June 28, 1938. P. H. NAST 2,121,817

PUNCH MECHANISM

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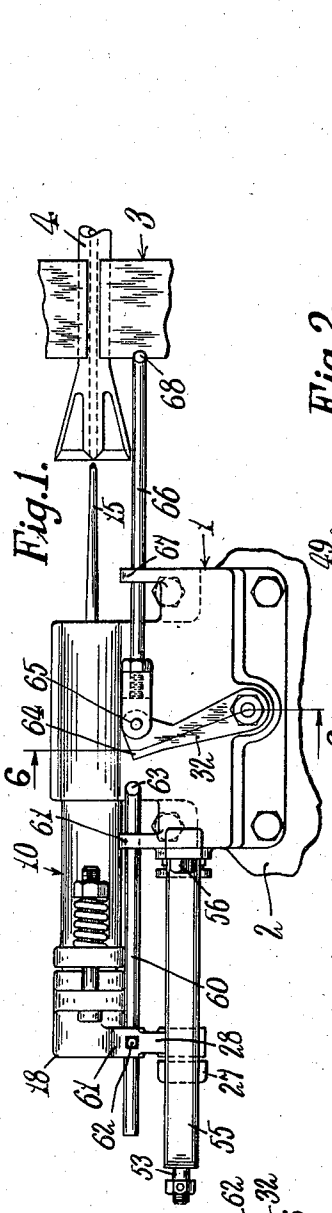


Fig. 1.

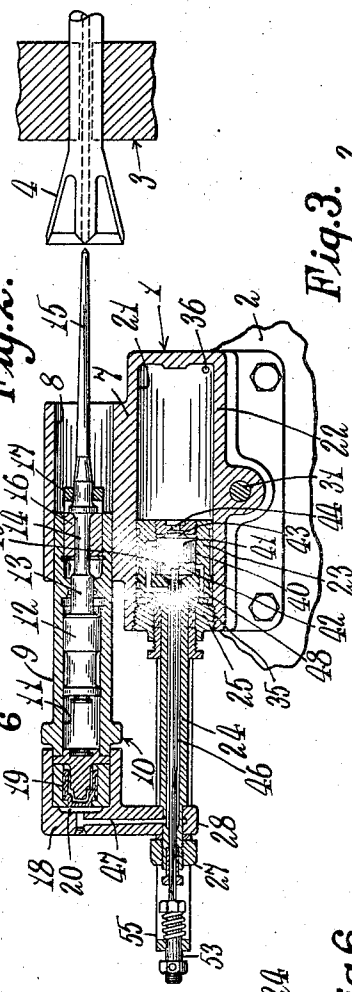


Fig. 2.

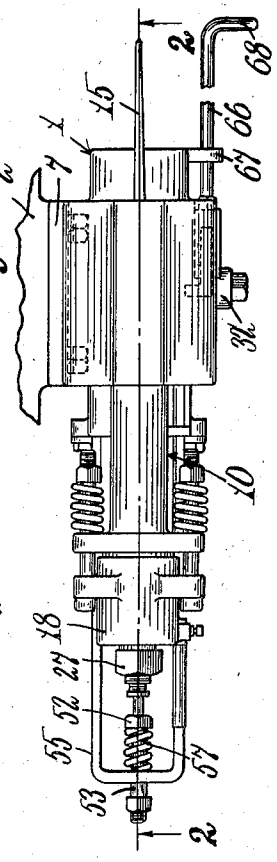


Fig. 3.

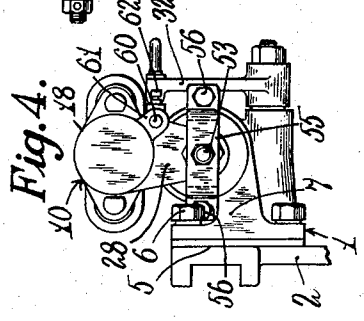


Fig. 4.

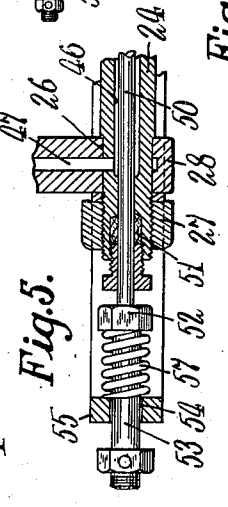


Fig. 5.

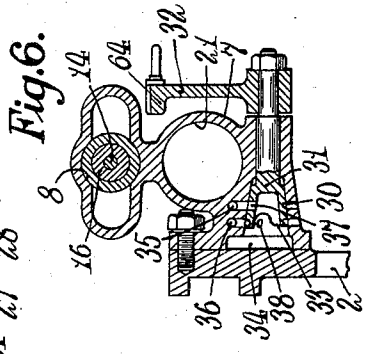


Fig. 6.

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PUNCH MECHANISM

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Application December 3, 1934, Serial No. 755,728

25 Claims. (Cl. 76—5)

This invention relates to punch mechanisms, and more particularly to improvements in a punch mechanism for reforming the bore in a hollow rock drill steel.

In hollow rock drill steels it is frequently necessary to reform or reopen the drill steel bore after the steel sharpening or forming process has taken place, the sharpening or forming process causing the steel bore to be partially closed or obstructed. This bore reforming operation is generally effected by driving a punch pin into the steel bore to open the latter. It often occurs that the punch pin sticks in the steel bore and causes some difficulty in the removal of the same.

An object of this invention is to provide an improved punch mechanism for driving a punch pin into the steel bore and for releasing a stuck pin from the bore. Another object is to provide an improved punch mechanism having an improved punch pin hammer mechanism and improved means for feeding the hammer mechanism to drive the punch pin into and release the same from the drill steel bore. Another object is to provide an improved control means for the feeding means and for controlling the hammer mechanism. A still further object is to provide an improved control means for a punch mechanism whereby, when the punch pin has been driven into the drill steel bore a predetermined distance, the direction of feed is automatically reversed to effect withdrawal of the pin from the drill steel bore and having associated therewith means for varying the range of feed. These and other objects and advantages of the invention will, however, hereinafter more fully appear.

In the accompanying drawing there is shown for purposes of illustration one form which the invention may assume in practice.

In the drawing,—

Fig. 1 is a side elevational view of the illustrative form of the improved punch mechanism.

Fig. 2 is a view in longitudinal section taken substantially on line 2—2 of Fig. 3.

Fig. 3 is a plan view of the punch mechanism shown in Fig. 1.

Fig. 4 is a rear end elevational view of the punch mechanism shown in Fig. 1.

Fig. 5 is a detail sectional view showing a portion of the improved control means.

Fig. 6 is a cross sectional view taken substantially on line 6—6 of Fig. 1, with parts shown in elevation.

In this illustrative construction there is shown a punch mechanism generally designated 1 mounted on a suitable support 2 in juxtaposition to a clamping mechanism generally designated 3. The support 2 and clamping mechanism 3 may constitute elements of a forging machine having additional bit-sharpening functions. Maintained in bore re-forming position between the jaws of the clamping mechanism 3 is shown a usual hollow rock drill steel 4 arranged in longitudinal alinement with the punch mechanism so that when the punch mechanism is fed forwardly to drive its punch pin into the drill steel bore the bore is re-formed, and thereafter the punch pin is automatically withdrawn from the drill steel.

Now referring to the improved punch mechanism, it will be noted that secured to a vertical plane face 5 of the support 2, as by screws 6, is a frame 7 having a horizontal guide bore 8 for slidably receiving the cylinder 9 of a punch pin hammer mechanism generally designated 10. The cylinder of this hammer mechanism has a bore 11 containing a reciprocable hammer piston 12 having a striking nose 13 for delivering impact blows to the shank 14 of an elongated punch pin 15. The collared punch pin shank is supported within a chuck 16 carried within the forward end of the hammer motor cylinder, and is retained therein by a suitable punch pin retainer 17 with which the shank collar cooperates. Arranged within a rear head block 18 suitably secured to the rear end of the motor cylinder is a valve box 19 containing a suitable form of fluid distributing valve mechanism for controlling the supply of motive fluid to the cylinder 9 to effect reciprocation of the hammer piston 12, this valve mechanism controlling, in a well known manner, the flow of pressure fluid from a pressure chamber 20 through suitable ports and passages to the opposite ends of the cylinder bore. Reference may be made to Letters Patent No. 1,148,310 for a disclosure of a suitable distributing valve arrangement.

Arranged parallel with the guide bore 8 beneath the latter and likewise formed in the frame 7 is the bore 21 of a horizontal feed cylinder 22. Reciprocable in this feed cylinder is a feed piston 23 having a tubular piston rod 24 extending rearwardly through the packed rear head 25 of the feed cylinder and secured at its rear end at 26 by a clamping nut 27 threaded on the rod, to a depending projection 28 formed integral with the rear head block 18 of the hammer motor.

The improved control means for the punch mechanism comprises a valve bore 30 formed in the frame 7 and arranged transversely beneath

the feed cylinder bore in a vertical plane midway between the ends of the latter, and mounted in this valve bore is a rotary control valve 31 having secured thereto an operating lever 32. As shown in Fig. 6, the control valve has an internal chamber 33 communicating with a pressure fluid supply chamber 34 in turn communicating with any suitable pressure fluid source. A forward feed passage 35 leads from the valve bore to the rear end of the feed cylinder, while a reverse feed passage 36 leads from the valve bore to the forward end of the feed cylinder, and the control valve has suitable radial ports 37 and 38 for selectively connecting the feed passages 35 and 36, respectively, with the valve chamber 33. The feed piston 23 is provided with a valve bore 40 containing a reciprocatory valve 41 of the piston type having at its opposite ends conical end-seating portions 42 and 43 adapted to engage appropriate valve seats at the opposite ends of the valve bore 40. An axial passage 44 connects the forward end of the valve chamber 40 with the forward end of the feed cylinder bore, while formed in the piston rod 24 is an axial passage 46 for connecting the rear end of the valve bore 40 with a passage 47 communicating with the pressure chamber 20 formed in the rear head block 18 of the hammer motor. Connecting the valve bore 40 with the feed cylinder bore at the rear side of the feed piston is a passage 48, while connecting the axial passage 46 with the forward end of the valve bore 40 is a passage 49. Communication of 48 with the valve bore is interrupted when the valve 41 is in its relative rearward position in the bore, and when the valve is in the forward position, shown in Fig. 2, the mouth of 49 is covered. Secured to the piston valve 41 and extending rearwardly axially through the bore 46 in the piston rod 24, is a slidable rod 50 projecting through a stuffing box 51 carried within the rear end of the feed piston rod 24, as shown in Fig. 5. This valve rod 50, when the parts are in the position shown in Fig. 5, abuts the head 52 of a bolt 53 slidably guided in a bore 54 formed in a bracket 55. This bracket is of a U shape and is secured, as by bolts 56, to the frame 7. Interposed between the bracket 55 and the bolt head 52 and encircling the bolt is a coiled spring 57 for normally urging the bolt into its foremost position. This spring mounted bolt forms a yieldable abutment for the valve rod 50.

Means is provided for limiting the range of forward feeding movement of the punch mechanism and for effecting automatic reversal of the punch mechanism when the punch pin has been driven a predetermined distance into the drill steel bore comprising a control rod 60 guided within bores formed in lugs 61, 61 formed on the projection 28 and frame 7, respectively, and this rod is adjustable in a direction longitudinally of the punch mechanism and held in adjusted position by a set screw 62. The forward end of this control rod is bent laterally to provide a projection 63 engageable with an abutment 64 formed on the valve lever 32. Pivotally connected at 65 to the valve lever is a manual operating rod 66 guided within the bore of a lug 67 formed on the frame 7 and having a grasping handle 68.

The mode of operation of the improved punch mechanism will be clearly apparent from the description given. When the parts are in the position shown in Fig. 2 with the rock drill steel 4 clamped in operative bore re-forming position between the jaws of the clamping mechanism 3, and with the valve lever 32 thrown rearwardly, as shown in Fig. 1, pressure fluid may flow from the pressure chamber 34 through the valve chamber 33, port 37 and passage 35 to the rear end of the feed cylinder bore at the rear side of the feed piston 23, the pressure fluid acting on the rear pressure area of the feed piston to move the latter forwardly within its bore. Pressure fluid at the same time flows through passage 48, through the valve bore 40 past the rear side of the piston 41, through the axial passage 46 in the piston rod 24 and passage 47 to the pressure chamber 20 of the hammer mechanism, and as a result, the hammer piston 12 is rapidly reciprocated within its bore to deliver impact blows to the shank of the punch pin 15. As the feed piston moves forwardly within its bore, the hammer motor is fed forwardly therewith within the guide bore 8 to drive, with a hammering action, the punch pin 15 into the drill steel bore to reform the latter. When the punch pin has been fed forwardly within the steel bore a predetermined distance, the projection 63 engages the abutment 64 on the valve lever 32, thereby throwing the lever forwardly from the position shown in Fig. 1 to a position wherein the port 38 communicates with the reverse feed passage 36. Pressure fluid then flows through this reverse feed passage to the forward end of the feed cylinder bore at the forward side of the feed piston, the pressure fluid acting on the forward pressure area of the feed piston to move the latter rearwardly in its bore, moving therewith the hammer mechanism to withdraw the punch pin from the drill steel bore. The pressure fluid in the forward end of the cylinder bore acts on the forward pressure area of the piston valve 41 to move the latter rearwardly from the position shown in Fig. 2 to the position wherein the valve seating portion 42 cuts off communication of the axial passage 46 with the passage 48, pressure fluid at that time flowing through passage 49 and passages 46 and 47 to the pressure chamber of the hammer motor. During this withdrawal operation a vibrating action is transmitted to the punch pin through the steel retainer 17 acting on the pin shank collar by vibration set up within the hammer motor by the recoil of the hammer piston due to its sudden reversal in motion. It will thus be seen that as the punch pin is withdrawn from the drill steel bore it has imparted thereto a vibrative action which tends to facilitate pin release. Upon rearward movement of the punch mechanism, before the feed piston engages the rear cylinder head, the piston valve 41 will have had its rearward movement stopped by engagement of the valve rod 50 with the head of the spring bolt 53, so that the continued rearward movement of the feed piston will result in the relative position of the parts shown in Fig. 2, wherein piston valve 41 has its valve seating portion 43 cutting off communication of the passage 44 with the valve bore 40, thereby interrupting the flow of pressure fluid from the forward end of the cylinder bore through passage 44, passage 49, passage 46 and passage 47 to the pressure chamber 20 of the hammer motor. Thus the mechanism will be shut down, with the punch retracted and so held by air pressure. The control valve 31 embodies means for connecting the inactive side of the feed cylinder bore to exhaust. By changing the position of the control rod 60, the time when the projection 63 engages the valve lever abutment 64 may be varied, thereby to vary the range of forward feeding movement

of the punch mechanism. The operator by grasping the handle of the control rod **66** may swing the valve lever **32** to move the control valve into any desired position. These and other uses and advantages of the improved punch mechanism will be clearly apparent to those skilled in the art.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In a punch mechanism, a support having a guide, a hammer mechanism slidable on said guide for driving a punch pin with a hammering action into a drill steel bore, means for feeding said hammer mechanism forwardly on its guide, and means for effecting automatic reversal of said feeding means when the punch pin has been driven into the drill steel bore a predetermined distance, said automatic means including means adjustable at will for varying the distance the punch pin may be driven into the drill steel bore prior to such reversal.

2. In a punch mechanism, a support providing a guide, a hammer mechanism slidable on said guide, reversible means for feeding said hammer mechanism forwardly and rearwardly on its guide to effect movement of a punch pin into and out of a drill steel bore, said feeding means including a feeding element, and means for effecting operation of said hammer mechanism during both forward and reverse feeding movements thereof embodying means cooperating directly with said feeding element of said feeding means and by such cooperation controlling said hammer mechanism.

3. In a punch mechanism, a support providing a guide, a hammer mechanism slidable on said guide, reversible means for feeding said hammer mechanism forwardly and rearwardly on its guide to effect movement of a punch pin into and out of a drill steel bore, said feeding means including a feeding element, means for effecting operation of said hammer mechanism during both forward and rearward feeding movements thereof embodying means cooperating directly with said feeding element of said feeding means and by such cooperation controlling said hammer mechanism, and means for effecting automatic reversal of the direction of feed of said hammer mechanism when the punch pin has been driven into the drill steel bore a predetermined distance.

4. In a punch mechanism, a support having a guide, a hammer mechanism slidable on said guide, reversible means for feeding said hammer mechanism forwardly and rearwardly on its guide while hammering to drive a punch pin into and effect its withdrawal from a drill steel bore, said reversible feeding means including relatively reciprocable feed cylinder and piston elements, valve means for selectively supplying pressure fluid to the opposite ends of the feed cylinder element, and means for effecting operation of said hammer mechanism during both forward and rearward feeding movements thereof embodying means cooperating with the feed piston element for controlling said hammer mechanism.

5. In a punch mechanism, a support having a guide, a hammer mechanism slidable on said guide, reversible means for feeding said hammer mechanism forwardly and rearwardly on its guide to effect movement of a punch pin into and out of a drill steel bore, said reversible feeding means including relatively reciprocable feed cylinder and piston elements, valve means for selectively supplying pressure fluid to the opposite ends of the feed cylinder element, means for effecting operation of said hammer mechanism during both forward and rearward feeding movements thereof embodying means cooperating with the feed piston element for controlling said hammer mechanism, and means associated with said pressure fluid supply controlling valve means for effecting automatic reversal of said feeding means when the punch pin has been driven into the drill steel bore a predetermined distance.

6. In a punch mechanism, a support having a guide, a hammer mechanism slidable on said guide and comprising a pressure fluid actuated hammer motor for delivering impact blows to a punch pin, reversible feeding means for said hammer mechanism for feeding said hammer mechanism forwardly and rearwardly on its guide to effect movement of the punch pin into and out of a drill steel bore, said feeding means including relatively reciprocable pressure fluid actuated cylinder and piston elements, valve means for controlling the supply of pressure fluid to the opposite ends of the feed cylinder element, and means for effecting operation of said hammer mechanism during both forward and rearward feeding movements thereof embodying valve means cooperating with the feed piston element for controlling the supply of pressure fluid to said hammer motor.

7. In a punch mechanism, a support having a guide, a hammer mechanism slidable on said guide and comprising a pressure fluid actuated hammer motor for delivering impact blows to a punch pin, reversible feeding means distinct from said guide and spaced from the latter for feeding said hammer mechanism forwardly and rearwardly on its guide to effect movement of the punch pin into and out of a drill steel bore, said feeding means including relatively reciprocable pressure fluid actuated cylinder and piston elements, valve means for controlling the supply of pressure fluid to the opposite ends of the feed cylinder element, and valve means cooperating with the feed piston element for controlling the supply of pressure fluid to said hammer motor, the pressure fluid flowing from the feed cylinder element under the control of said last mentioned valve means to said hammer motor.

8. In a punch mechanism, a support having a guide, a hammer mechanism slidable on said guide comprising a pressure fluid actuated hammer motor for percussively actuating a punch pin, reversible means distinct from said guide and spaced from the latter for feeding said hammer mechanism forwardly and rearwardly on its guide to effect movement of the punch pin into and out of a drill steel bore, said feeding means comprising relatively reciprocable pressure fluid actuated feed cylinder and piston elements, valve means for supplying pressure fluid to the opposite ends of said feed cylinder element, and valve means cooperating with said feed piston element for controlling a supply of pressure fluid from the feed cylinder element to said hammer motor, said hammer motor when said feed piston element is moving in one direction receiving pressure fluid

from one end of said feed cylinder element and when said feed piston element is moving in the opposite direction receiving pressure fluid from the opposite end of said feed cylinder element.

9. In a punch mechanism, a support having a guide, a hammer mechanism slidable on said guide comprising a pressure fluid actuated hammer motor for percussively actuating a punch pin, reversible means for feeding said hammer mechanism forwardly and rearwardly on its guide to effect movement of the punch pin into and out of a drill steel bore, said feeding means comprising relatively reciprocable pressure fluid actuated feed cylinder and piston elements, valve means for supplying pressure fluid to the opposite ends of said feed cylinder element, valve means associated with said feed piston element for controlling a supply of pressure fluid from the feed cylinder element to said hammer motor, said hammer motor when said feed piston element is moving in one direction receiving pressure fluid from one end of said feed cylinder element and when said feed piston element is moving in the opposite direction receiving pressure fluid from the opposite end of said feed cylinder element, said valve means for controlling the supply of pressure fluid to the hammer motor comprising a valve bore formed in said feed piston element, and a relatively reciprocable piston valve in said valve bore, said piston valve when in one relative position admitting pressure fluid from one end of the feed cylinder element to the hammer motor and when in its opposite relative position admitting pressure fluid from the opposite end of the feed cylinder element to the hammer motor.

10. In a punch mechanism, a pressure fluid actuated hammer motor for percussively actuating a punch pin, reversible pressure fluid actuated feeding means for feeding said hammer motor forwardly and rearwardly while in operation to drive the punch pin into and effect its withdrawal from a drill steel bore comprising a reversible feeding motor arranged wholly in lateral offset relation to said hammer motor and having a motor chamber, means for controlling the supply of pressure fluid to the motor chamber of said feeding means, and means for effecting operation of said hammer motor during both forward and rearward feeding movements thereof embodying means for supplying pressure fluid to said hammer motor from the portion of the motor chamber of said feeding means within which pressure fluid is acting to provide the feeding force.

11. In a punch mechanism, a pressure fluid actuated hammer motor for percussively actuating a punch pin, reversible pressure fluid actuated feeding means for feeding said hammer motor forwardly and rearwardly to effect movement of the punch pin into and out of a drill steel bore, said feeding means includiing a feeding motor having a motor chamber, means for controlling the supply of pressure fluid to said feeding means, and means for effecting operation of said hammer motor during both forward and rearward feeding movements thereof embodying means for supplying pressure fluid from the motor chamber of said feeding means to said hammer motor, said operation-effecting means including means for automatically cutting off the supply of pressure fluid to the hammer motor when said feeding means reaches its extreme limit of rearward feed.

12. In a punch mechanism, a pressure fluid actuated hammer motor for percussively actuating a punch pin, reversible pressure fluid actuated feeding means for feeding said hammer forwardly and rearwardly to effect movement of the punch pin into and out of a drill steel bore including relatively reciprocable feed cylinder and piston elements in offset relation with respect to said hammer motor, valve means for connecting either end of said feed cylinder element with a source of pressure fluid supply while the other end thereof is connected to exhaust, and valve means arranged within said feed piston element for controlling the supply of pressure fluid from said feed cylinder element to said hammer motor.

13. In a punch mechanism, a pressure fluid actuated hammer motor for percussively actuating a punch pin, reversible pressure fluid actuated feeding means for feeding said hammer forwardly and rearwardly to effect movement of the punch pin into and out of a drill steel bore including relatively reciprocable feed cylinder and piston elements, valve means for connecting either end of said feed cylinder element with a source of pressure fluid supply while the other end thereof is connected to exhaust, and valve means arranged within said feed piston element for controlling the supply of pressure fluid from said feed cylinder element to said hammer motor, said last mentioned valve means including means for automatically cutting off the supply of pressure fluid from said feed cylinder element to said hammer motor when said feeding means reaches its extreme limit of rearward feed.

14. In a punch mechanism, a pressure fluid actuated hammer motor for percussively actuating a punch pin, reversible pressure fluid actuated feeding means for feeding said hammer forwardly and rearwardly to effect movement of the punch pin into and out of a drill steel bore including relatively reciprocable feed cylinder and piston elements in offset relation with respect to said hammer motor, valve means for connecting either end of said feed cylinder element with a source of pressure fluid supply while the other end thereof is connected to exhaust, and valve means arranged within said feed piston element for controlling the supply of pressure fluid from said feed cylinder element to said hammer motor, said last mentioned valve means closing off the exhaust side of the feed cylinder element from the hammer motor while the live pressure side of the feed cylinder element is connected to the hammer motor.

15. In a punch mechanism, a support having a guide, a hammer mechanism slidable on said guide and comprising a pressure fluid actuated hammer motor for delivering impact blows to a punch pin, reversible feeding means for said hammer mechanism distinct from said guide for feeding said hammer mechanism forwardly and rearwardly on its guide to effect movement of the punch pin into and out of a drill steel bore, said feeding means including relatively reciprocable pressure fluid actuated cylinder and piston elements, valve means for controlling the supply of pressure fluid to the opposite ends of the feed cylinder element, and valve means associated with the feed piston element for controlling the supply of pressure fluid to said hammer motor, the pressure fluid flowing from the feed cylinder element under the control of said last mentioned valve means to said hammer motor.

16. In a punch mechanism, a support having a guide, a hammer mechanism slidable on said guide comprising a pressure fluid actuated hammer motor for percussively actuating a punch pin, reversible means distinct from said guide

for feeding said hammer mechanism forwardly and rearwardly on its guide to effect movement of the punch pin into and out of a drill steel bore, said feeding means comprising relatively reciprocable pressure fluid actuated feed cylinder and piston elements, valve means for supplying pressure fluid to the opposite ends of said feed cylinder element, and valve means associated with said feed piston element for controlling a supply of pressure fluid from the feed cylinder element to said hammer motor, said hammer motor when said feed piston element is moving in one direction receiving pressure fluid from one end of said feed cylinder element and when said feed piston element is moving in the opposite direction receiving pressure fluid from the opposite end of said feed cylinder element.

17. In a punch mechanism, a support having a guideway, a pressure fluid actuated hammer motor slidably mounted on said guideway for percussively actuating a punch pin, reversible pressure fluid actuated feeding means distinct from said support guideway for feeding said hammer motor forwardly and rearwardly to effect movement of the punch pin into and out of a drill steel bore including relatively reciprocable feed cylinder and piston elements, valve means for connecting either end of said feed cylinder element with a source of pressure fluid supply while the other end thereof is connected to exhaust, and valve means arranged within said feed piston element for controlling the supply of pressure fluid from said feed cylinder element to said hammer motor.

18. In a punch mechanism, a support having a guideway, a pressure fluid actuated hammer motor slidably mounted on said guideway for percussively actuating a punch pin, reversible pressure fluid actuated feeding means distinct from said support guideway for feeding said hammer motor forwardly and rearwardly to effect movement of the punch pin into and out of a drill steel bore including relatively reciprocable feed cylinder and piston elements, valve means for connecting either end of said feed cylinder element with a source of pressure fluid supply while the other end thereof is connected to exhaust, and valve means arranged within said feed piston element for controlling the supply of pressure fluid from said feed cylinder element to said hammer motor, said last mentioned valve means closing off the exhaust side of the feed cylinder element from the hammer motor while the live pressure side of the feed cylinder element is connected to the hammer motor.

19. In a punching mechanism, a guide, a hammer mechanism slidable on said guide, means for feeding said hammer mechanism forwardly and rearwardly along said guide, means for automatically reversing the direction of feed when said hammer mechanism has been fed in one direction a predetermined distance, and associated means for varying the distance of travel of said hammer mechanism.

20. In a punch mechanism, in combination, a pressure fluid actuated hammer mechanism for percussively actuating a punch pin, a pressure fluid actuated reversible feeding motor arranged in parallel offset relation with the hammer mechanism for feeding the latter forwardly to drive the punch pin into the work and rearwardly to release the punch pin from the work, said feeding motor having a motor chamber containing a movable motor element, means for supplying pressure fluid to the motor chamber of said feeding motor to effect operation thereof in either direction, and means for supplying pressure fluid from the active, feeding-force-exerting portion of the motor chamber of said feeding motor to said hammer mechanism to effect operation of the latter during either direction of feed.

21. In a punch mechanism, in combination, a pressure fluid actuated hammer mechanism for percussively actuating a punch pin, a pressure fluid actuated reversible feeding motor for feeding the hammer mechanism forwardly to drive the punch pin into the work and rearwardly to release the punch pin from the work, said motor having a motor chamber containing a movable motor element, means for supplying pressure fluid to the motor chamber of said feeding motor to effect operation thereof in either direction, and means for supplying pressure fluid from the motor chamber of said feeding motor to said hammer mechanism to effect operation of the latter during either direction of feed, said pressure fluid supply means including a reversing valve for supplying pressure fluid to said hammer mechanism from the rearward end of the feeding motor and for cutting off communication of the hammer mechanism with the forward end of the feeding motor during forward feed and vice versa.

22. In a punch mechanism, in combination, a pressure fluid actuated hammer mechanism for percussively actuating a punch pin, a pressure fluid actuated reversible feeding motor for feeding the hammer mechanism forwardly to drive the punch pin into the work and rearwardly to release the punch pin from the work, said feeding motor having a motor chamber containing a movable motor element, means for supplying pressure fluid to the motor chamber of said feeding motor to effect operation thereof in either direction, and means for supplying pressure fluid from the motor chamber of said feeding motor to said hammer mechanism to effect operation of the latter during either direction of feed and including a reversing valve for cutting off communication of the hammer mechanism with the forward end of the feeding motor during forward feed and vice versa, said reversing valve controlled at least in part by the pressure of the fluid in the feeding motor.

23. In a punch mechanism, in combination, a pressure fluid actuated hammer mechanism for percussively actuating a punch pin, a pressure fluid actuated reversible feeding motor for feeding the hammer mechanism forwardly to drive the punch pin into the work and rearwardly to release the punch pin from the work, said feeding motor having a motor chamber containing a movable motor element, means for supplying pressure fluid to the motor chamber of said feeding motor to effect operation thereof in either direction, means for supplying pressure fluid from the motor chamber of said feeding motor to said hammer mechanism to effect operation of the latter during either direction of feed and including a reversing valve means for cutting off communication of the hammer mechanism with the forward end of the feeding motor during forward feed and vice versa, said reversing valve means controlled at least in part by the pressure of the fluid in the feeding motor, and mechanical means for positively shifting the connections effected by said valve means as said hammer mechanism assumes a predetermined position.

24. In a punch mechanism, in combination, a

support providing a guideway, a pressure fluid actuated hammer mechanism mounted on said guideway to move longitudinally therealong for percussively actuating a punch pin, a pressure fluid actuated reversible feeding motor for feeding the hammer mechanism either forwardly or rearwardly along said guideway to effect movement of the punch pin into or out of the work, a reversing valve for said feeding motor, an abutment movable with said hammer mechanism, valve operating means engageable with said abutment for effecting shifting of said valve to reverse the direction of feed when the punch pin has been driven into the work a predetermined distance, a valve for controlling the supply of pressure fluid to said hammer mechanism, a stop on said support, and controlling means for said last mentioned valve engageable with said stop for effecting the cutting off of the flow of pressure fluid to said hammer mechanism when said feeding means assumes a position near the end of its reverse feed.

25. In a punch mechanism, in combination, a pressure fluid actuated hammer mechanism for percussively actuating a punch pin, a pressure fluid actuated reversible feeding motor arranged in parallelism with the hammer mechanism for feeding the latter forwardly to drive the punch pin into the work and rearwardly to release the punch pin from the work and comprising a cylinder having a bore containing a reciprocable feed piston having its piston rod connected to the hammer mechanism, means for supplying pressure fluid to said feed cylinder to effect operation of the feed piston in either direction, and means for supplying pressure fluid from said feed cylinder of said feeding motor to said hammer mechanism to effect operation of the latter during either direction of feed including supply passage means formed in said piston rod and communicable with the cylinder bore.

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