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PERCUSSIVE TOOL

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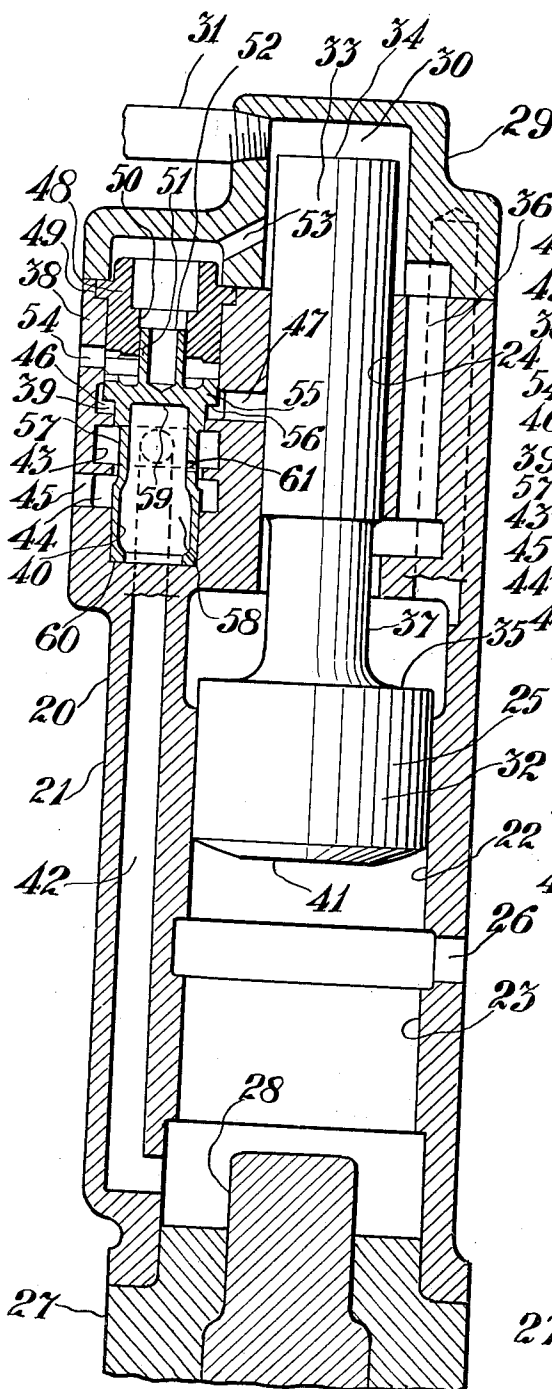


FIG. 1.

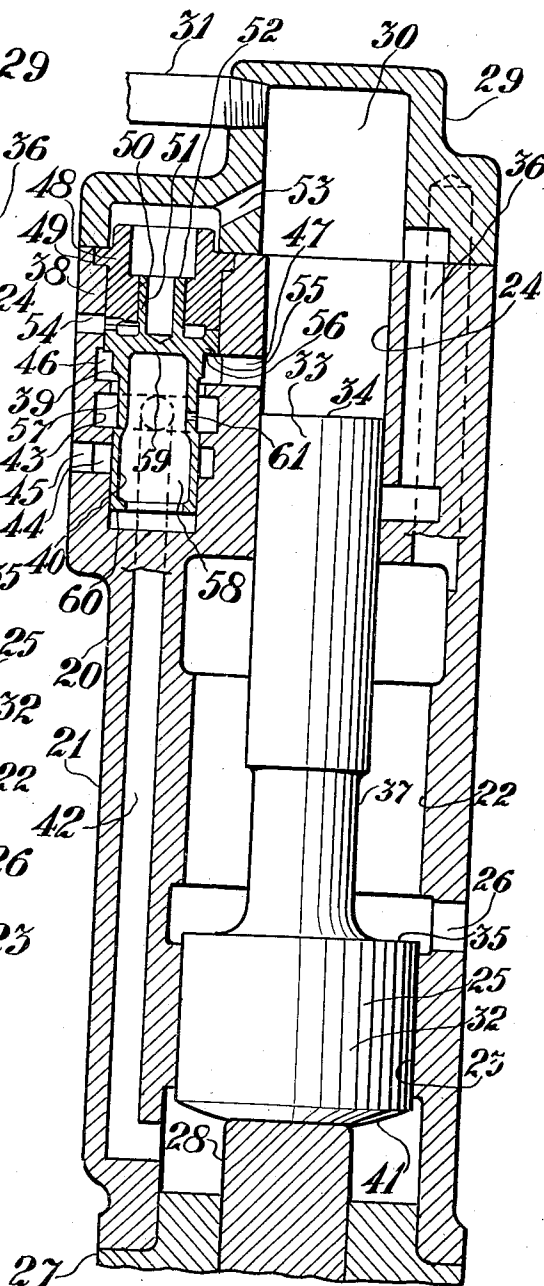


FIG. 2.

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UNITED STATES PATENT OFFICE

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PERCUSSIVE TOOL

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2 Claims. (Cl. 121—18)

This invention relates to percussive tools, and more particularly to fluid actuated percussive tools of the type in which the piston and an auxiliary valve control the admission of pressure fluid to the cylinder for actuating the piston.

One object of the invention is to effect a nicely timed admission of pressure fluid to the cylinder at the end of the working stroke of the piston and thereby make possible the delivery of a heavy blow against the working implement which the percussive tool actuates.

Other objects will be in part obvious and in part pointed out hereinafter.

In the drawing accompanying this specification and in which similar reference numerals refer to similar parts,

Figure 1 is an elevation, in section, of so much of a percussive tool as will serve to illustrate the invention and showing the piston and the valve in limiting positions which they will assume in practice, and

Figure 2 is a view similar to Figure 1 showing the piston and the valve in other limiting positions.

Referring more particularly to the drawing, 25 designates, in general, the percussive tool having a cylinder 21 which is bored to provide a piston chamber 22 comprising a front enlarged portion 23 and a rearward reduced portion 24. The piston chamber contains a reciprocatory hammer piston 25 and the enlarged portion 23 has an atmospheric exhaust port 26 which is controlled by the piston 25.

A closure is provided for the front end of the piston chamber by a front cylinder washer 27 which serves the additional function of a guide for an anvil block 28 disposed slidably therein to transmit the blows of the piston 25 to a working implement (not shown). The rearward end of the cylinder 21 serves as a seat for a back head 29 which forms a closure for the reduced portion 24 of the piston chamber and has a cavity 30 into which pressure fluid is constantly admitted through a conduit 31 connected to the back head.

The piston 25 is of a well known type having a head 32 lying in the enlarged portion 23 and a stem 33 extending into the reduced portion 24 of the piston chamber. The stem 33 is guided only by the portion 24 but during the movements of the piston it extends into the cavity 30, and on the rearward or free end of the stem 33 is a pressure surface 34 which is constantly exposed to pressure fluid tending to move the piston forwardly on its working stroke.

The piston is, however, provided with an addi-

tional actuating surface designated 35 which is located on the rearward end of the head 32 and pressure fluid is intermittently introduced into the rear end of the enlarged portion 23 of the piston chamber to act against the actuating surface 35. Such pressure fluid augments that acting against the pressure surface 34 and is conveyed into the portion 23 by an inlet passage 36 leading from the cavity 30 and opening into the reduced portion 24 of the piston chamber, preferably at a point near the juncture of said portion with the portion 23.

Pressure fluid is constantly present in the passage 36, and on the stem 33, adjacent the head 32, is a neck portion 37 which, when the piston approaches its rearmost limiting position, effects communication between the passage 36 and the portion 23 of the piston chamber.

As will be readily understood from the foregoing description, the forward movement of the piston is effected by the pressure fluid acting against the pressure surface 34 and by pressure fluid valved into the piston chamber by the piston, and in order to effect the rearward actuation of the piston the percussive tool is provided with valve mechanism shown arranged in the same transverse plane as the reduced portion 24 of the piston chamber.

The valve mechanism comprises a valve chest 38 which may be an integral portion of the cylinder 21 and is bored to provide a valve chamber 39 to accommodate a reciprocatory valve 40. The valve controls the admission of pressure fluid to the front end of the piston chamber to act against an actuating surface 41 on the front end of the piston. Such pressure fluid is conveyed to the front end of the enlarged portion 23 of the piston chamber by an inlet passage 42 which opens into an intermediate portion of the valve chamber 39 or, more specifically, into an annular groove 43 in the valve chamber.

A similar groove 44 is formed in the valve chamber forwardly of the groove 43 and is in constant communication with the atmosphere through a vent 45 in the valve chest. Likewise, a groove 46 is formed rearwardly of the groove 43, and communication is afforded between the groove 46 and the piston chamber by a supply passage 47 which opens intermediate the ends of the reduced portion 24 of the piston chamber. The passage 47 is so located that when the piston approaches the anvil block 28 the stem 33 will uncover the passage 47 and admit pressure fluid from the reduced portion 24 of the piston chamber into the groove 46.

The valve chamber 39 extends forwardly of the groove 44 and a closure is provided for its rearward end by a plug 48 extending into the valve chamber. On the periphery of the plug 48 is an annular external flange 49 of which the rearward surface lies flush with the end of the cylinder and provides a seat for a portion of the adjacent surface of the back head which holds the plug 48 in position.

The plug 48 is hollow, having a bore 50 extending therethrough and a portion of the bore 50 acts as a guide for a stem 51 of the valve 40. The rearward end of the stem 51 constitutes a pressure surface 52 which is constantly exposed to pressure fluid flowing through the plug and through a passage 53 in the back head leading from the cavity 30. Preferably a vent 54 is formed in the valve chest immediately adjacent the front end of the plug 48 to provide an escape for any pressure fluid which may leak along the valve, either from the supply passage 47 or the bore 50.

On the portion of the valve adjacent the stem 51 is an external flange 55 of which the front end constitutes an actuating surface 56. The actuating surface 56 is in constant communication with the supply passage 47, and in the periphery of the valve, forwardly of the flange 55, is an annular groove 57 which, in the foremost limiting position of the valve, effects communication between the grooves 43 and 44 and in the rearmost limiting position of the valve communicates the groove 46 with the groove 43.

For the sake of reducing the weight of the valve the portion of the valve lying forwardly of the flange 55 is hollow having a cavity 58 and the end surface 59 of said cavity constitutes a holding surface against which pressure fluid acts intermittently to augment the pressure fluid acting against the actuating surface 56 for holding the valve in its rearmost limiting position. Such pressure fluid, of course, also acts against the front end 60 of the valve and is admitted into the cavity 58 by a port 61 in the wall of the valve and so located that when the valve approaches or lies in position to admit pressure fluid into the inlet passage 42 pressure fluid will also flow into the cavity 58.

The operation of the device, briefly summarized, is as follows: With the piston 25 and the valve 40 in the position shown in Figure 1, and assuming that the cavity 30 is in full communication with the source of pressure fluid supply, pressure fluid will act against the pressure areas 34 and 52 of the piston and the valve, respectively. That acting against the valve will hold it in its foremost limiting position in which the annular groove 57 affords communication between the grooves 43 and 44 so that the front end of the piston chamber will be in open communication with the atmosphere through the inlet passage 42, the grooves 43 and 44 and the vent 45.

In this position of the piston 25 pressure fluid passes from the cavity through the inlet passage 36 along the neck 37 of the piston into the rearmost end of the enlarged portion 23 of the piston chamber where it acts against the actuating surface 35 to augment the pressure fluid acting against the pressure surface 34 for moving the piston forwardly on its working stroke.

When the piston reaches the position to cover the exhaust port 26 the air in advance of the piston is expelled from the piston chamber through the inlet passage 42, the grooves 43 and 44 and the vent 45 so that the blow of the piston

will be uncushioned and the piston will, therefore, strike heavily against the anvil block. However, immediately before the piston delivers its blow the stem 33 uncovers the supply passage 47. Pressure fluid then flows into the groove 46 against the actuating surface 56 and shifts the valve rearwardly to a position in which it cuts off communication between the grooves 43 and 44 and establishes communication through the annular groove 57 between the grooves 46 and 43. Pressure fluid will then flow from the reduced portion 24 of the piston chamber through the inlet passage 42 and into the front end of the piston chamber where it acts against the actuating surface 41 to return the piston to its initial position.

This movement of the piston may be effected expeditiously since the only opposing force is that of the pressure fluid acting against the pressure surface 34 since that previously valved into the rearward end of the portion 23 of the piston chamber will have exhausted to the atmosphere through the exhaust port 26 during the forward stroke of the piston.

Upon shifting of the valve 40 rearwardly a portion of the pressure fluid entering the groove 43 flows through the port 61 and acts against the holding surface 56 and against the front end 60 of the valve to assist in holding the valve immovable in its rearmost limiting position. While the valve is thus held pressure fluid will continue to flow into the front end of the piston chamber until the piston 25 reaches a position in which the stem 33 covers the supply port 47 and cuts off the admission of pressure fluid to the valve chamber. This is accomplished before the front end of the piston uncovers the exhaust port 26 and when the piston uncovers said port the pressure fluid in the front end of the piston chamber and that acting against the actuating surface 56 and the surfaces 59 and 60 will exhaust to the atmosphere. The pressure fluid acting against the pressure surface 52 of the valve will then again shift the valve forwardly to its initial position, thus completing the cycle of operation.

I claim:

1. In a fluid actuated percussive tool, a cylinder having an exhaust port, a piston in the cylinder to control the exhaust port and having a pressure surface constantly exposed to pressure fluid for actuating the piston on its working stroke, an actuating surface on the piston of greater area than the pressure surface intermittently exposed to pressure fluid to return the piston, means defining a valve chamber, an inlet passage leading from the valve chamber to the front end of the cylinder, a vent for the valve chamber, a valve to control communication between the inlet passage and the vent and having an actuating surface intermittently subjected to pressure fluid valved by the piston for shifting the valve to admit pressure fluid to the actuating surface of the piston, and a pressure surface on the valve constantly exposed to pressure fluid to shift the valve for cutting off the flow of pressure fluid to the actuating surface of the piston.

2. In a fluid actuated percussive tool, a cylinder having an exhaust port, a piston in the cylinder to control the exhaust port and having a pressure surface constantly exposed to pressure fluid for actuating the piston on its working stroke, an actuating surface on the front end of the piston of greater area than the pressure surface, a valve chest having a valve chamber, an inlet passage for conveying pressure fluid from the valve chest

to the actuating surface of the piston, a valve in the valve chest having an actuating surface intermittently subjected to pressure fluid valved by the piston to shift the valve for effecting communication between the inlet passage and pressure fluid supply, an annular groove in the periphery of the valve, a vent for the valve chamber, and a pressure surface on the valve con-

stantly exposed to pressure fluid for shifting the valve to cut off the flow of pressure fluid to the inlet passage and to move the annular groove into position to effect communication between the inlet passage and the vent for relieving compression from the front end of the cylinder. 5

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