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3,035,548

HYDRAULICALLY OPERATED PERCUSSION DEVICES

Filed Nov. 24, 1959

2 Sheets-Sheet 1

FIG. 1

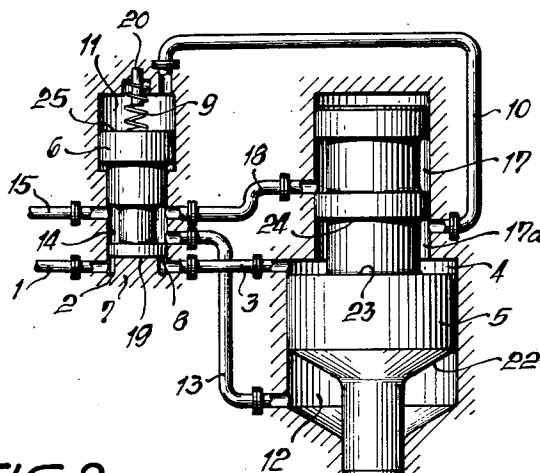
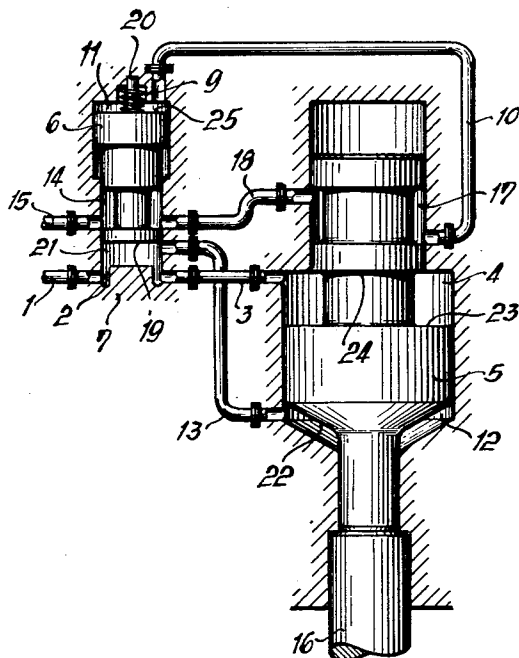


FIG. 2



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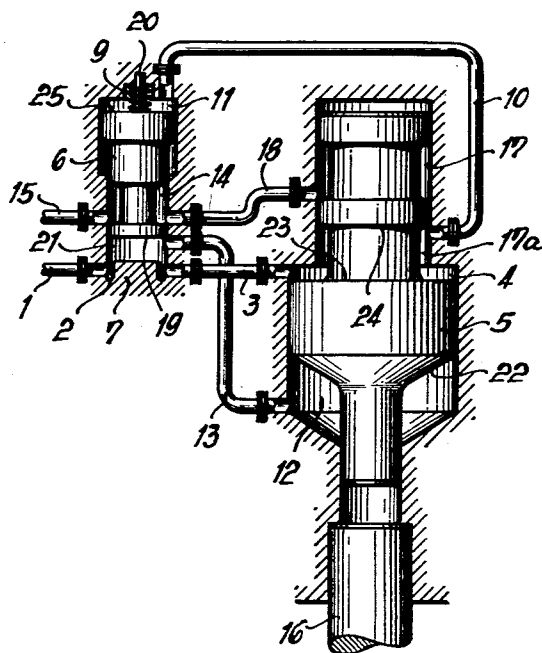
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2 Sheets-Sheet 2

FIG. 3



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HYDRAULICALLY OPERATED PERCUSSION DEVICES

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This invention relates to a control system for a hydraulically operated percussion device of the kind wherein the percussion piston acts on a tool of the push-in type, which is guided preferably loosely and longitudinally slidably in the device, and wherein the reversal of the percussion piston is effected by means of a pressure medium, the action of which on the front and rear cylinder chamber of the percussion cylinder accommodating the percussion piston is controlled indirectly by said percussion piston by way of a control slide valve. In percussion devices of this kind, the fact that the hydraulic reversal of the percussion piston occurs at points of the piston travel which are fixed and generally not variable, constitutes a problem. Since the push-in tool is guided to be loosely slidable in the guide bush of the percussion device in such manner that it constantly reciprocates or swings to and fro between the rear and front guide limiting means during the percussion work, this type of control system has the disadvantage that the percussion piston, which as a rule operates at high speed, is frequently already reversed before it has been able to deliver its full energy to the push-in tool. The resulting loss in percussion work is considerable and has led to preference being given in practice generally to pneumatically operated percussion tools which, although they operate with a considerably lower efficiency than hydraulically operating percussion devices, nevertheless have the property that the percussion piston transmits its kinetic energy to the push-in tool even after the reversal into the return stroke.

The object of the invention is to obviate the aforesaid disadvantages of control systems for hydraulically operating percussion devices, and to improve the same in such manner that the percussion piston is reversed into the return stroke independently of the respective position of the push-in tool, only when the said piston has delivered its energy to the push-in tool.

In this way, the invention renders it possible for the first time to make profitable use of the per se known advantages of hydraulic operation, namely its much more favourable efficiency in comparison with pneumatic drives and its greater economy for such percussion tools, in which the former hydraulic control systems were not advantageous, with regard to the use of a push-in type of tool, which is inserted only loosely in the guide bush and which is guided in the latter so as to be slidable.

To solve this problem, the control system according to the invention consists in that the reversal of the percussion piston into the return stroke occurs only after it has struck the push-in tool, in consequence of the fact that the resultant momentary pressure rise occurring in the rear cylinder chamber moves the control slide valve into the position in which the front cylinder chamber of the percussion cylinder is subjected to the action of the pressure medium.

According to one essential feature of the invention, the percussion piston surface effecting the percussion stroke and subjected constantly to the action of pressure medium both during the percussion stroke and during the

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return stroke is smaller than the piston surface effecting the return stroke, the rear cylinder chamber in both opposite end positions of the control slide valve being subjected to the action of pressure medium, for example oil or water, while the front cylinder chamber is subjected to the action of pressure medium in one end position of the control slide valve initiating the return stroke and is vented in the opposite end position of the control slide valve initiating the percussion stroke. According to one advantageous embodiment of the invention, during the percussion stroke the control slide is held in its end position by a restoring element, for example a spring, against the pressure of the pressure medium acting on only a part of its piston surface. As a result of the pressure rise occurring in the rear cylinder chamber of the percussion cylinder when the percussion piston strikes against the push-in tool, it can, however, be lifted off the seat surface of its end stop on the percussion stroke side, and can be moved, by the pressure medium acting in these circumstances on its entire piston surface, into the opposite end position initiating the return stroke, and be held fast there until the return stroke of the percussion piston is completed.

The return of the control slide valve into the end position initiating the percussion stroke after the completion of the return stroke is effected in these circumstances by additional action of the pressure medium, which action is advantageously controlled by the percussion piston itself on the completion of the return stroke.

According to a further essential feature of the invention, the control slide valve is constructed as a differential piston, the piston surface subject to the action of the restoring element, for example a spring, being dimensioned to be larger than the piston surface situated opposite this.

According to one advantageous embodiment of the invention, the end face of the control cylinder situated opposite the restoring element is formed with an annular passage which is open towards the cylinder and which coaxially surrounds the stop and which is connected on the one hand to the pressure medium supply line and on the other hand to the pressure medium line leading to the cylinder chamber of the percussion cylinder. In these circumstances, the arrangement may be such that the control slide valve in its end position initiating the return stroke of the percussion piston frees, not only the pressure medium line leading to the rear cylinder chamber of the percussion cylinder, but in addition the pressure medium line leading to the front cylinder chamber.

In order to prevent the reversal and continued operation of the percussion piston by means of the stop at the front cylinder surface if no tool has been inserted into the percussion device, it may be advantageous to allow the pressure medium line leading to the front cylinder chamber of the percussion cylinder to lead into the cylinder chamber at a point which is covered by the percussion piston itself in its front end position, with the result that the percussion device comes to rest.

For the alternate admission of pressure medium to and venting of the control slide valve cylinder chamber accommodating the restoring element, an auxiliary control element which advantageously comprises one piece with the percussion piston may be associated with the latter in the region of a rear shouldered cylinder chamber. In these circumstances it is possible for the control cylinder chamber accommodating the restoring element to be subjected to the action of pressure medium by means of the auxiliary control element by way of the control cylinder

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chamber situated opposite the restoring element and subsequently by way of the rear chamber of the percussion cylinder. Venting of this chamber of the control cylinder is then effected by means of the auxiliary control member associated with the percussion piston, during the percussion stroke, but before the control slide valve is reversed into the opposite end position initiating the return stroke of the percussion piston on the striking of the latter against the push-in tool and the resulting pressure rise in the rear cylinder chamber of the percussion cylinder.

The invention can be profitably applied to all hydraulic percussion devices, especially manually operated, in which use is made of a loosely inserted push-in tool, for example percussion chisels, ripping hammers, coal picks or riveting hammers, and percussion drilling tools, the latter also including the type wherein the push-in drill is turned continuously or intermittently during the percussion work. In the latter case, the invention offers the possibility that the pressure medium displaced from the rear cylinder chamber during the return stroke of the percussion piston can be used to operate a rotary drive associated with the push-in tool.

The control system according to the invention is illustrated diagrammatically in the drawing, wherein:

FIG. 1 shows the percussion piston and the control slide valve at the beginning of the percussion stroke;

FIG. 2 shows the positions of the percussion piston and control slide valve immediately after completion of the percussion stroke and

FIG. 3 shows the positions of the percussion piston and of the control slide valve at the end of the return stroke, but before the reversal of the control slide valve into the end position initiating the percussion stroke.

The percussion piston is denoted by reference 5, the control slide valve by reference 6 and the push-in tool guided to be loosely slidable in the guide bush of the percussion device is denoted by reference 16. Reference 1 denotes the supply line for the pressure medium and 15 the return line, while 3, 10, 13 and 18 denote the various connecting lines between the percussion cylinder and the control cylinder.

The mode of operation of the percussion device is as follows:

In the position shown in FIG. 1, the pressure fluid is taken through the supply line 1, the annular passage 2 provided at the end of the control cylinder, and the connecting line 3 likewise connected to said passage, to the rear (upper, in the drawing) cylinder chamber 4 of the percussion cylinder, so that the percussion piston 5 is pushed forward in the direction of the percussion stroke by way of its rear annular piston surface. At the same time, the pressure fluid is taken through the chamber 17 of the auxiliary control element associated with the percussion piston at the rear end, and through the connecting line 10, into the rear (upper, in the drawing) cylinder chamber 11 of the control cylinder, although the spring 9 provided in this chamber and acting against the control slide valve is so dimensioned that it holds the control slide fast on the seat surface of the stop 7 against the normal fluid pressure acting in the region of the annulus 2 on the reduced annular piston surface 8 of the control slide valve.

The percussion piston 5 moving in the forward direction during the percussion stroke delivers the pressure fluid situated in the front cylinder chamber 12 in a substantially pressureless state through the connecting line 13 and the chamber 14 of the control slide valve into the return line 15.

Before the percussion piston 5 meets the rear end face of the push-in tool, the auxiliary control element associated with the same at the rear end connects the connecting line 10 by way of its chamber 17 to the line 18, which by way of the chamber 14 of the control slide valve likewise leads into the return line 15. In spite of the

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venting of the rear control slide chamber 1 the spring 9 holds the control slide valve fast unchanged on the seat surface of the stop 7, until an instantaneous pressure rise occurs abruptly in the rear cylinder chamber 4 of the percussion cylinder at the moment when the percussion piston strikes the rear end face of the push-in tool 16, and in consequence, the control slide valve is lifted off its seat surface against the action of the spring 9 and—after pressure equalisation has taken place—in consequence of the normal fluid pressure now acting on the entire lower piston surface 19 it is pushed into and held in the upper end position.

During the return movement of the control slide valve 6, the latter slides the pressure fluid, which has become pressure-less, out of the rear cylinder chamber 11 through the connecting line 10, the chamber 17 of the auxiliary control element, and the line 18, into the return line 15, until said control slide 6 bears against the stop pin 20. As will be apparent from FIG. 2 which illustrates this position of the control slide 6, during its return movement, the control slide 6 simultaneously frees the entry of the connecting line 13 into the front cylinder chamber 21 of the control cylinder, so that the pressure fluid now passes by way of the line 13 into the front cylinder chamber 12 of the percussion cylinder. In consequence of the difference between the piston surfaces 22 and 23 of the percussion piston 5, which are now both subjected to the action of the pressure fluid, said piston is moved back in the direction of the return stroke. The pressure medium situated in the rear chamber 4 of the percussion cylinder is displaced in the first instance during the return stroke by way of the connecting line 3 into the front cylinder chamber of the control cylinder 21, being used either by way of the connecting line 13 to fill the larger front cylinder chamber 12 of the percussion cylinder or, if required, advantageously to operate a rotary drive for the push-in tool 16.

Before completion of the return stroke, the percussion piston 5 frees the opening of the connecting line 10 by the slide valve surface 24 of its auxiliary control element, so that the rear cylinder chamber 4 of the percussion cylinder is connected to the rear cylinder chamber 11 of the control cylinder. The pressure medium penetrating in this way into the rear chamber 11 of the control cylinder immediately acts on the rear piston surface 25 which is kept free of the stop pin 20 and which is dimensioned to be larger than the opposite piston surface 19 of the control slide valve 6, so that the reversal of the control slide valve takes place at the same time under the action of the tensioned spring 9, until said slide valve presses against the stop 7 under the action of the pressure medium flowing in from the cylinder chamber 4 by way of the line 10. FIG. 3 illustrates the beginning of this phase, while the end of this phase, in which the control slide valve bears against the stop surface 7 and a new percussion stroke is initiated, is illustrated in FIG. 1.

This cycle is repeated for as often and as long as there is a flow of pressure fluid through the line 1 assuming that the push-in tool 16 has been inserted in the guide bush of the percussion device. If the tool has not been inserted, the percussion piston is pushed into the front end position limited by the cylinder end wall, in which case it covers the connecting line 13 discharging laterally into the front cylinder chamber 12 and thus comes to rest.

I claim:

1. Control arrangement for a fluid pressure operated percussion device, comprising, in combination, a first cylinder and a tool piston slidable in said first cylinder; a second cylinder and a percussion piston slidable in said second cylinder and defining in the same a front chamber and a rear chamber, said percussion piston being arranged to act on said tool piston during forward movement in said second cylinder; conduit means including an inlet conduit for a pressure fluid, an outlet conduit,

and conduits opening at the rear and front ends of said second cylinder in said rear chamber and said front chamber; and a valve means in said conduit means and having a pressure chamber communicating with said inlet conduit, said valve means including a movable valve member with a pressure face in said pressure chamber and being normally in a first position in which said rear chamber is connected through said pressure chamber to said inlet conduit, said valve member having a second position in which said pressure chamber is connected to said front chamber so that when said percussion piston engages said tool piston and the pressure in said rear chamber increases, the pressure in said pressure chamber is correspondingly increased to move said valve member to said second position so that pressure fluid enters said front chamber and said percussion piston performs a return stroke, the effective area of said pressure face of said valve member being greater in said second position than in said first position of said valve member so that the pressure of said inlet conduit acting in said pressure chamber on said pressure face is sufficient to hold said valve member in said second position until the return stroke of the percussion piston is completed.

2. Control arrangement for a fluid pressure operated percussion device, comprising, in combination, a first cylinder and a tool piston slidable in said first cylinder; a second cylinder and a percussion piston slidable in said second cylinder and defining in the same a front chamber and a rear chamber, said percussion piston having a smaller effective rear face in said rear chamber and a greater effective front face in said front chamber, said percussion piston being arranged to act on said tool piston during forward movement in said second cylinder; conduit means including an inlet conduit for a pressure fluid, an outlet conduit, and conduits opening at the rear and front ends of said second cylinder in said rear chamber and said front chamber; and a valve means in said conduit means and having a pressure chamber communicating with said inlet conduit, said valve means including a movable valve member with a pressure face in said pressure chamber and being normally in a first position in which said rear chamber is connected through said pressure to said inlet conduit and said front chamber is connected to said discharge conduit, said valve member having a second position in which said pressure chamber and said inlet conduit are connected to said front chamber and to said rear chamber, and said front and rear chambers are disconnected from said discharge conduit so that when said percussion piston engages said tool piston and the pressure in said rear chamber increases, the pressure in said pressure chamber is correspondingly increased to move said valve member to said second position so that pressure fluid enters said front chamber and said percussion piston performs a return stroke, the effective area of said pressure face of said valve member being greater in said second position than in said first position of said valve member so that the pressure of said inlet conduit acting in said pressure chamber on said pressure face is sufficient to hold said valve member in said second position until the return stroke of the percussion piston is completed.

3. Control arrangement for a fluid pressure operated percussion device, comprising, in combination, a first cylinder and a tool piston slidable in said first cylinder; a second cylinder and a percussion piston slidable in said second cylinder and defining in the same a front chamber and a rear chamber, said percussion piston being arranged to act on said tool piston during forward movement in said second cylinder; conduit means including an inlet conduit for a pressure fluid, an outlet conduit, and conduits opening at the rear and front ends of said second cylinder in said rear chamber and said front chamber; and a valve means in said conduit means and having a pressure chamber communicating with said inlet conduit, said valve means including a movable valve member with a pressure

face in said pressure chamber and biasing means for normally holding said valve member in a first position in which said rear chamber is connected through said pressure chamber to said inlet conduit, said valve member having a second position in which said pressure chamber is connected to said front chamber so that when said percussion piston engages said tool piston and the pressure in said rear chamber increases, the pressure in said pressure chamber is correspondingly increased to move said valve member to said second position so that pressure fluid enters said front chamber and said percussion piston performs a return stroke, the effective area of said pressure face of said valve member being greater in said second position than in said first position of said valve member so that the pressure of said inlet conduit acting in said pressure chamber on said pressure face is sufficient to hold said valve member in said second position until the return stroke of the percussion piston is completed.

4. Control arrangement for a fluid pressure operated percussion device, comprising, in combination, a first cylinder and a tool piston slidable in said first cylinder; a second cylinder and a percussion piston slidable in said second cylinder and defining in the same a front chamber and a rear chamber, said percussion piston having a smaller effective rear face in said rear chamber and a greater effective front face in said front chamber, said percussion piston being arranged to act on said tool piston during forward movement in said second cylinder; conduit means including an inlet conduit for a pressure fluid, an outlet conduit, and conduits opening at the rear and front ends of said second cylinder in said rear chamber and said front chamber; and a valve means in said conduit means and having a pressure chamber communicating with said inlet conduit, said valve means including a movable valve member with a pressure face in said pressure chamber and biasing means for normally holding said valve member in a first position in which said rear chamber is connected through said pressure chamber to said inlet conduit and said front chamber is connected to said discharge conduit, said valve member having a second position in which said pressure chamber and said inlet conduit are connected to said front chamber and to said rear chamber, and said front and rear chambers are disconnected from said discharge conduit so that when said percussion piston engages said tool piston and the pressure in said rear chamber increases, the pressure in said pressure chamber is correspondingly increased to move said valve member to said second position so that pressure fluid enters said front chamber and said percussion piston performs a return stroke, the effective area of said pressure face of said valve member being greater in said second position than in said first position of said valve member so that the pressure of said inlet conduit acting in said pressure chamber on said pressure face is sufficient to hold said valve member in said second position until the return stroke of the percussion piston is completed.

5. Control arrangement for a fluid pressure operated percussion device, comprising, in combination, a first cylinder and a tool piston slidable in said first cylinder; a second cylinder and a percussion piston slidable in said second cylinder and defining in the same a front chamber and a rear chamber, said percussion piston being arranged to act on said tool piston during forward movement in said second cylinder; conduit means including an inlet conduit for a pressure fluid, an outlet conduit, and conduits opening at the rear and front ends of said second cylinder in said rear chamber and said front chamber; a valve means in said conduit means and having a pressure chamber communicating with said inlet conduit, said valve means including a movable valve member with a pressure face in said pressure chamber and biasing means for normally holding said valve member in a first position in which said rear chamber is connected through said pressure chamber to said inlet conduit, said valve member having a second position in which said pressure chamber

is connected to said front chamber so that when said percussion piston engages said tool piston and the pressure in said rear chamber increases, the pressure in said pressure chamber is correspondingly increased to move said valve member to said second position so that pressure fluid enters said front chamber and said percussion piston performs a return stroke, the effective area of said pressure face of said valve member being greater in said second position than in said first position of said valve member so that the pressure of said inlet conduit acting in said pressure chamber on said pressure face is sufficient to hold said valve member in said second position until the return stroke of the percussion piston is completed; and auxiliary valve means in said conduit means operatively connected to said percussion piston and actuated by the same at the end of the return stroke to connect said rear chamber with said valve means for shifting said valve member from said second position to said first position so that another forward stroke of said percussion piston is initiated.

6. Control arrangement for a fluid pressure operated percussion device, comprising, in combination, a first cylinder and a tool piston slidable in said first cylinder; a second cylinder and a percussion piston slidable in said second cylinder and defining in the same a front chamber and a rear chamber, said percussion piston having a smaller effective rear face in said rear chamber and a greater effective front face in said front chamber, said percussion piston being arranged to act on said tool piston during forward movement in said second cylinder; conduit means including an inlet conduit for a pressure fluid, an outlet conduit, and conduits opening at the rear and front ends of said second cylinder in said rear chamber and said front chamber; a valve means in said conduit means and having a pressure chamber communicating with said inlet conduit, said valve means including a movable valve member with a pressure face in said pressure chamber and biasing means for normally holding said valve member in a first position in which said rear chamber is connected through said pressure chamber to said inlet conduit and said front chamber is connected to said discharge conduit, said valve member having a second position in which said pressure chamber and said inlet conduit are connected to said front chamber and to said rear chamber, and said front and rear chambers are disconnected from said discharge conduit so that when said percussion piston engages said tool piston and the pressure in said rear chamber increases, the pressure in said pressure chamber is correspondingly increased to move said valve member to said second position so that pressure fluid enters said front chamber and said percussion piston performs a return stroke, the effective area of said pressure face of said valve member being greater in said second position than in said first position of said valve member so that the pressure of said inlet conduit acting in said pressure chamber on said pressure face is sufficient to hold said valve member in said second position until the return stroke of the percussion piston is completed; and auxiliary valve means in said conduit means operatively connected to said percussion piston and actuated by the same at the end of the return stroke to connect said rear chamber with said valve means for shifting said valve member from said second position to said first position so that another forward stroke of said percussion piston is initiated.

7. An arrangement as set forth in claim 6 wherein said valve member is a differential piston.

8. An arrangement as set forth in claim 6 wherein said pressure face of said valve member abuts in said first position a central stop so that the effective area of said pressure face in said first position is annular, said pressure face being spaced from said stop in said second position so that the entire area of said pressure face is effective.

9. A fluid pressure operated percussion device comprising a percussion tool slidable in a cylinder; a percussion piston slidable in a cylinder and arranged to act on

said percussion tool; a control piston slidable in a control cylinder; first conduit means extending between a source of pressure fluid and said control cylinder; second conduit means extending between said control cylinder and the rear face of the percussion piston, means operatively connected to said control piston for urging the same to move forwardly into a first position in which it permits communication between said first and second conduits only, the pressure fluid acting only on a part of the front face of said control piston; third conduit means extending between said control cylinder and the front face of said percussion piston; and the arrangement being such that the engagement of said percussion piston with said percussion tool, as a result of the delivery of pressure fluid to the rear face of said percussion piston by way of said first conduit, control cylinder and second conduit, causes a sudden increase in pressure in the control cylinder, which results in the movement of the control piston into a second position in which the pressure fluid acts on an area of said front face which is greater than said part of said front face on which said pressure fluid acts in said first position so that the normal pressure of said first conduit means moves said control piston to a third position in which said control piston permits communication between the said first, second and third conduits, pressure fluid consequently being delivered through said third conduit to the front face of the percussion piston so as to effect the reversal of the latter into its return stroke.

10. A fluid pressure operated percussion device comprising a percussion tool slidable in a cylinder; a percussion piston slidable in a cylinder and arranged to act on said percussion tool; a control piston slidable in a control cylinder; first conduit means extending between a source of pressure fluid and said control cylinder; second conduit means extending between said control cylinder and the rear face of the percussion piston, means operatively connected to said control piston for urging the same to move forwardly into a first position in which it permits communication between said first and second conduits only, the pressure fluid acting only on a part of the front face of said control piston; third conduit means extending between said control cylinder and the front face of said percussion piston; and the arrangement being such that the engagement of said percussion piston with said percussion tool, as a result of the delivery of pressure fluid to the rear face of said percussion piston by way of said first conduit, control cylinder and second conduit, causes a sudden increase in pressure in the control cylinder, which results in the movement of the control piston into a second position in which the pressure fluid acts on an area of said front face which is greater than said part of said front face on which said pressure fluid acts in said first position so that the normal pressure of said first conduit means moves said control piston to a third position in which said control piston permits communication between the said first, second and third conduits, pressure fluid consequently being delivered through said third conduit to the front face of the percussion piston so as to effect the reversal of the latter into its return stroke, said front face of said percussion piston having a larger area than the rear face of said percussion piston.

11. A device as claimed in claim 10, wherein the said third conduit leads into the front chamber of the percussion cylinder at a point which becomes covered by the percussion piston should there be no premature reversal of the latter, so as to stop the device in such circumstances.

12. Control arrangement for a fluid pressure operated percussion device, comprising, in combination, a first cylinder and a tool piston slidable in said first cylinder; a second cylinder and a percussion piston slidable in said second cylinder and defining in the same a front chamber and a rear chamber, said percussion piston being arranged to act on said tool piston during forward movement in said second cylinder; conduit means including an inlet conduit for a pressure fluid, an outlet conduit, and

conduits opening at the rear and front ends of said second cylinder in said rear chamber and said front chamber; and a valve means in said conduit means and having a pressure chamber communicating with said inlet conduit, said valve means including a movable valve member with a pressure face in said pressure chamber, said valve member having first and second positions in which said rear chamber is connected through said pressure chamber to said inlet conduit, and a third position in which said pressure chamber is connected to said front chamber, said valve means and said valve member being arranged and constructed in such a manner that the normal pressure provided by said inlet conduit is insufficient to move said valve member from said first to said second position, but is sufficient to move said valve member from said second position to said third position so that said valve member remains in said first position during forward stroke of said percussion piston until the same engages said tool piston and the pressure in said rear chamber and in said pressure chamber is suddenly increased, said increased pressure moving said valve member to said second position whereupon the normal pressure in said pressure chamber moves said valve member to said third position so that pressure fluid enters said front chamber and said percussion piston performs a rearward stroke.

13. Control arrangement for a fluid pressure operated percussion device, comprising, in combination, a first cylinder and a tool piston slidable in said first cylinder; a second cylinder and a percussion piston slidable in said second cylinder and defining in the same a front chamber and a rear chamber, said percussion piston being arranged to act on said tool piston during forward movement in said second cylinder; conduit means including an inlet conduit for a pressure fluid, an outlet conduit, and conduits opening at the rear and front ends of said second cylinder in said rear chamber and said front chamber; and a valve means in said conduit means and having a pressure chamber communicating with said inlet conduit, said valve means including a movable valve member with a pressure face in said pressure chamber, said valve member having first and second positions in which said rear chamber is connected through said pressure chamber to said inlet conduit, and a third position in which said pressure chamber is connected to said front chamber, the effective area of said pressure face of said valve member being greater in said second and third positions than in said first position of said valve member so that the normal pressure provided by said inlet conduit is insufficient to move said valve member from said first to said second position, but is sufficient to move said valve member from said second position to said third position so that said valve member remains in said first position during forward stroke of said percussion piston until the same engages said tool piston and the pressure in said rear chamber and in said pressure chamber is suddenly increased, said increased pressure moving said valve member to said second position whereupon the normal pressure in said pressure chamber moves said valve member to said third position so that pressure fluid enters said front chamber and said percussion piston performs a rearward stroke.

14. Control arrangement for a fluid pressure operated percussion device, comprising, in combination, a first cylinder and a tool piston slidable in said first cylinder; a second cylinder and a percussion piston slidable in said second cylinder and defining in the same a front chamber and a rear chamber, said percussion piston being arranged to act on said tool piston during forward movement in said second cylinder; conduit means including an inlet conduit for a pressure fluid, an outlet conduit, and conduits opening at the rear and front ends of said second cylinder in said rear chamber and said front chamber; a valve means in said conduit means and having a pressure chamber communicating with said inlet conduit, said valve means including a movable valve member with a pressure face in said pressure chamber, said valve

member having first and second positions in which said rear chamber is connected through said pressure chamber to said inlet conduit, and a third position in which said pressure chamber is connected to said front chamber, said valve means and said valve member being arranged and constructed in such a manner that the normal pressure provided by said inlet conduit is insufficient to move said valve member from said first to said second position, but is sufficient to move said valve member from said second position to said third position so that said valve member remains in said first position during forward stroke of said percussion piston until the same engages said tool piston and the pressure in said rear chamber and in said pressure chamber is suddenly increased, said increased pressure moving said valve member to said second position whereupon the normal pressure in said pressure chamber moves said valve member to said third position so that pressure fluid enters said front chamber and said percussion piston performs a rearward stroke; and auxiliary valve means in said conduit means operatively connected to said percussion piston and actuated by the same at the end of the rearward stroke to connect said rear chamber with said valve means for shifting said valve member from said third position to said first position so that another forward stroke of said percussion piston is initiated.

15. A fluid pressure operated percussion device comprising a percussion tool slidable in a cylinder; a percussion piston slidable in a cylinder and arranged to act on said percussion tool; a control piston slidable in a control cylinder; first conduit means extending between a source of pressure fluid and said control cylinder; second conduit means extending between said control cylinder and the rear face of the percussion piston, biasing means operatively connected to said control piston for urging the same to move forwardly into a first position in which it permits communication between said first and second conduits only, the pressure fluid acting only on a part of the front face of said control piston; third conduit means extending between said control cylinder and the front face of said percussion piston; the arrangement being such that the engagement of said percussion piston with said percussion tool, as a result of the delivery of pressure fluid to the rear face of said percussion piston by way of said first conduit, control cylinder and second conduit, causes a sudden increase in pressure in the control cylinder, which results in the movement of the control piston into a second position in which it permits communication between the said first, second and third conduits, pressure fluid consequently being delivered through said third conduit to the front face of the percussion piston so as to effect the reversal of the latter into its return stroke, said front face of said percussion piston having a larger area than the rear face of said percussion piston; and an auxiliary control element adapted to slide in a cylinder and operatively connected to said percussion piston for movement with the same, said auxiliary control element acting to control the alternate action of the pressure fluid and the venting of the control cylinder.

16. A device as claimed in claim 15, wherein the control cylinder chamber housing the said biasing means is subjected to the action of pressure fluid by means of the said auxiliary control element by way of the control cylinder chamber situated remote from the restoring element and by way of the rear cylinder chamber of the percussion cylinder.

17. A device as claimed in claim 16, wherein the venting of the control cylinder chamber housing the said biasing means is effected by the auxiliary control element associated with the percussion piston, during the percussion stroke but before the control piston is reversed into its said second position, the said reversal being effected by the pressure rise in the rear percussion cylinder chamber on the completion of the percussion stroke.

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18. A device as claimed in claim 16, wherein, when in its said second position, the control piston bears against a stop pin, its rear piston surface being left free.

19. A device as claimed in claim 15, wherein the said percussion piston and the said auxiliary control element 5 are formed integrally one with the other.

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