

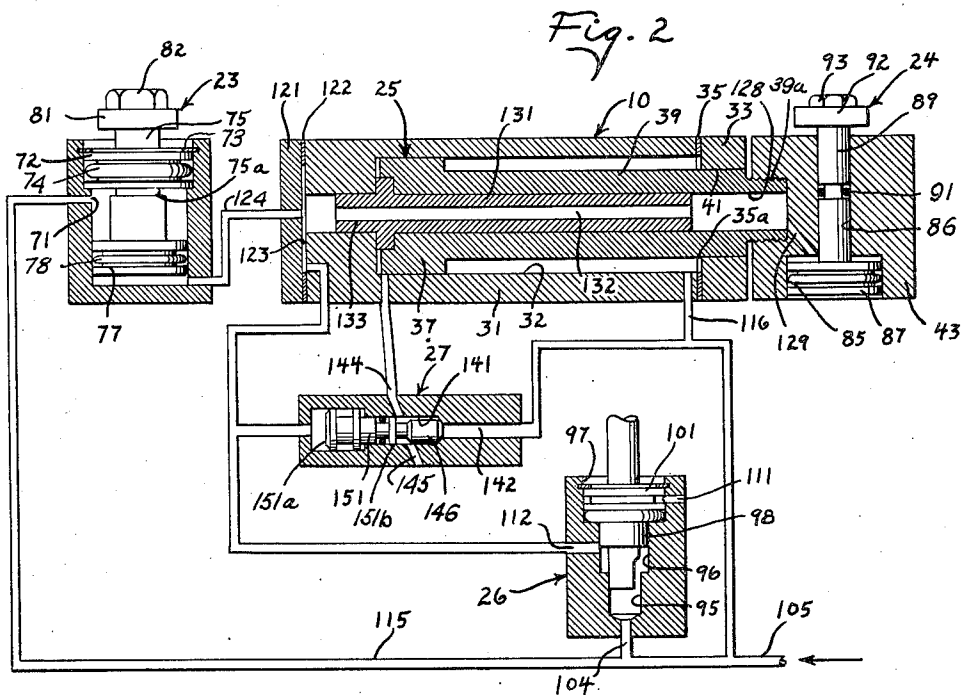
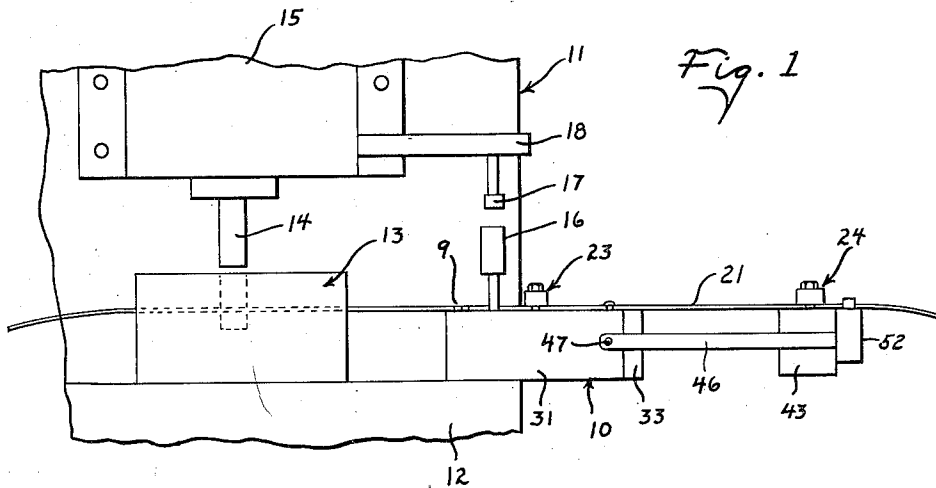
June 12, 1962

R. D. NORDLOF
STOCK FEED MECHANISM

3,038,645

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3 Sheets-Sheet 1



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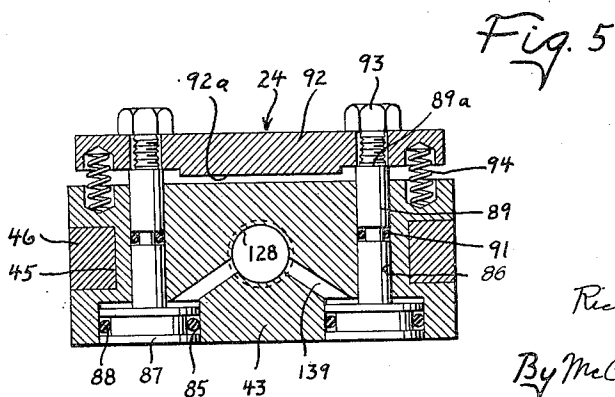
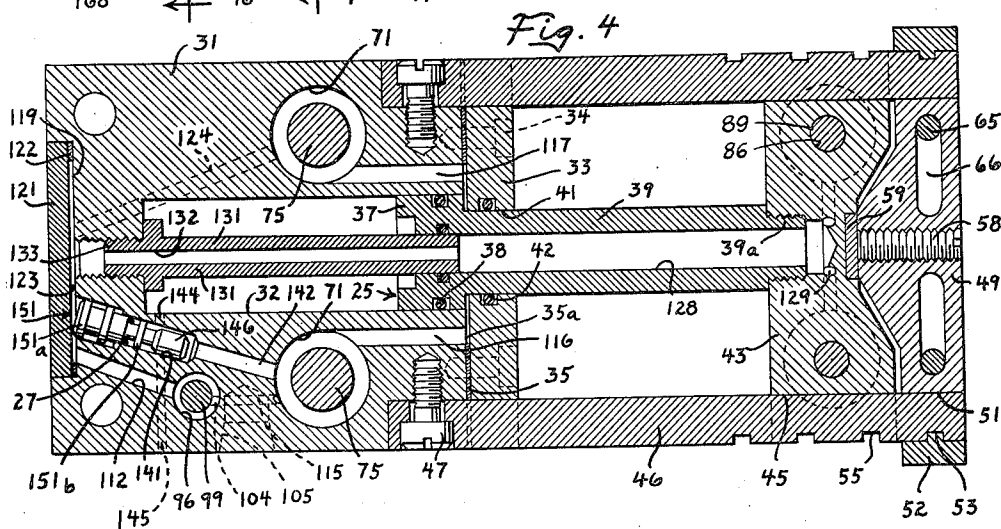
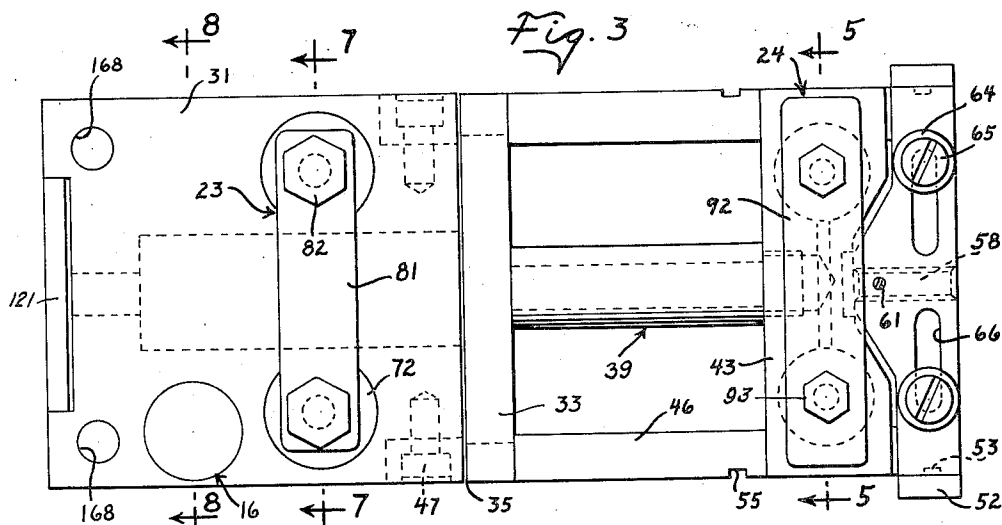
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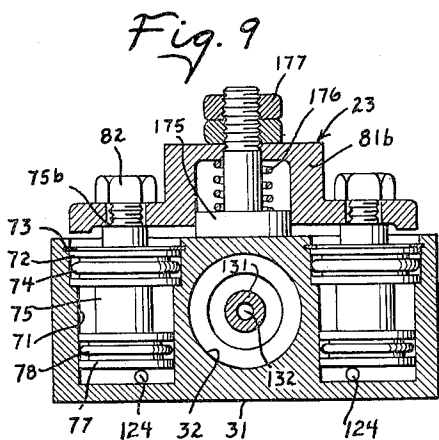
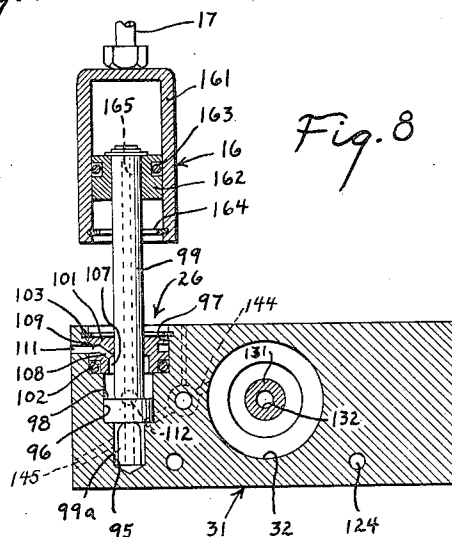
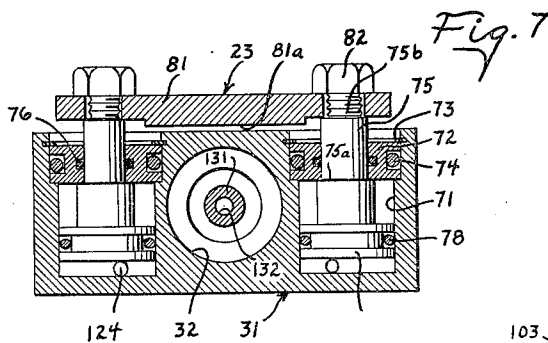
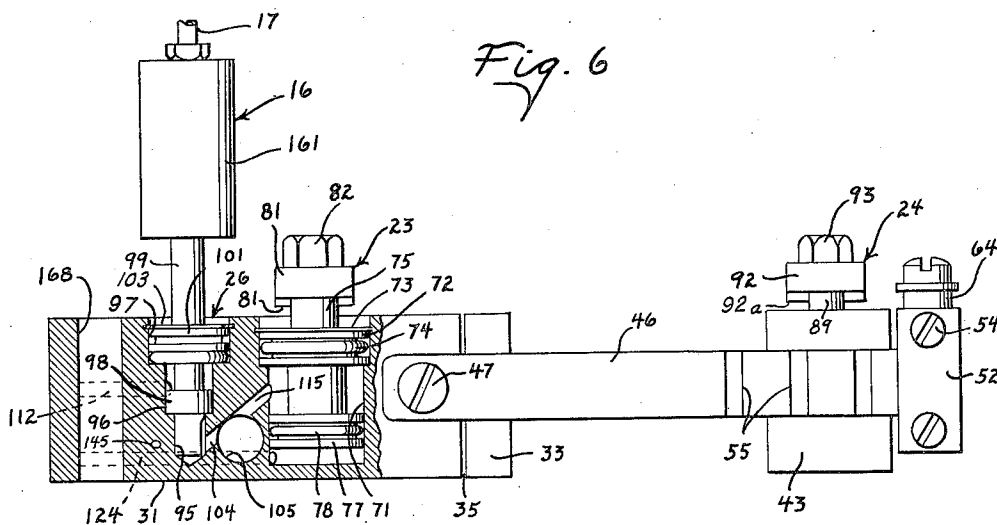
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STOCK FEED MECHANISM

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3 Sheets-Sheet 3



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3,038,645

STOCK FEED MECHANISM

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7 Claims. (Cl. 226—149)

This invention relates to improvements in stock feed mechanisms and particularly to an improved apparatus for intermittently feeding long pieces of stock.

An important object of this invention is to provide a stock feeding apparatus for a punch press which is of compact construction, adapted to be mounted directly on the press and operated by the punch press ram in timed relation with the operation of the press.

Another object of this invention is to provide an improved stock feed apparatus which will accurately feed strip or bar type stock in selectively adjustable increments.

Still another object of this invention is to provide a stock feeding apparatus in which the stock holding and feeding clamps as well as the stock advancing mechanism are fluid operated and which has an improved arrangement for controlling the application of fluid pressure to the several instrumentalities to effect operation of the clamps and the stock advancing mechanism in timed relation.

Yet another object of this invention is to provide a fluid operated stock feed apparatus having an improved actuator for operating the feed apparatus from the punch press ram.

These, together with various ancillary objects and advantages of this invention will be more readily appreciated as the same becomes better understood by reference to the following detailed description when taken in connection with the accompanying drawings wherein:

FIGURE 1 is a diagrammatic view illustrating the mounting of the stock feeding apparatus on a punch press;

FIG. 2 is a diagrammatic view illustrating the fluid control circuit for the several instrumentalities of the feed mechanism;

FIG. 3 is a top plan view of the stock feed apparatus;

FIG. 4 is a horizontal sectional view through the stock feed apparatus;

FIG. 5 is a transverse sectional view taken on the plane 5—5 of FIG. 3;

FIG. 6 is a side elevational view of the feed apparatus with parts broken away and shown in section to illustrate details of construction;

FIG. 7 is a transverse sectional view taken on the plane 7—7 of FIG. 3;

FIG. 8 is a transverse sectional view taken on the plane 8—8 of FIG. 3; and

FIG. 9 is a transverse sectional view through the stock feeding apparatus and illustrating a modified form of stock holding clamp.

The stock feed mechanism 10 of the present invention is particularly adapted for feeding stock to a punch press 11. The stock feed mechanism is arranged to be mounted on the punch press, as by attachment to the bolster plate 12, to feed the stock 21 to the dies 13. The feed mechanism is operated in synchronism with the operation of the punch 14 carried by the ram 15 and, as diagrammatically shown in FIGURE 1, the feed mechanism has an actuator 16 arranged to be operated by a finger 17 which is attached by a bracket 18 to the ram 15 for reciprocation therewith. The feed mechanism advances the strip stock 21 in selectively adjustable increments past the dies 13 and punch 14.

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The feeding apparatus in general includes a fluid operated stock holding clamp 23, a fluid operated stock feeding clamp 24, a fluid operated mechanism 25 for extending and retracting the feeding clamp relative to the holding clamp, a control valve 26 for controlling the application of fluid pressure to the fluid operated clamps, and a pilot valve 27 operated by the control valve 26 and arranged to control the application of fluid pressure to the mechanism 25 to extend and retract the same in timed relation with the operation of the holding and feeding clamps 23 and 24. More particularly, the feeding mechanism comprises a main body 31 having a feed cylinder bore 32 extending inwardly from one end thereof and a head 33 attached to the end of the body as by fasteners 34 and overlying the end of the bore to define a feed cylinder. A gasket 35 is interposed between the head and the body and has a central opening 35a forming a small chamber at the end of the feed cylinder bore 32, for a purpose to be described more fully hereinafter. A feed piston 37 is slidably disposed in the bore 32 and is sealed thereto by an O-ring 38, which piston has a rod 39 extending outwardly from the body through an opening 41 in the head 33. An O-ring seal 42 slidably engages the rod to prevent the leakage of fluid thereby.

A crosshead 43 is attached to the outer end of the rod and, as shown in FIG. 4, is threadedly attached to the reduced diameter end 39a on the rod. The head has grooves 45 in opposite ends thereof which slidably receive the guide rails 46 attached to the body 31 by fasteners 47. A stop bar 49 is adjustably attached to the outer ends of the guide rails 46 and is notched as indicated at 51 to slidably receive the guide rails. End plates 52 having keys 53 thereon are secured to the ends of the stop bar 49, as by fasteners 54 (see FIG. 6). The keys 53, as best shown in FIG. 4, are adapted to be received in opposed pairs of transversely extending keyways 55 formed in the guide rails 46, to lock the stop bar in various different positions along the guide rails. The stop bar 49 is arranged to engage the crosshead 43 on the piston, to limit the stroke thereof, and small adjustments in the stroke are effected by means of a stop screw 58 which is threadedly mounted in the stop bar 49 and arranged to engage a stop plate 59 on the crosshead. The stop screw 58 can be turned to any selected adjusted position and a locking screw 61 (see FIG. 3) is provided for locking the stop screw in its adjusted position. Stock guide rollers 64 are mounted for rotation on bolts 65 carried by the stop bar 49, which bolts extend through elongated slots 66 to permit the rollers to be adjusted laterally to accommodate different stock sizes.

The stock holding clamp 23 is mounted on the body 31 and includes a pair of upright clamp cylinder bores 71 disposed at opposite sides of the feed cylinder bore 32, which clamp cylinder bores are counterbored at their upper ends to receive a sealing gland 72 which is retained in position by a split ring 73. The gland is sealed to the walls of the counterbore by an O-ring 74 and has a central opening therein which slidably receives the reduced diameter end of a clamp piston rod 75. The piston rod has a shoulder 75a intermediate its ends adapted to engage the underside of the gland 72 to limit upward movement of the stock holding clamp and an O-ring 76 is provided for sealing the interface between the piston rod 75 and the gland. A piston 77 is formed on the lower end of the rod and an O-ring 78 is mounted in a groove on the periphery of the piston to form a sliding seal with the bore 71. A clamp bar 81 extends between the piston rods 75 and is clamped against an upper shoulder 75b thereon by means of nuts 82. A stock engaging face 81a is formed on the bar 81, intermediate the piston rods and is adapted to clamp the stock to the upper face of the body 31.

The stock feeding clamp is mounted on the crosshead

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43 and, as best shown in FIG. 5, includes clamp cylinder bores 85 formed in the underside of the crosshead, and stem guide bores 86 which extend from the clamp cylinder bores to the upper side of the crosshead. Pistons 87 are slidably disposed in the clamp cylinder bores 85, and sealed thereto by O-rings 88 and a stem 89 is attached to each piston. The stems 89 extend through the guide bores 86 and are sealed thereto by O-rings 91. A stock feed bar 92 extends between the piston rods 89 and is clamped to an upper shoulder 89a on the rods by means of nuts 93. A stock engaging surface 92a is formed on the underside of the bar 92 for engagement with the stock to clamp the same to the crosshead 43. Springs 94 are interposed between the bar 92 and the crosshead to yieldably urge the bar to its stock release position.

The control valve 26 is also conveniently mounted in the main body 31 and, as best shown in FIGS. 6 and 8, is mounted in a stepped bore having a lower section 95, an intermediate section 96 and an upper section 97. A valve member 98 is slidably disposed in the intermediate section 96 of the bore, and has a stem 99 which slidably extends through a gland 101 mounted in the upper section 97 of the bore. The gland is sealed to the body by an O-ring 102 and retained in position by a split ring 103. Fluid under pressure is continuously supplied to the lower section 95 of the bore through a passage 104 (see FIG. 6) which communicates with a pressure inlet fitting 105 formed in the side of the body, and adapted for connection through a suitable conduit to the source of fluid pressure. A recess 107 is formed in the underside of the gland 101 (see FIG. 8) and is communicated to atmosphere through a passage 108 and groove 109 in the gland and passage 111 in the main body 31. A passage 112 communicates with the intermediate section 96 of the bore and the valve member 98 is movable to selectively communicate the passage 112 with the pressure inlet section 95 of the stepped bore, and with the atmosphere through passage 111.

In the embodiment illustrated, the stock holding clamp 23 is normally urged to its stock engaging position and for this purpose fluid under pressure is supplied from the pressure inlet fitting 105 through a passage 115 to one of the clamp cylinder bores 71 at the upper side of the piston 77 therein, and through passages 116 (FIG. 4), the chamber formed by the opening 35a in the gasket 35, and through passage 117 to the other clamp cylinder bore 71 at the upper side of the piston therein. In addition, it will be noted that fluid under pressure in the chamber defined by the opening 35a in the gasket 35, is also applied to the outer face of the piston 37 to normally urge the piston to its retracted position.

The main body 31 is recessed at one end thereof, as indicated at 119, and a plate 121 overlies the recess and is sealed thereto by an O-ring 122 having a central opening defining a chamber 123. The passage 112 from the control valve communicates with the chamber 123 and passages 124 extend from the chamber to each of the clamp cylinder bores 71, at the underside of the pistons therein, to introduce and exhaust fluid therefrom under the control of the control valve 98. The pistons 77 and the attached stems 75 function as differential type pistons, so that, when fluid under pressure is supplied to the underside thereof, the pistons will be moved upwardly against the fluid pressure acting on the relatively smaller area at the upper side of the pistons. When the underside of the piston is connected to exhaust, the fluid pressure at the upper side moves the piston down and causes the clamp bar 81 to firmly clamp the stock to the top of the body 31.

As previously described, the feed bar 92 is normally urged to its disengaged position by springs 94. Fluid is supplied to the clamp cylinder bores 85 at the upper sides of the pistons 87 therein through a passage 128 formed in the piston rod 39. This passage communicates at one end through lateral passages 129 in the crosshead 43 with the cylinder bores 85 at the upper side of the pistons. A

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tube 131 having a passage 132 therein is attached at one end 133 to the body 31 and slidably extends into the passage 128 in the piston rod, to communicate the cylinder bores 85 in the crosshead 43 with the chamber 123 at the end of the valve body, and to also segregate the fluid pressure applied to the clamp pistons 87 from the pressure applied to the end of the feed piston 37.

The introduction and withdrawal of fluid from the feed cylinder bore 32 is under the control of the pilot valve 27 and the pilot valve is, in turn, fluid pressure operated under the control of the control valve 26. As best shown in FIG. 4, the pilot valve includes an elongated chamber 141 which communicates through passage 142, clamp cylinder bore 71 and passage 115 with the pressure inlet 105. A lateral passage 144 communicates with the pilot valve chamber 141 at one side thereof, and an exhaust passage 145 communicates with the valve chamber at the side opposite the passage 144. A pilot valve member 146 is loosely disposed in the chamber to permit fluid to flow therearound, and is arranged to have one end thereof seat against the pressure inlet passage 142 to block the flow of fluid under pressure to the passage 144 leading to the feed cylinder. A differential piston type fluid operator 151 is disposed in the valve chamber and has an enlarged head 151a exposed to the fluid pressure in the chamber 123. A reduced diameter portion 151b is exposed to the fluid pressure in the pilot valve chamber 141. When the control valve is operated to supply fluid under pressure to the chamber 123, the operator 151 will be moved to the right as shown in FIG. 2 to thereby move the end of the pilot valve member 146 against the passage 142 to block flow to the feed cylinder 32. When the control valve is operated to exhaust fluid from the chamber 123, the fluid pressure acting on the end of the pilot valve member 146 will move the same to the left to the position shown in FIG. 4 whereby fluid flows from the passage 142 around the pilot valve member and through the passage 144 into the feed cylinder. The fluid pressure acting on the side of the pilot valve member 146 will move it in a direction towards the exhaust passage 145 to thereby block the flow of fluid to the exhaust passage.

The control valve 98 is normally urged to its raised position by the fluid pressure acting on the underside thereof and an actuator is mounted on the upper end of the stem to effect movement of the control valve from its raised position shown in FIG. 2 to its lower position shown in FIG. 8, during the initial portion of the stroke of the punch press ram 15, and to hold the control valve in its lowered position until the ram has been retracted to substantially its initial position, to thereby assure that the punch is completely withdrawn from the stock before the stock is indexed. As shown herein, the actuator comprises a cap 161 which is slidably supported on an enlarged head 162 attached to the upper end of the stem. An O-ring 163 seals the interface between the head 162 and the cap, and a retainer ring 164 on the cap prevents accidental withdrawal. Fluid under pressure is supplied to the chamber within the cap 161 through an axial passage 165 which extends through the valve stem and communicates the cap with the pressure inlet section of the bore 95 at the lower end of the stem.

In use, the stock feed apparatus 10 is arranged to be mounted on the base 12 of the punch press, as by bolts 9 which extend through bores 168 in the body 31. As the ram 15 of the press moves downwardly during a punching operation, the finger 17 engages the actuator to first move the control valve 98 from its raised position shown in FIG. 2 to its lowered position shown in FIG. 8. The actuator maintains the valve in its lowered position as the ram completes its punching stroke and until the ram has returned to substantially its initial position.

When the control valve is in its raised position, fluid under pressure is supplied through the passage 112 to the

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chamber 123 and through passages 124 to the underside of the stock holding pistons 77, to normally maintain the holding clamp bar 81 in its released position. Fluid under pressure is also supplied through passage 132 in the rod 131, and through passage 128 in the piston to the clamp cylinder bores 85 to urge the pistons 87 therein downwardly and move the clamp bar 92 into engagement with the stock. In addition, fluid under pressure is supplied to the pilot valve operator 151 to move the pilot valve 146 against the passage 142 to block the pressure passage 142 and communicate the passage 144 to the exhaust passage 145. The feed piston 39 is therefore normally in its retracted position shown in FIG. 2.

As the control valve 98 is moved downwardly, it cuts off the supply of fluid pressure to the passage 112 and communicates the latter to exhaust or atmosphere. This reduces the fluid pressure at the underside of the stock holding pistons 77 and at the upper side of the feed pistons 87 to respectively move the holding bar 81 downwardly into stock gripping position and permit the feeding bar 92 to move upwardly under the bias of springs 94 to its stock release position. In addition, the pilot valve actuator 151 moves to the left when the pressure on the head 151a thereof is reduced and the pilot valve 146 moves to the position shown in FIG. 4 uncovering the port 142 and blocking the exhaust port 145. Fluid under pressure is then supplied from passage 142 around the pilot valve 146 and through passage 144 to the feed cylinder 32. This fluid pressure acting on a relatively larger area at the left hand side of the piston 37 overcomes the fluid pressure acting on the right hand side thereof and extends the piston and head 43.

When the operating finger 17 on the ram moves out of engagement with actuator cap 161, the control valve returns to its raised position shown in FIG. 2. Pressure is then reapplied to the underside of the holding piston 77 and to the upper side of the feed piston 87. Since these clamping pistons have a very short travel, the holding bar 81 and the feed bar 92 move rapidly to a stock release position and a stock gripping position, respectively. The pressure responsive operator 151 for the pilot valve then moves the pilot valve 146 to a position shown in FIG. 2 blocking flow of fluid to the feed cylinder 32 and communicating the latter to atmosphere. This retracts the head 43 and feeds a length of stock determined by the stroke of the piston. The stroke of the piston can be selectively varied in the manner previously described by adjusting the stop bar 49 and the stop screw 53 to limit extension of the piston.

A modified form of holding clamp 23 is shown in FIG. 9. In this embodiment, the stock holding bar 81b has a U-shaped central portion which slidably supports a shoe 175. The shoe is yieldably urged downwardly into engagement with the stock by means of a spring 176 and stop nuts 177 are provided for limiting downward movement of the shoe. This type holding clamp applies a yieldable pressure to the stock and permits some shifting of the stock in the event a positive type stock feed control is employed.

I claim:

1. A stock feed apparatus for feeding stock to a punch press comprising a body having a feed cylinder therein, a piston slidable in said cylinder and having a rod extending outwardly therefrom, a head on the outer end of said rod, a feed clamp mounted on said head and including fluid pressure operated means for moving the clamp between stock gripping and release positions, means including a control valve for controlling the application of fluid pressure to said piston and said pressure operated means, passage means for supplying fluid under pressure to said valve, said valve having a stem removable from a first position to a second position and back, an actuator for said stem including a cap slidably supported on the stem and defining a fluid chamber at one

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end of the stem, and a passage extending through said stem and communicating at said one end with said chamber and at the other end with said passage means to provide a resilient fluid cushion between said cap and said one end of the stem.

2. A stock feed apparatus comprising, a body having a feed cylinder therein, a feed piston slidable in said feed cylinder from a first position to a second position and back, a piston rod connected to one side of said feed piston and extending out of said feed cylinder, a feed head on the outer end of said piston rod, a feed clamp mounted on said feed head, a stationary stock holding clamp, a first fluid pressure operated means for moving one of said clamps between stock release and gripping positions, fluid supply means for supplying continuous fluid pressure to one side of said feed piston to normally urge said feed piston to said first position, a three-way feed control valve having an inlet connected to said fluid supply means and a control port connected to said feed cylinder at the other side of said feed piston and an exhaust outlet, said three-way valve including a valve member movable between a first position communicating said control port with said inlet and a second position communicating said control port with said exhaust outlet to supply and exhaust fluid from said feed cylinder at said other side of said feed piston, a second fluid pressure operated means for moving said valve member from said first position to said second position, a main control valve having a first connection to said supply means and a second connection to said first and second fluid pressure operated means operative to selectively supply and exhaust fluid pressure from said first and second fluid pressure operated means, said second fluid pressure operated means being operative when fluid pressure is supplied thereto to move said valve member to said second position and exhaust fluid from said feed cylinder at said other side of the feed piston therein, said three-way valve including means defining a valve bore, said inlet communicating with said bore at one end thereof, said exhaust outlet and said control port communicating with the sides of said bore intermediate the ends thereof, said valve member comprising an elongated valve element loosely disposed in said bore to define a flow passage therearound and having a face at one end adapted to close said inlet, said second fluid pressure operated means engaging the end of said valve element opposite said face to move the same to said second position closing said inlet, said valve element being laterally shiftable in said bore to close said exhaust outlet when the valve element moves away from said inlet to thereby pass fluid from said inlet to said control port.

3. A stock feed apparatus comprising a body having a feed cylinder therein, a feed piston slidable in said feed cylinder from a first position to a second position and back, a piston rod connected to one side of the feed piston and extending out of said feed cylinder, a feed head on the outer end of said piston rod, a feed clamp mounted on said feed head, a first fluid pressure operated means for moving said feed clamp between stock release and engaging positions, a stock holding clamp mounted on said body, a second fluid pressure operated means for moving said holding clamp between stock engaging and release positions, said body having a feed control valve therein, said feed control valve including a valve bore in said body having an inlet and a control port and an exhaust outlet, fluid supply means for continuously supplying fluid pressure to said inlet, passage means in said body connecting said control port with said feed cylinder at one side of said feed piston therein, said feed control valve including a feed valve member movable from a first position communicating said control port with said inlet to a second position communicating said control port with said exhaust outlet to supply and exhaust fluid pressure from said feed cylinder, a third fluid pressure operated means in said body engageable with said

feed valve member for moving the same from said first position to said second position when fluid pressure is applied to said third fluid pressure operated means, and a main control valve in said body having an inlet passage connected to said fluid supply means and exhaust passage and a control passage connected to each said first, second and third fluid pressure operated means to selectively supply and exhaust fluid pressure therefrom, said main control valve including a stem having a head on one end movable with the stem from a first position to a second position and back, an actuator for said stem including a cap slidably supported on said head on the stem and defining a fluid chamber at one side of that head, and passage means extending through said stem communicating said fluid chamber with said inlet passage of the main control valve to provide a resilient cushion between said cap and said head on said stem.

4. A stock feed apparatus comprising a body having a feed cylinder therein, a feed piston slidable in said feed cylinder from a first position to a second position and back, a piston rod connected to one side of said feed piston and extending out of said feed cylinder, a feed head on the outer end of said piston rod, a feed clamp mounted on said feed head, a stationary stock holding clamp, a first fluid pressure operated means for moving one of said clamps between stock gripping and release positions, fluid supply means connected to said feed cylinder for supplying continuous fluid pressure to one side of said feed piston to normally urge said feed piston to said first position, a three-way feed control valve having an inlet connected to said fluid supply means and a control port connected to said feed cylinder at the other side of said feed piston and an exhaust outlet, said three-way feed control valve including a feed valve member movable between a first position communicating said control port with said inlet and a second position communicating said control port with said exhaust outlet to supply and exhaust fluid pressure from said feed cylinder at said other side of said feed piston, said feed valve member having a face portion disposed transverse to the direction of movement of said feed valve member and exposed to fluid pressure at said inlet and arranged to normally urge said feed valve member to one of said positions thereof, a second fluid pressure operated means for moving said feed valve member from said one of said positions to the other of said positions when fluid pressure is applied to said second pressure operated means, and a main control valve having an inlet passage connected to said supply means and an exhaust passage and a control passage connected to said first and second fluid pressure operated means to selectively supply and exhaust fluid pressure from said first and second fluid pressure operated means.

5. A stock feed apparatus comprising a body having a feed cylinder therein, a feed piston slidable in said feed cylinder from a first position to a second position and back, a piston rod connected to one side of said feed piston and extending out of said feed cylinder, a feed head on the outer end of said piston rod, a feed clamp mounted on said feed head, a stationary stock holding clamp, a first fluid pressure operated means for moving one of said clamps between stock gripping and release positions, fluid supply means connected to supply continuous fluid pressure to said one side of said feed piston to normally urge said feed piston to said first position, a three-way feed control valve having an inlet connected to said fluid supply means and a control port connected to said feed cylinder at the other side of the feed piston and an exhaust outlet, said three-way feed control valve including a feed valve member movable between a first position communicating said control port with said inlet and a second position communicating said control port with said exhaust outlet to supply and exhaust fluid from said feed cylinder at said other side of the feed piston, said feed valve member having a face portion disposed transverse to the direc-

tion of movement of said feed valve member and exposed to fluid pressure at said inlet and arranged to normally urge said feed valve member to said first position, a second fluid pressure operated means in said body for moving said feed valve member from said first position to said second position when fluid pressure is applied to said second fluid pressure operated means, and a main control valve in said body having an inlet passage connected to said fluid supply means and an exhaust passage and a control passage connected to each said first and second fluid pressure operated means to selectively supply and exhaust fluid pressure from said first and second fluid pressure operated means.

6. A stock feed apparatus comprising a body having a feed cylinder therein, a feed piston slidable in said feed cylinder from a first position to a second position and back, a piston rod connected to one side of the feed piston and extending out of said feed cylinder, a feed head on the outer end of said piston rod, a feed clamp mounted on said feed head, a first fluid pressure operated means for moving said feed clamp between stock release and engaging positions, a stock holding clamp mounted on said body, a second fluid pressure operated means for moving said holding clamp between stock engaging and release positions, fluid supply means connected to said feed cylinder for supplying continuous fluid pressure to said one side of said feed piston to normally urge said feed piston to said first position, said body having a three-way feed control valve therein, said three-way feed control valve including a valve bore in said body having an inlet connected to said fluid supply means and a control port and an exhaust outlet, passage means in said body connecting said control port with said feed cylinder at the other side of said feed piston, said feed control valve including a feed valve member movable from a first position communicating said control port with said inlet to a second position communicating said control port with said exhaust outlet to supply and exhaust fluid pressure from said feed cylinder at said other side of said feed piston, said feed valve member having a face portion disposed transverse to the direction of movement of said feed valve member and exposed to fluid pressure at said inlet and arranged to normally urge said feed valve member to said first position, a third fluid pressure operated means in said body engageable with said feed valve member for moving said feed valve member from said first position to said second position when fluid pressure is applied to said third pressure operated means, and a main control valve in said body having an inlet passage connected to said fluid supply means and a control passage connected to each said first, second and third fluid pressure operated means and an exhaust passage to selectively supply and exhaust fluid pressure from said first, second and third fluid pressure operated means.

7. The combination of claim 6 wherein said first fluid pressure operated means includes a pair of clamp cylinders in said feed head at opposite sides of said piston rod and said second fluid pressure operated means includes a pair of clamp cylinders in said body at opposite sides of said feed cylinder, first and second pairs of clamp pistons in said clamp cylinders in the feed head and body respectively, said feed clamp being attached to said first pair of clamp pistons and said stock holding clamp being attached to said second pair of clamp pistons.

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