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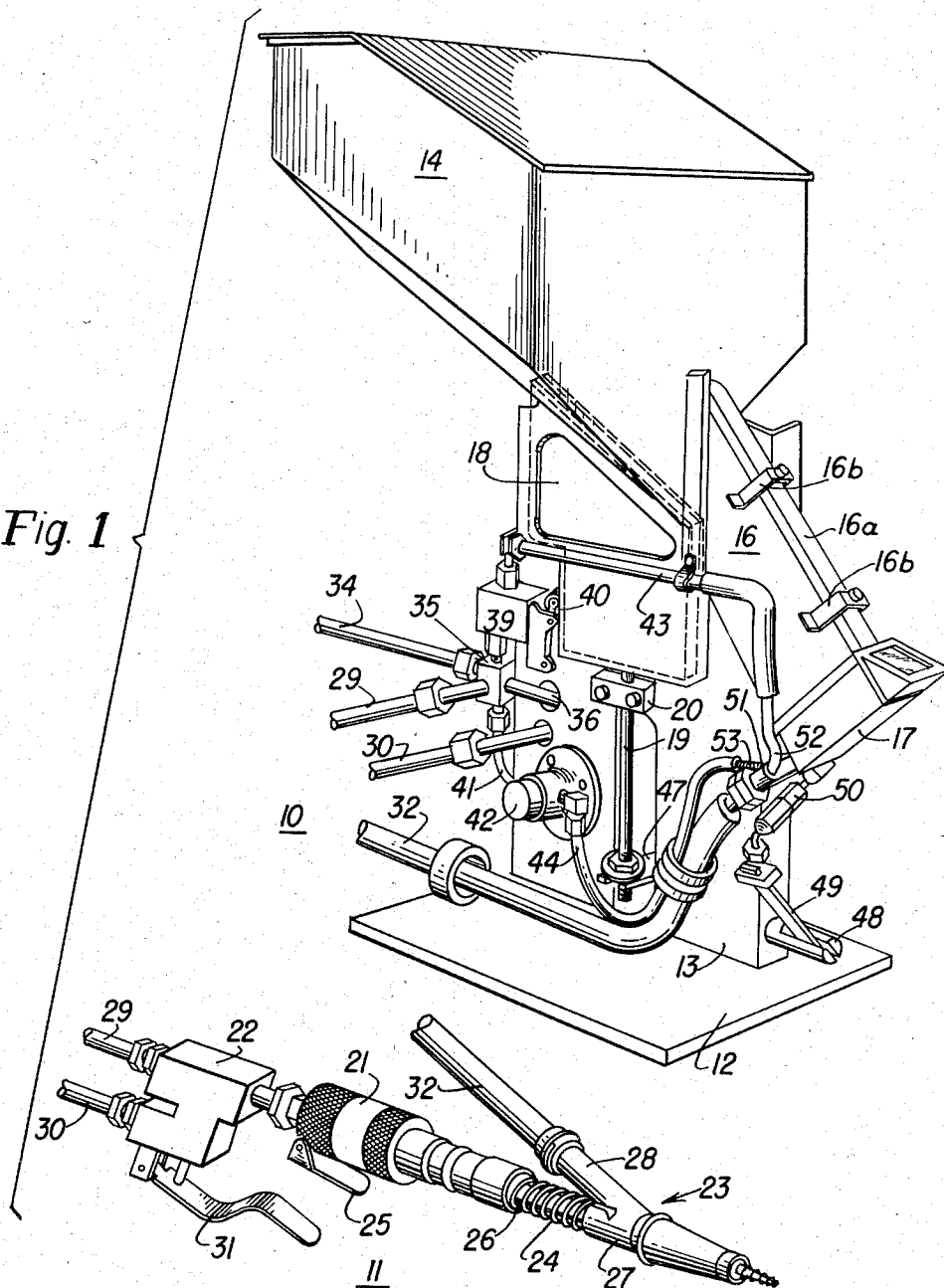
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FASTENER FEEDING AND DRIVING MACHINES

Filed April 7, 1958

3 Sheets-Sheet 1

Fig. 1



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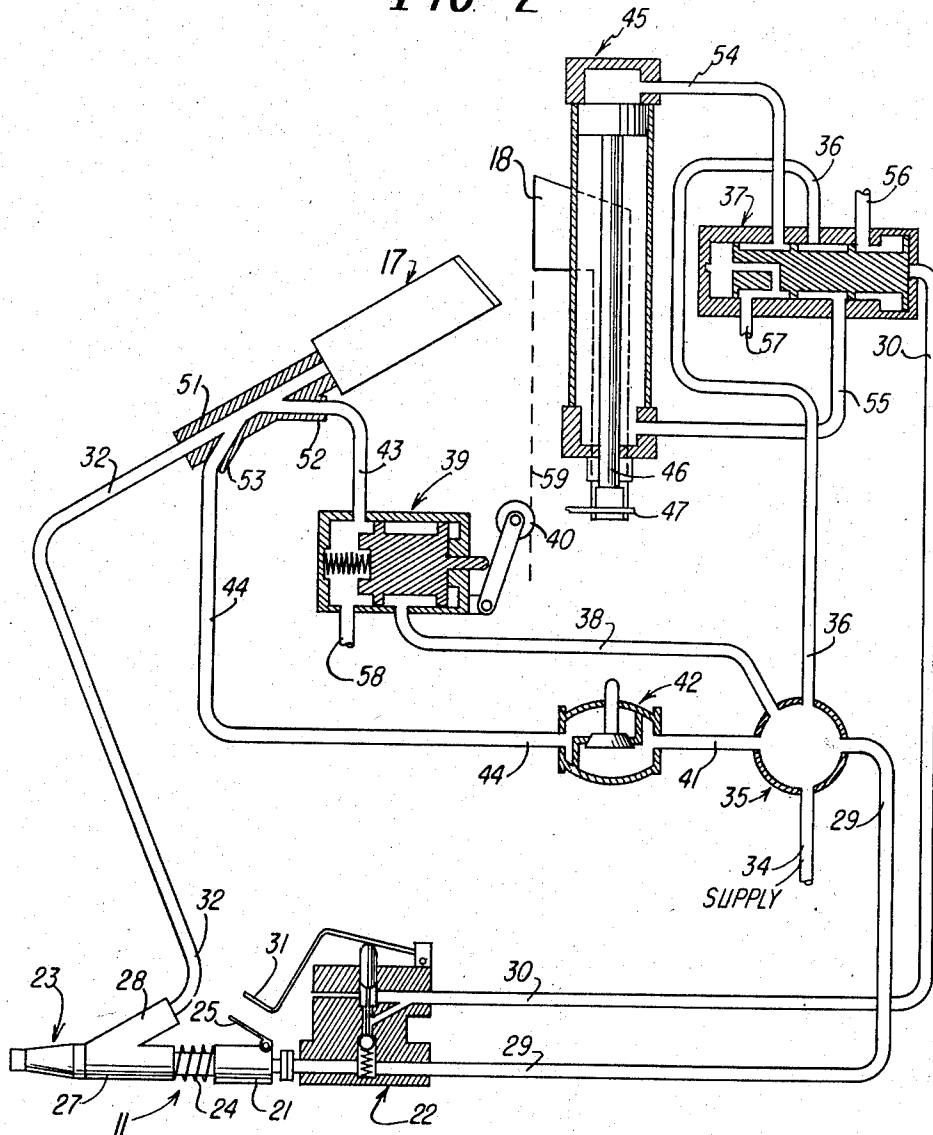
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3 Sheets-Sheet 2

FIG 2



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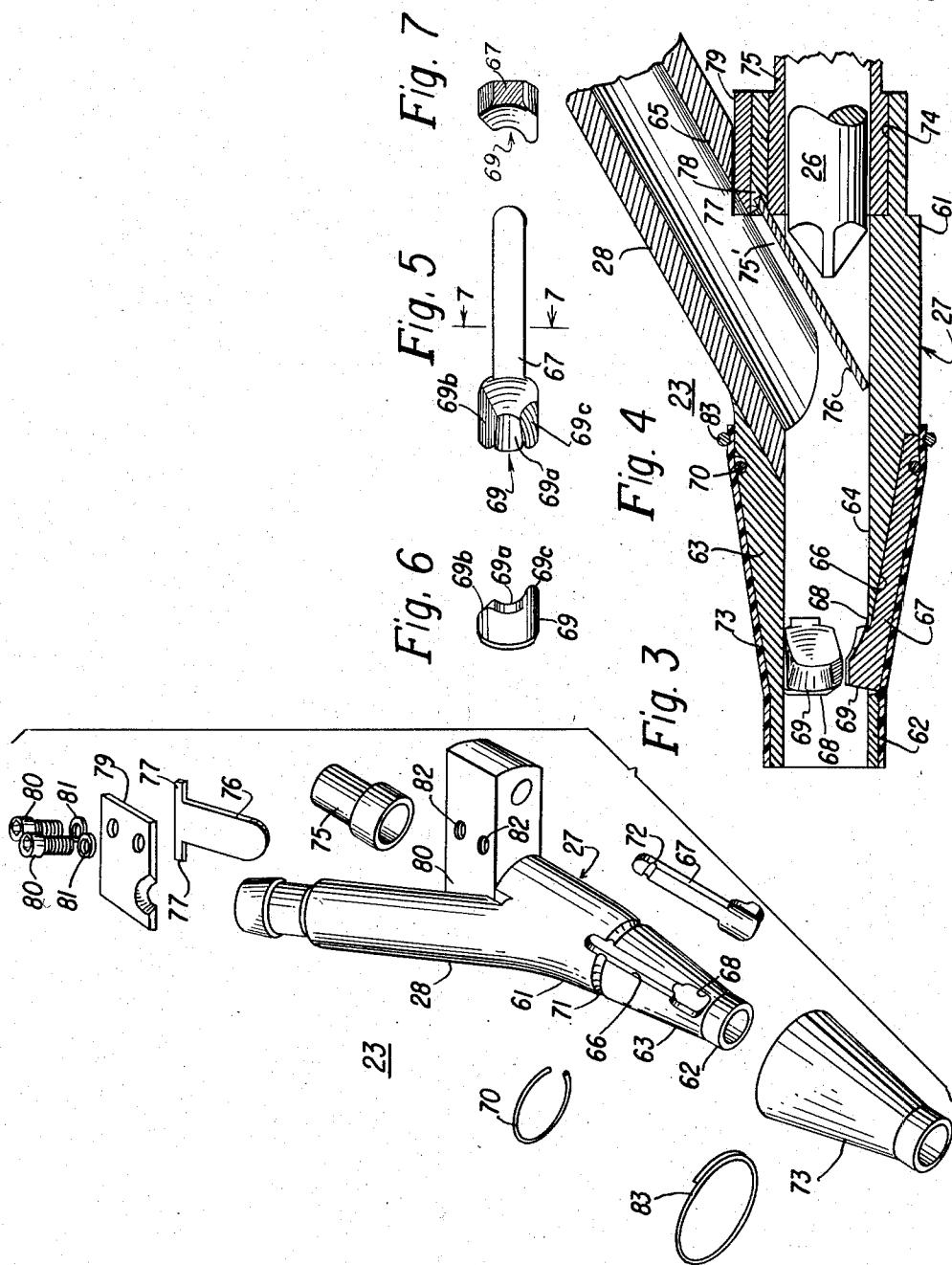
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FASTENER FEEDING AND DRIVING MACHINES

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Application April 7, 1958, Serial No. 726,843

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 fastener feeding mechanism, an improved fastener driving head to which the fasteners are supplied successively and one by one from the fastener feeding mechanism.

Another object of the invention is to provide in a machine of the character described, a fastener driving head of improved and simplified construction and arrangement, that is adapted to receive and to position a fastener that is supplied thereto by an associated pneumatic fastener feeding mechanism and then to release the positioned fastener to an associated driving element.

A further object of the invention is to provide in a machine of the character described, a fastener driving head incorporating an improved facility for positively preventing tumbling of a fastener supplied thereto by the associated pneumatic fastener feeding mechanism.

A still further object of the invention is to provide in a machine of the character described, a fastener driving head incorporating an improved chuck construction for supporting a fastener in proper position to be engaged by the associated driving element, without interference with the driving element as the supported fastener is delivered thereto for the driving purpose.

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 driving a plurality of substantially identical fasteners;

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

Fig. 3 is an enlarged exploded perspective view of the fastener driving head incorporated in the machine of Fig. 1;

Fig. 4 is a greatly enlarged vertical sectional view, partly broken away, of the driving head of Fig. 3;

Fig. 5 is a greatly enlarged plan view of one of the fingers incorporated in the collet forming a part of the driving head of Fig. 4;

Fig. 6 is a greatly enlarged front end elevational view of the collet finger of Fig. 5; and

Fig. 7 is a greatly enlarged rear sectional view of the collet finger, taken in the direction of the arrows along the line 7—7 in Fig. 5.

Referring now to Fig. 1 of the drawings, there is shown

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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 a manually operable and applied fastener driving gun 11 embodying the features of the present invention. While the invention is described for use in connection with screws, it will 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 the gun 11. 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, in turn, the lower end of the magazine 16 carries feeding mechanism 17 that is preferably of the construction and arrangement of that disclosed in the copending application of Charles F. Shinkle and James F. Rafferty, Serial No. 720,655, filed March 11, 1958.

An elevator 18 is carried by the upper end of a rod 19 that is mounted in a bearing 20 carried by the standard 13 for vertical reciprocatory movements; which elevator 18 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 18 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 18 is moved into its lower position illustrated in order to cause a plurality of screws contained in the front of the hopper 14 to fall upon the top of the elevator 18; and the elevator 18 is moved into its upper position in order to cause a number of screws to become oriented in an elongated slot formed in the top of the elevator 18; which slot formed in the top of the elevator 18 is disposed in cooperating relation, when the elevator 18 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 18 into the cooperating slot formed in the top of the magazine 16, when the elevator 18 is operated into its upper position. Accordingly, a downwardly extending orienting row of the screws arranged in stacked sidewise relation are carried by the magazine 16 and supplied to the feeding mechanism 17, 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 mechanism 17, 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 16b, thereby permitting ready inspection of the supply of screws from the magazine 16 into the feeding mechanism 17.

The gun 11 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

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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 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 11 back to the standard 13 and are connected and arranged in a manner more fully explained hereinafter.

Further, the machine 10 comprises a pneumatic control arrangement that will best be understood by reference to Fig. 1, taken in connection with Fig. 2; and more particularly, a main compressed air supply 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 11. Also the manifold 35 communicates with a conduit 36 that extends to a main control valve mechanism 37. Further, the manifold 35 communicates with a conduit 38 that extends to a control valve mechanism 39 that is provided with a control element 40 that is operatively associated with the elevator 18 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. In turn, the control valve mechanism 39 communicates with a conduit 43 that extends to the mechanism 17; and likewise, the manually operable valve 42 communicates with a conduit 44 that also extends to the mechanism 17. Further, the machine 10 comprises a main operating cylinder or motor 45 that is provided with a piston that is connected to a piston rod 46, which is operatively connected to a movable member 47 to which the lower end of the rod 19 carrying the elevator 18 is connected. Also the movable member 47 is operatively connected to a rock shaft 48, which is connected to a strap 49, that, in turn, is connected by a toggle link 50 to an operating element of the mechanism 17.

Also, the mechanism 17 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 18, 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 there-

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from into the conduit 55 and thence into the lower end of the main motor 45; whereby the elevator 18 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 18 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 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 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 is operated to move the elevator 18 from its upper position into its lower position. The initial movement of the elevator 18 toward its lower position effects actuation of the rock shaft 48 so that the mechanism 17 is operated through the strap 49 and the toggle connection 50 into its closed position; the final movement of the elevator 18 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 11.

The continued depression of the lever 31 effects depression of the lever 25 as previously noted, so that the compressed air in the conduit 29 is supplied to the pneumatic motor housed in the body 21 of the gun 11 so as to effect rotation of the associated bit 26. At this time, the operator applies the gun 11 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 a manner more fully explained hereinafter.

Subsequently, when the operator releases the gun 11 so that the driving head 23 is moved back into its extended position with respect to the body 21, 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 11 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 18 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 11.

Also, the return movement of the elevator 18 back into its upper position effects actuation of the rock shaft 48, so that the mechanism 17 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 11, 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

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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 17 to the gun 11.

In the event, it is desirable to eject a screw from the tubular member 51 that has been supplied thereto from the mechanism 17, the manually operable pushbutton 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 17 and out of the upper end thereof. The last-mentioned facility is normally utilized when a malformed screw is fed from the mechanism 17 into the tubular member 51 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 member 52, it is supplied into the tubular member 51 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 so as to chase the screw up the mechanism 17 and thence to the exterior.

Referring now to Figs. 3 to 7, inclusive, the driving head 23 of the gun 11 there illustrated, and embodying the features of the present invention, essentially comprises the previously-mentioned tubular body portion 27 extending longitudinally and receiving the extreme front end of the bit 26, as well as the angularly inclined tubular arm 28 that is operatively connected to the fastener supply conduit 32. In the arrangement, the center line of the tubular arm 28 extends rearwardly and upwardly at an acute angle with respect to the longitudinal center line of the tubular body portion 27; the body portion 27 includes a substantially cylindrical rear section 61 of relatively large outside diameter and a substantially cylindrical front section 62 of relatively small outside diameter, and a forwardly tapered intermediate substantially conical section 63 joining the rear section 61 and the front section 62. In Fig. 4, the longitudinally extending substantially cylindrical opening formed through the body portion 27 is indicated at 64, and the elongated opening extending through the arm 28 is indicated at 65. A plurality of longitudinally extending and circumferentially spaced-apart slots 66 are provided in the conical section 63; and a corresponding plurality of longitudinally extending fingers 67 are respectively arranged in the slots 66. Preferably three such slots 66 are formed in the conical section 63, and three such fingers 67 are respectively arranged therein. Each of the slots 66 has the general configuration of a spatula including an enlarged opening 68 adjacent to the front end thereof; which opening 68 communicates with the longitudinally extending opening 64 formed through the body portion 27; similarly, each of the fingers 67 has the corresponding general configuration of a spatula, including an enlarged head or jaw 69 adjacent to the front end thereof. The three jaws 69 respectively carried by the three fingers 67 are respectively arranged in the three openings 68 formed in the front ends of the three slots 66 and are directed inwardly into cooperating relation with each other, as best shown in Fig. 4.

The three fingers are mounted adjacent to the rear ends thereof upon the conical section 63 for pivotal movements in the respective ones of the slots 66 in order to accommodate movements of the jaws 69 between closed and open positions with respect to each other. This mounting arrangement comprises a split spring ring 70 disposed in an annular groove 71 provided adjacent to the rear of the conical section 63, and a cooperating notch 72 formed in each of the fingers 67 adjacent to the rear end thereof. This arrangement accommodates ready placement and removal of each of the fingers 67 in the

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corresponding one of the slots 66, as required. The fingers 67 are held in place with the jaws 69 biased into their closed position by an associated substantially conical resilient sleeve 73 carried by the exterior surface of the conical section 63; which sleeve 73 may be formed of a suitable flexible resilient plastic material, such as neoprene.

The extreme rear end of the rear section 61 of the tubular body portion 27 is provided with a counterbore 74 into which there is arranged a guide tube 75, in which the extreme front end of the bit 26 is rotatably mounted. Further, a laterally extending slot 75' is formed in the rear section 61 adjacent to the junction thereof with the tubular arm 28; and arranged within the slot 75' is a forwardly and downwardly projecting substantially T-shaped tongue-like element 76 that is provided with a pair of oppositely directed arms 77 that are mounted in cooperating grooves 78 respectively formed in the top of the rear section 61 on opposite sides of the slot 75'. Accordingly, the tongue-like element 76 is mounted for pivotal movement from its normal position, as shown in Fig. 4, into an upper position disposed entirely in the end of the cylindrical opening 65 formed in the tubular arm 28. The pivotal connections between the arms 77 provided on the rear end of the tongue-like element 76 and the grooves 78 are retained by a cover plate 79 that is removably secured in place upon a top flattened surface 80 provided on the extreme rear end of the rear section 61 by an arrangement including a pair of screws 80 and a cooperating pair of lock washers 81. In the arrangement, the threaded shanks of the screws 80 extend through cooperating openings formed in the plate 79 and are received in cooperating threaded holes 82 provided in the flattened surface 80 of the rear section 61. Finally, the flexible sleeve 73 is removably retained in place upon the exterior surface of the conical section 63, and also upon the exterior surface of the front section 62, by an arrangement including a split spring ring 83.

Considering now the general mode of operation of the driving head 23 of the gun 11, when the screw is chased downwardly through the conduit 32 and thence through the cylindrical opening 65 formed through the tubular arm 28, it rides downwardly over the top surface of the tongue-like element 76 into the longitudinally extending cylindrical opening 64 formed through the body portion 27 and thence shank-first through the jaws 69 in their closed position. The substantially tongue-like element 76 provides a smooth transition for the screw between the cylindrical opening 65 formed in the tubular arm 28 and the cylindrical opening 64 formed in the tubular body portion 27, thereby cutting off the rear end of the cylindrical opening 65 from the front end thereof and covering the extreme front end of the bit 26 in order positively to prevent tumbling of the screw as it is moved through the cylindrical opening 64, thereby positively insuring that the screw is delivered in shank-first relation to the cooperating jaws 69 in their closed position. While the compressed air supplied behind the screw through the conduit 32 is adequate to force the shank of the screw through the cooperating jaws 69 in their closed position, the pressure of the compressed air is not adequate to force the enlarged head of the screw through the cooperating jaws 69.

Subsequently, when the operator applies the gun 11 and causes the driving head 23 to be moved into its retracted position with respect to the body 21 thereof, the extreme front end of the bit 26 engages the underside of the tongue-like element 76 forcing it out of the way and moving it upwardly into the adjacent upper end of the cylindrical opening 65 formed in the tubular arm 28. The extreme front end of the bit 26 is then moved relatively forwardly into engagement with the cross-slotted enlarged head of the screw that is positioned between the jaws 69 in their closed position, the bit 26 being rotated at this time, as previously explained. The head of the

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engaged screw is then forced forwardly from behind the jaws 69, through the jaws 69, and thence out of the front end of the cylindrical opening 64 into fastening engagement with the associated work-piece; whereby the jaws 69 are moved from their closed position into their open position, as the head of the screw passes therethrough, and against the bias of the flexible sleeve 73. Of course, the extreme front end of the bit 26 also passes through the jaws 69 retaining them in their open position.

Subsequently, when the driving head 23 is moved into its extended position with respect to the body 21 of the gun 11, the bit 26 is withdrawn from between the jaws 69; whereby the jaws 69 are moved back into their closed position by the resilient sleeve 73. The continued movement of the driving head 23 into its fully extended position effects the return of the extreme front end of the bit 26 behind the tongue-like element 76; whereby the element 76 is returned into its normal position illustrated in Fig. 4.

In conjunction with the construction and arrangement of the jaws 69, it will be observed in Figs. 5 to 7, inclusive, that each jaw 69 comprises a substantially centrally disposed segment 69a, an adjacent leading segment 69b and an adjacent trailing segment 69c, the segments 69b and 69c respectively leading and trailing the rotary movement of the bit 26, as viewed from the rear of the cylindrical opening 64 formed through the body portion 27. Specifically, in the arrangement, the leading segment 69b is relieved, or disposed below the central segment 69a, while the trailing segment 69c is elevated, or disposed above, the central segment 69a; which construction and arrangement prevents the bit 26 from being caught upon the jaw 69 as it moves relatively forwardly therethrough incident to movement of the driving head 23 into its retracted position with respect to the body portion 21 of the gun 11.

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, a manually applied driving gun provided with a driving head incorporating an improved collet or chuck mechanism for receiving and for holding in proper position a fastener to be driven in an associated work-piece.

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, the combination comprising a substantially tubular body having a longitudinally extending opening therethrough and provided with a plurality of longitudinally extending and circumferentially spaced-apart slots therein disposed adjacent to the front end thereof, a corresponding plurality of longitudinally extending fingers respectively arranged in said slots, a corresponding plurality of inwardly directed jaws respectively carried by said fingers adjacent to the front ends thereof and arranged in cooperating relation with each other, means mounting said fingers adjacent to the rear ends thereof upon said body for pivotal movements in the respective ones of said slots in order to accommodate movements of said jaws between closed and open positions with respect to each other, resilient means biasing said jaws into their closed position, a longitudinally extending bit cooperating said body and arranged in alignment with said opening, means mounting said body and said bit for relative longitudinal cooperating movements with respect to each other, so that said bit has a retracted position disposed rearwardly of said jaws

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and an advanced position disposed behind said jaws, means for supplying a fastener from the exterior in shank-first relation into said opening behind said jaws when said bit occupies its retracted position and then for forcing the shank of the fastener between said jaws in their closed position and then for advancing the fastener into a predetermined position in said body in which the shank of the fastener is clamped between said jaws in their closed position and in which the head of the fastener is disposed behind said jaws and in stopping engagement therewith and in which the extreme front end of the shank of the fastener projects from the front end of said body, and means for moving said body and said bit relative to each other in a cycle, so that said bit is moved from its retracted position into its advanced position and is then returned into its retracted position, said movement of said bit into its advanced position effecting driving engagement of the forward end thereof with the fastener in its predetermined position in said body and forcing the head of the engaged fastener through said jaws and then driving the engaged fastener from the front end of said body and into fastening engagement with an associated work-piece, said jaws being moved into their open position against the bias of said resilient means in response to the movement therethrough of the head of the engaged fastener and the movement therebetween of said bit into its advanced position and said jaws being moved back into their closed position by said resilient means in response to the subsequent withdrawal from therebetween of said bit in its return movement into its retracted position.

2. The machine combination set forth in claim 1, wherein said tubular body includes a substantially cylindrical rear section of relatively large diameter and a substantially cylindrical front section of relatively small diameter and a forwardly tapered intermediate substantially conical section joining said rear and front sections, and wherein said longitudinally extending slots are disposed fundamentally in said intermediate section.

3. The machine combination set forth in claim 1, wherein said tubular body is provided with at least three of said longitudinally extending slots arranged in circumferentially spaced-apart relation.

4. The machine combination set forth in claim 1, wherein said means for mounting said fingers adjacent to the rear ends thereof upon said body for pivotal movements in respective ones of said slots essentially comprises a split spring ring disposed in an annular groove provided in said tubular body and engaging a corresponding plurality of notches respectively formed in said fingers adjacent to the rear ends thereof, thereby to accommodate ready placement and removal of said fingers with respect to said slots.

5. The machine combination set forth in claim 1, wherein said resilient means for biasing said jaws into their closed position essentially comprises a resilient member carried by the outer surface of said body adjacent to the front end thereof and encircling the same and overlying said fingers.

6. The machine combination set forth in claim 5, wherein said resilient member is removably supported in frictional engagement with the outer surface of said body adjacent to the front end thereof and is formed of flexible elastomeric material.

7. The machine combination set forth in claim 1, wherein each of said longitudinally extending slots provided in said body has the general configuration of a spatula including an enlarged opening adjacent to the front end thereof, and each of said longitudinally extending fingers also has the corresponding general configuration of a spatula including an enlarged head adjacent to the front end thereof, and wherein the inwardly directed jaw carried by each of said fingers is located upon the enlarged head thereof and disposed in cooperat-

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ing relation with the enlarged opening provided in the associated one of said slots.

8. In a machine for supplying and for driving successively a plurality of substantially identical screws each of the type including a threaded shank provided with an enlarged head at one end thereof, the combination comprising a substantially tubular body having a longitudinally extending opening therethrough and provided with a plurality of longitudinally extending and circumferentially spaced-apart slots therein disposed adjacent to the front end thereof, a corresponding plurality of longitudinally extending fingers respectively arranged in said slots, a corresponding plurality of inwardly directed jaws respectively carried by said fingers adjacent to the front ends thereof and arranged in cooperating relation with each other, means mounting said fingers adjacent to the rear ends thereof upon said body for pivotal movements in the respective ones of said slots in order to accommodate movements of said jaws between closed and open positions with respect to each other, resilient means biasing said jaws into their closed position, a longitudinally extending bit cooperating with said body and arranged in alignment with said opening, means mounting said body and said bit for relative longitudinal cooperating movements with respect to each other, so that said bit has a retracted position disposed rearwardly of said jaws and an advanced position disposed between said jaws, means for supplying a screw from the exterior in shank-first relation into said opening behind said jaws when said bit occupies its retracted position and then for forcing the shank of the screw between said jaws in their closed position and then for advancing the screw into a predetermined position in said body in which the shank of the screw is clamped between said jaws in their closed position and in which the head of the screw is disposed behind said jaws and in stopping engagement therewith and in which the extreme front end of the shank of the screw projects from the front end of said body, means for rotating said bit and for moving said body and said bit relative to each other in a cycle, so that said rotating bit is moved from its retracted position into its advanced position and is then returned into its retracted position, said movement of said bit into its advanced position effecting driving engagement of the forward end thereof with the screw in its predetermined position in said body and forcing the head of the engaged screw through said jaws and then driving the engaged screw from the front end of said body and into fastening engagement with an associated work-piece, said jaws being moved into their open position against the bias of said resilient means in response to the movement therethrough of the head of the engaged screw and the movement therebetween of said bit into its advanced position and said jaws being moved back into their closed position by said resilient means in response to the subsequent withdrawal from therebetween of said bit in its return movement into its retracted position, the leading edge of the clamping face of each of said jaws being relieved slightly with respect to the trailing edge thereof so as to prevent hanging or interference with said rotating bit as it is moved between said jaws.

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, the combination comprising a substantially tubular body having a longitudinally extending opening therethrough and provided with a plurality of longitudinally extending and circumferentially spaced-apart slots therein disposed adjacent to the front end thereof, a corresponding plurality of longitudinally extending fingers respectively arranged in said slots, a corresponding plurality of inwardly directed jaws respectively carried by said fingers adjacent to the front ends thereof and arranged in cooperating relation with each other, means mounting said fingers adjacent to the rear

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ends thereof upon said body for pivotal movements in the respective ones of said slots in order to accommodate movements of said jaws between closed and open positions with respect to each other, resilient means biasing said jaws into their closed position, a longitudinally extending bit cooperating with said body and arranged in alignment with said opening, means mounting said body and said bit for relative longitudinal cooperating movements with respect to each other, so that said bit has a retracted position disposed rearwardly of said jaws and an advanced position disposed between said jaws, said body also having a hole formed therethrough adjacent to the rear end thereof and disposed behind said jaws, pneumatic means for supplying a fastener from the exterior through said hole in shank-first relation into said opening behind said jaws when said bit occupies its retracted position and then for forcing the shank of the fastener between said jaws in their closed position and then for advancing the fastener into a predetermined position in said body in which the shank of the fastener is clamped between said jaws in their closed position and in which the head of the fastener is disposed behind said jaws and in stopping engagement therewith and in which the extreme front end of the shank of the fastener projects from the front end of said body, and means for moving said body and said bit relative to each other in a cycle, so that said bit is moved from its retracted position into its advanced position and is then returned into its retracted position, said movement of said bit into its advanced position effecting driving engagement of the forward end thereof with the fastener in its predetermined position in said body and forcing the head of the engaged fastener through said jaws and then driving the engaged fastener from the front end of said body and into fastening engagement with an associated workpiece, said jaws being moved into their open position against the bias of said resilient means in response to the movement therethrough of the head of the engaged fastener and the movement therebetween of said bit into its advanced position and said jaws being moved back into their closed position by said resilient means in response to the subsequent withdrawal from therebetween of said bit in its return movement into its retracted position.

10. 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, the combination comprising a substantially tubular body having a longitudinally extending opening therethrough and provided with a plurality of longitudinally extending and circumferentially spaced-apart slots therein disposed adjacent to the front end thereof, a corresponding plurality of longitudinally extending fingers respectively arranged in said slots, a corresponding plurality of inwardly directed jaws respectively carried by said fingers adjacent to the front ends thereof and arranged in cooperating relation with each other, means mounting said fingers adjacent to the rear ends thereof upon said body for pivotal movements in the respective ones of said slots in order to accommodate movements of said jaws between closed and open positions with respect to each other, resilient means biasing said jaws into their closed position, a longitudinally extending bit cooperating with said body and arranged in alignment with said opening, means mounting said body and said bit for relative longitudinal cooperating movements with respect to each other, so that said bit has a retracted position disposed rearwardly of said jaws and an advanced position disposed between said jaws, said body also having a hole formed therethrough adjacent to the rear end thereof and disposed behind said jaws, an outwardly and rearwardly directed tube carried by said body adjacent to the rear thereof and having a passage therethrough communicating at the front end thereof with said hole and so that the axis of said passage is disposed at an acute angle with respect to the

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longitudinal axis of said opening, pneumatic means for supplying a fastener from the exterior through said passage in shank-first relation and then through said hole into said opening behind said jaws when said bit occupies its retracted position and then for forcing the shank of the fastener between said jaws in their closed position and then for advancing the fastener into a predetermined position in said body in which the shank of the fastener is clamped between said jaws in their closed position and in which the head of the fastener is disposed behind said jaws and in stopping engagement therewith and in which the extreme front end of the shank of the fastener projects from the front end of said body, and means for moving said body and said bit relative to each other in a cycle, so that said bit is moved from its retracted position into its advanced position and is then returned into its retracted position, said movement of said bit into its advanced position effecting driving engagement of the forward end thereof with the fastener in its predetermined position in said body and forcing the head of the engaged fastener through said jaws and then driving the engaged fastener from the front end of said body and into fastening engagement with an associated work-piece, said jaws being moved into their open position against the bias of said resilient means in response to the movement there-through of the head of the engaged fastener and the movement therebetween of said bit into its advanced position and said jaws being moved back into their closed position by said resilient means in response to the subsequent withdrawal from therebetween of said bit in its return movement into its retracted position.

11. The machine combination set forth in claim 10, and further comprising a movable tongue-like element projecting forwardly and inwardly into the intersection of said opening and said passage, so as to provide a smooth transition for the movement of the fastener from said passage into said opening in order positively to prevent tumbling of the fastener out of its shank-first relation as it is moved forwardly into said opening, said

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tongue-like element being moved out of the intersection of said opening and said passage as said bit is moved from its retracted position into its advanced position and being moved back into the intersection of said opening and said passage as said bit is returned from its advanced position back into its retracted position.

12. The machine combination set forth in claim 11, wherein said tongue-like element is pivotally mounted upon said body adjacent to the junction thereof with said tube and is formed of relatively thin sheet material.

13. The machine combination set forth in claim 10, wherein the extreme front end of said tubular body projects forwardly from said jaws to define a chamber in the extreme front end of said opening that is adapted to receive and to contain the enlarged head of the fastener during the initial driving thereof into fastening engagement with the associated work-piece.

14. The machine combination set forth in claim 10, wherein the extreme front end of said tubular body terminates in a substantially cylindrical nose disposed forwardly of said jaws and adapted to engage the associated work-piece and defining a chamber in the extreme front end of said opening adapted to receive and to contain the enlarged head of the fastener during the initial driving thereof into fastening engagement with the associated work-piece.

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Disclaimer

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Hereby enters this disclaimer to claims 1, 2, 3, 4, 5, 6, 9, 10, 13 and 14 of said patent.
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