identical fasteners, improved mechanism for feeding the fasteners successively and one by one as required from the magazine or supply source thereof to the driving gun thereof to perform the fastener function in associated work-pieces.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. In a machine for supplying and for driving successively a plurality of substantially identical fasteners each of the type including a shank provided with an enlarged head at one end thereof, wherein said machine includes a fastener driving head and a magazine for holding a downwardly extending oriented row of the fasteners arranged in stacked sidewise relation; the combination comprising a block disposed below said magazine and extending downwardly therefrom, said block having both a downwardly directed slot formed in the upper end thereof and a downwardly directed bore formed therethrough between the ends thereof, said slot communicating at the upper end thereof with the lower end of said magazine and being adapted to receive a plurality of the fasteners therefrom each in sidewise relation and with the heads thereof disposed at the upper end of said block, said bore communicating at the upper end thereof with the lower end of said slot and being adapted to receive a single one of the fasteners therefrom in sidewise relation and then to translate the received fastener in shank-first endwise relation therethrough toward the lower end thereof, a tube communicating with the lower end of said bore and extending to said driving head, first mechanism disposed at the upper end of said block and operative to engage the head of the lowermost fastener in said slot and to separate the engaged fastener from the adjacent fastener disposed thereabove in said slot and to transfer the separated fastener from the lower end of said slot to the upper end of said bore, second mechanism operative to chase a fastener from the lower end of said bore through said tube to said driving head, and means for operating repeatedly both of said mechanisms, so as correspondingly to supply successively and one by one the fasteners from said magazine to said driving head.

2. The machine combination set forth in claim 1, wherein said slot and said bore are disposed substantially normal to each other.

3. The machine combination set forth in claim 1, wherein said slot has a width only slightly in excess of the diameter of the shank of the fastener and said bore has a diameter only slightly in excess of the diameter of the head of the fastener.

4. The machine combination set forth in claim 1, wherein said first mechanism essentially comprises a cam movably mounted upon the upper end of said block and having a recess formed therein and being operative to engage in said recess the head of the lowermost fastener in said slot and to separate the engaged fastener from

the adjacent fastener disposed thereabove in said slot and to transfer the separated fastener from the lower end of said slot to the upper end of said bore.

5. The machine combination set forth in claim 1, wherein said first mechanism essentially comprises a cam rockably mounted upon the upper end of said block and operative in a cycle from a first position into a second position and back into its first position, said cam having a recess formed therein and also carrying an outwardly projecting finger, said recess engaging the head of the lowermost fastener in said slot and said finger projecting in separating relation between the lowermost fastener in said slot and the adjacent fastener disposed thereabove in said slot and the engaged and separated fastener being transferred from the lower end of said slot to the upper end of said bore as said cam is rocked from its first position into its second position.

6. In a machine for supplying and for driving successively a plurality of substantially identical fasteners each of the type including a shank provided with an enlarged head at one end thereof, wherein said machine includes a fastener driving head and a magazine for holding a downwardly extending oriented row of the fasteners arranged in stacked sidewise relation; the combination comprising a block disposed below said magazine and extending downwardly therefrom, said block having both a downwardly directed slot formed in the upper end thereof and a downwardly directed bore formed therethrough between the ends thereof, said slot communicating at the upper end thereof with the lower end of said magazine and being adapted to receive a plurality of the fasteners therefrom each in sidewise relation and with the heads thereof disposed at the upper end of said block, said bore communicating at the upper end thereof with the lower end of said slot and being adapted to receive a single one of the fasteners therefrom in sidewise relation and then to translate the received fastener in shank-first endwise relation therethrough from the upper end thereof to the lower end thereof, a tube communicating with the lower end of said bore and extending to said driving head, first mechanism disposed at the upper end of said block and operative to separate the lowermost fastener in said slot from the adjacent fastener disposed thereabove in said slot and to transfer the separated fastener from the lower end of said slot to the upper end of said bore, second mechanism carried by the intermediate portion of said block and operative to control the communication between the upper end and the lower end of said bore, third mechanism operative to supply air under pressure into the lower end of said bore in order to chase a fastener from the lower end thereof through said tube to said driving head, and means for operating repeatedly and cyclically said three mechanisms named, so as correspondingly to supply successively and one by one the fasteners from said magazine to said driving head, wherein said second mechanism is operated into an open position when said first mechanism is operated to transfer the separated fastener from the lower end of said slot to the upper end of said bore in order to accommodate translation of the transferred fastener through said bore from the upper end to the lower end thereof, and wherein said second mechanism is operated into a closed position when said third mechanism is operated to supply compressed air into the lower end of said bore in order to prevent the passage of the compressed air back into the upper end of said bore.

7. In a machine for supplying and for driving successively a plurality of substantially identical fasteners each of the type including a shank provided with an enlarged head at one end thereof, wherein said machine includes a fastener driving head and a magazine for holding a downwardly extending oriented row of the fasteners arranged in stacked sidewise relation; the combination comprising a block disposed below said magazine and extending downwardly therefrom, said block having both a

downwardly directed slot formed in the upper end thereof and a downwardly directed bore formed therethrough between the ends thereof, said slot communicating at the upper end thereof with the lower end of said magazine and being adapted to receive a plurality of the fasteners therefrom each in sidewise relation and with the heads thereof disposed at the upper end of said block, said bore communicating at the upper end thereof with the lower end of said slot and being adapted to receive a single one of the fasteners therefrom in sidewise relation and then to translate the received fastener in shank-first endwise relation therethrough from the upper end thereof to the lower end thereof, a tube communicating with the lower end of said bore and extending to said driving head, an elongated shaft rotatably mounted in an elongated hole formed through said block between the ends thereof, a cam carried by the upper end of said shaft at the upper end of said block and operative to separate the lowermost fastener in said slot from the adjacent fastener disposed thereabove in said slot and to transfer the separated fastener from the lower end of said slot to the upper end of said bore, a valve element carried by the intermediate portion of said shaft and arranged in a cross opening provided in the intermediate portion of said block in communicating relation with the intermediate portions of said bore and said hole and operative to control the communication between the upper end and the lower end of said bore, an arm carried by the lower end of said shaft at the lower end of said block and operative to rotate said shaft so as simultaneously to operate said cam and said valve element, pneumatic mechanism operative to supply air under pressure into the lower end of said bore in order to chase a fastener from the lower end thereof through said tube to said driving head, and means for operating repeatedly and cyclically said arm and said pneumatic mechanism, so as correspondingly to supply successively and one by one the fasteners from said magazine to said driving head, wherein said arm is operated simultaneously to operate said valve element into its open position and to operate said cam to transfer the separated fastener from the lower end of said slot to the upper end of said bore in order to accommodate translation of the transferred fastener through said bore from the upper end to the lower end thereof, and wherein said arm is operated to operate said valve element into its closed position when said pneumatic mechanism is operated to supply compressed air into the lower end of said bore in order to prevent the passage of the compressed air back into the upper end of said bore.

8. In a machine for supplying and for driving successively a plurality of substantially identical fasteners each of the type including a shank provided with an enlarged head at one end thereof, wherein said machine includes a fastener driving head and magazine structure for holding a downwardly extending oriented row of the fasteners arranged in stacked sidewise relation; the combination comprising a block disposed below said magazine structure and extending downwardly therefrom, said block having a downwardly directed bore formed therethrough between the ends thereof, said bore being adapted to receive in the upper end thereof a single one of the fasteners from said magazine structure in shank-first endwise relation and then to translate the received fastener in shank-first endwise relation therethrough from the upper end thereof to the lower end thereof, a tube communicating with the lower end of said bore and extending to said driving head, first mechanism disposed at the upper end of said block and operative to separate the lowermost fastener from the adjacent fastener disposed thereabove in said magazine structure and to transfer the separated fastener in shank-first endwise relation into the upper end of said bore, second mechanism operative to chase a fastener from the lower end of said bore through said tube to said driving head, means for operating repeatedly said first and second mechanisms so as corre-

spondingly to supply successively and one-by-one the fasteners from said magazine structure to said driving head, a cap carried by the upper end of said block and having an opening therethrough communicating between the upper end of said bore and the exterior, pneumatic mechanism operative to chase a fastener from said bore through the upper end thereof and through said opening to the exterior in order to eject a malformed fastener from said bore, and manually operable means for selectively operating said pneumatic mechanism.

9. In a machine for supplying and for driving successively a plurality of substantially identical fasteners each of the type including a shank provided with an enlarged head at one end thereof, wherein said machine includes a fastener driving head and magazine structure for holding a downwardly extending oriented row of the fasteners arranged in stacked sidewise relation; the combination comprising a block disposed below said magazine structure and extending downwardly therefrom, said block having a downwardly directed bore formed therethrough between the ends thereof, said bore being adapted to receive in the upper end thereof a single one of the fasteners from said magazine structure in shank-first endwise relation and then to translate the received fastener in shank-first endwise relation therethrough from the upper end thereof to the lower end thereof, a tube communicating with the lower end of said bore and extending to said driving head, feed mechanism disposed at the upper end of said block and operative to separate the lowermost fastener from the adjacent fastener disposed thereabove in said magazine structure and to transfer the separated fastener in shank-first endwise relation into the upper end of said bore, first pneumatic mechanism operative to chase a fastener from the lower end of said bore through said tube to said driving head, means for operating repeatedly both said feed mechanism and said first pneumatic mechanism, so as correspondingly to supply successively and one-by-one the fasteners from said magazine structure to said driving head, second pneumatic mechanism operative to chase a fastener from said bore out of the upper end thereof to the exterior in order to eject a malformed fastener from said bore, and manually operable means for selectively operating said second pneumatic mechanism.

10. The machine combination set forth in claim 9, and further comprising a deflector carried by the upper end of said block for deflecting outwardly a fastener ejected from the upper end of said bore.

11. In a machine for supplying and for driving successively a plurality of substantially identical fasteners each of the type including a shank provided with an enlarged head at one end thereof, wherein said machine includes a fastener driving head and magazine structure for holding a downwardly extending oriented row of the fasteners arranged in stacked sidewise relation; the combination comprising a block disposed below said magazine structure and extending downwardly therefrom, said block having a downwardly directed bore formed therethrough between the ends thereof, said bore being adapted to receive in the upper end thereof a single one of the fasteners from said magazine structure in shank-first endwise relation and then to translate the received fastener in shank-first endwise relation therethrough from the upper end thereof to the lower end thereof, a tube communicating with the lower end of said bore and extending to said driving head, a cap carried by the upper end of said block and having an opening therethrough communicating between the upper end of said bore and the exterior, mechanism disposed at the upper end of said block and operative to separate the lowermost fastener from the adjacent fastener disposed thereabove in said magazine structure and to transfer the separated fastener in shank-first endwise relation into the upper end of said bore, and pneumatic mechanism selectively controllable to chase a fastener from said bore through said

tube to said driving head and to chase a fastener from said bore through said hole to the exterior, whereby properly formed fasteners may be supplied to said driving head and malformed fasteners may be ejected to the exterior.

12. The machine combination set forth in claim 11, and further comprising manually operable means for selectively controlling said pneumatic mechanism.

13. In a machine for supplying and for driving successively a plurality of substantially identical fasteners each of the type including a shank provided with an enlarged head at one end thereof, wherein said machine includes a fastener driving head and magazine structure for holding a downwardly extending oriented row of the fasteners arranged in stacked sidewise relation; the combination comprising a block disposed below said magazine structure and extending downwardly therefrom, said block having a downwardly directed bore formed therethrough between the ends thereof, said bore being adapted to receive in the upper end thereof a single one of the fasteners from said magazine structure in shank-first endwise relation and then to translate the received fastener in shank-first endwise relation therethrough from the upper end thereof to the lower end thereof, a tube communicating with the lower end of said bore and extending to said driving head, first mechanism disposed at the upper end of said block and operative to separate the lowermost fastener from the adjacent fastener disposed thereabove in said magazine structure and to transfer the separated fastener in shank-first endwise relation into the upper end of said bore, second mechanism carried by the intermediate portion of said block and operative to control the communication between the upper end and the lower end of said bore, third mechanism operative to supply air under pressure into the lower end of said bore in order to chase a fastener from the lower end thereof through said tube to said driving head, and means for operating repeatedly and cyclically said three mechanism named, so as correspondingly to supply successively and one-by-one the fasteners from said magazine structure to said driving head, wherein said second mechanism is operated into an open position when said first mechanism is operated to transfer the separated fastener from said magazine structure into the upper end of said bore in order to accommodate translation of the transferred fastener through said bore from the upper end to the lower end thereof, and wherein said second mechanism is operated into a closed position when said third mechanism is operated to supply compressed air into the lower end of said bore in order to prevent the passage of the compressed air back into the upper end of said bore.

14. In a machine for supplying and for driving successively a plurality of substantially identical fasteners each of the type including a shank provided with an

enlarged head at one end thereof, wherein said machine includes a fastener driving head and magazine structure for holding a downwardly extending oriented row of the fasteners arranged in stacked sidewise relation; the combination comprising a block disposed below said magazine structure and extending downwardly therefrom, said block having a downwardly directed bore formed therethrough between the ends thereof, said bore being adapted to receive in the upper end thereof a single one of the fasteners from said magazine structure in shank-first endwise relation and then to translate the received fastener in shank-first endwise relation therethrough from the upper end thereof to the lower end thereof, a tube communicating with the lower end of said bore and extending to said driving head, a cam carried by the upper end of said block and operative to separate the lowermost fastener from the adjacent fastener disposed thereabove in said magazine structure and to transfer the separated fastener in shank-first endwise relation into the upper end of said bore, a valve element carried by the intermediate portion of said block and arranged in a cross opening provided therein and in communicating relation with the intermediate portion of said bore and operative to control the communication between the upper end and the lower end of said bore, an arm carried by the lower end of said block and operative simultaneously to operate said cam and said valve element, pneumatic mechanism operative to supply air under pressure into the lower end of said bore in order to chase a fastener from the lower end thereof through said tube to said driving head, and means for operating repeatedly and cyclically said arm and said pneumatic mechanism, so as correspondingly to supply successively and one-by-one the fasteners from said magazine structure to said driving head, wherein said arm is operated simultaneously to operate said valve element into its open position and to operate said cam to transfer the separated fastener from said magazine structure into the upper end of said bore in order to accommodate translation of the transferred fastener through said bore from the upper end to the lower end thereof, and wherein said arm is operated to operate said valve element into its closed position when said pneumatic mechanism is operated to supply compressed air into the lower end of said bore in order to prevent the passage of the compressed air back into the upper end of said bore.

References Cited in the file of this patent

UNITED STATES PATENTS

50	2,534,140	Moore	Dec. 12, 1950
	2,544,165	Krasnow	Mar. 6, 1951
	2,638,945	Austin	May 19, 1953
	2,706,504	Moore	Apr. 19, 1955
	2,754,860	Moore et al.	July 17, 1956
55	2,803,274	Zubal et al.	Aug. 20, 1957