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2,591,853

VALVE FOR PERCUSSIVE TOOLS

Filed Aug. 21, 1947

2 SHEETS—SHEET 1

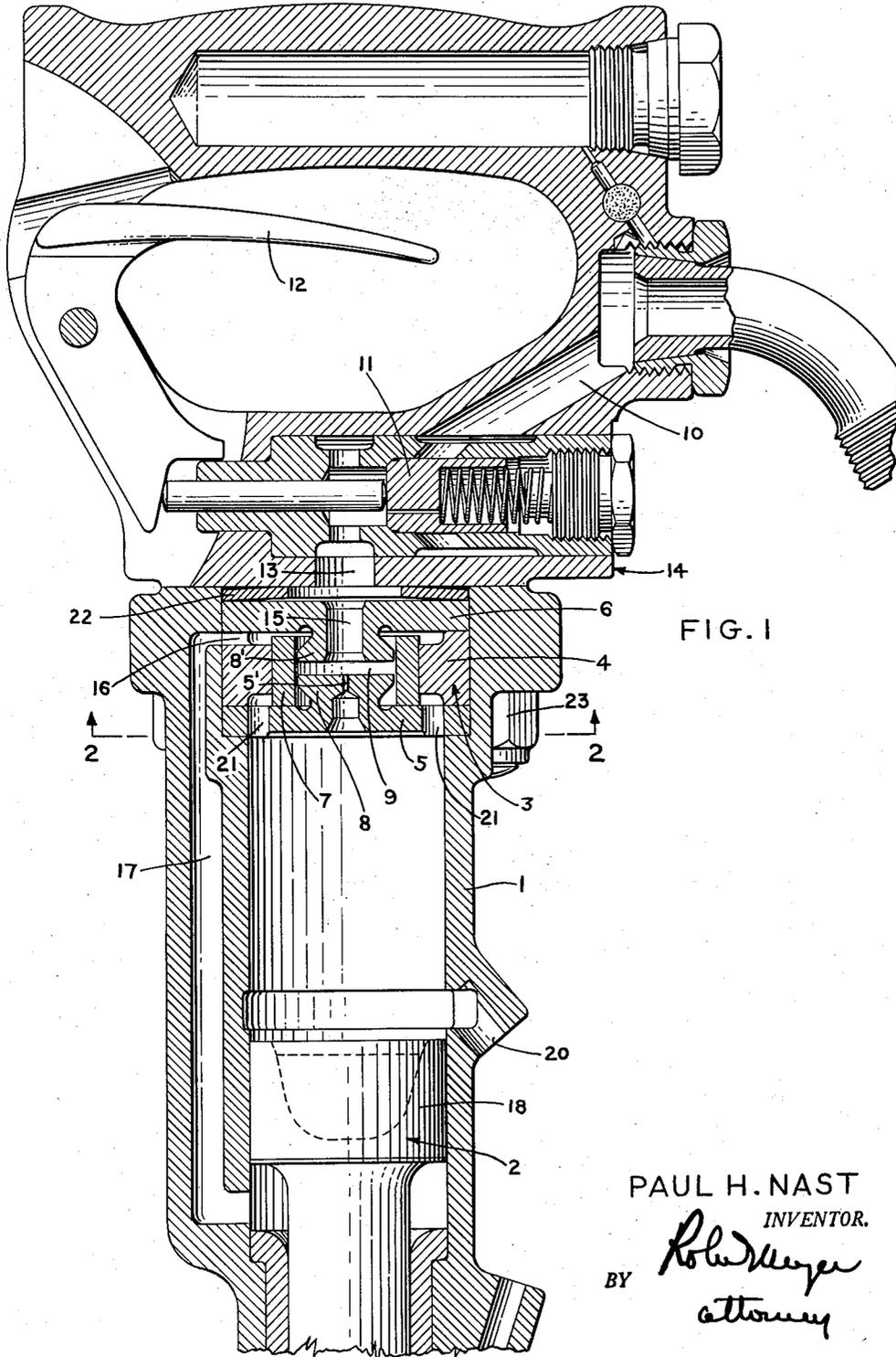


FIG. 1

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2 SHEETS—SHEET 2

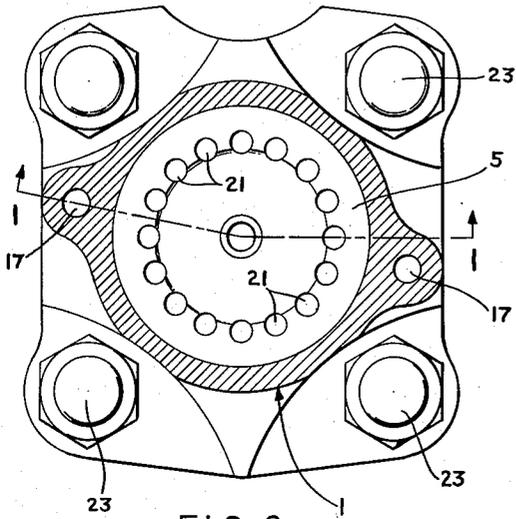


FIG. 2

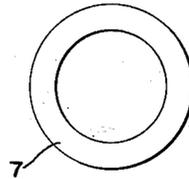


FIG. 3

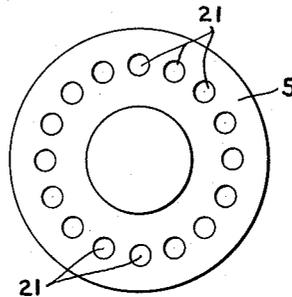


FIG. 5

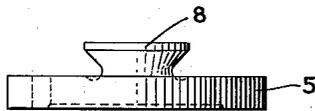


FIG. 4

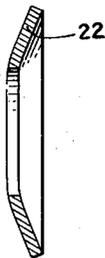


FIG. 6

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VALVE FOR PERCUSSIVE TOOLS

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4 Claims. (Cl. 121—28)

1

This invention relates to percussive tools such as clay diggers, trench diggers, paving breakers, etc., and, more particularly, to a valve structure therefor.

An object of the present invention is the provision of a valve for percussive tools, as specified, which is simple in construction, positive and quick in action to provide quick positive action of the tool with a minimum of air consumption.

With these and other objects in view, as may appear from the accompanying specification, the invention consists of various features of construction and combination of parts, which will be first described in connection with the accompanying drawings, showing a valve for percussive tools of a preferred form embodying the invention, and the features forming the invention will be specifically pointed out in the claims.

In the drawings:

Figure 1 is a fragmentary longitudinal section through a percussive tool employing the improved valve.

Figure 2 is a cross section through the tool taken on the line 2—2 of Figure 1.

Figure 3 is a plan view of the valve.

Figure 4 is a side elevation of one of the valve seats.

Figure 5 is a plan view of one of the valve seats.

Figure 6 is a section through a pressure ring employed in the tool assembly.

Referring more particularly to the drawings, the percussive tool which may be a clay digger, trench digger, paving breaker, or the like, includes the cylinder 1 in which the hammer piston 2 is reciprocated by air under pressure. The air admission to the front and rear ends of the cylinder 1 is controlled by the valve structure generically indicated at 3.

The valve structure 3 includes the annular valve box 4 together with forward cover plate 5, rearward cover plate 6 and the reciprocating valve 7, all of which are assembled in the rear end of the cylinder 1, as clearly shown in Figure 1 of the drawings.

The valve 7 is a ring valve of uniform thickness throughout its entire length and it has its ends and outer perimeter ground. The valve 7 is mounted within the annular valve box 4 between the inner surfaces of the forward and rear cover plates 5 and 6, and as clearly shown in Figure 1 of the drawings the valve is shorter than the distance between the inner main faces of the cover plates so as to permit movement of the valve for controlling the delivery of air into the cylinder 1.

2

Each of the cover plates 5 and 6 has an undercut flange 8 and 8' respectively, extending inwardly from its inner surface and in to the bore of the ring valve 7. These undercut flanges provide metering restricted openings from the pressure-air chamber 9 across the ends of the valve 7 as will be hereinafter more fully described.

In operation the pressure-air enters through a suitable inlet passage 10 under control of a throttle valve structure 11 operable by a suitable hand lever 12. From the air passage 10 which is controlled by the throttle valve 11, the air passes through the passageway 13 in the tool head 14, through the passage 15 which is centrally located in the rear cover plate 6 into the air pressure chamber 9. When the piston 2 is in its forward position, as shown in Figure 1 of the drawings, the ring valve 7 is seated against the forward cover plate 5 and the air under pressure flows from the chamber 9 around the edge of the undercut flange 8' on the rear cover plate 6 past the rear end of the ring valve, through the passageway 16 into the passageway 17. From the passageway 17 the pressure air flows into the cylinder 1 forwardly of the head 18 of the piston 2 and moves the piston rearwardly.

As the piston 2 moves rearwardly and the head 18 uncovers the exhaust port 20, a sharp pressure drop occurs in the cylinder chamber below passage 17 and port 16 and, consequently through the passage or space between the end of the valve 7 and the inner surface of the cover plate 6 and through the restricted metering space around the flange 8' on the rear cover plate 6. The high pressure air in chamber 9 therefor escapes through the small metering space around the flange 8' and through port 16 at high velocity causing friction on the inside diameter of valve 7 adjacent the small metering space around the flange 8' and moves it off its forward seat. Meanwhile the momentum of the piston 2 has continued the rearward motion of the piston 2 tending to compress such air as is present in the cylinder 1 forcing this air into the valve box through the ports 21 to exert a pressure on the forward and outward end of the sleeve ring valve 7 causing the ring valve to seat itself against the inner surface of the rear cover plate 6.

The seating of the ring valve against the inner surface of the rear cover plate 6 opens a passage from the pressure air chamber 9 around the undercut flange 8 on the forward cover plate 5 to the plurality of ports 21. Ports 21 being circumferentially spaced in a ring or circle through the front cover plate 5 and opening into the rear end of cylinder 1, thus allowing the high pressure air

3

to act against the piston head 18 which forces the piston 2 forward.

On the forward stroke, when the piston 2 uncovers the exhaust groove 20, a sharp pressure drop results in the cylinder 1 causing an increased velocity of the air through the metering flange 8 and the inside diameter of the valve 7, as above described for the rearward stroke, which creates a friction or drag that pulls the valve 7 off from the seat of the rear cover plate 6, to the seat of the front cover plate 5. When the valve 7 is unseated or cracked from the rear cover plate 6, the trapped air which is compressed to higher pressures than line pressure, in front of the piston 2 and passages 16 and 17, tend to act on the end of the valve throwing it against the seat of the front cover 5. On the rearward stroke the action is the same only in reverse manner.

The diameter of the flanges 8 meters or controls the amount of air for forward and reverse strokes so that the air consumption is held to a minimum. The hole 15 is held to a size so as not to pass any more air than is needed. This is also a metering point before the air is metered to the front and rear of the cylinder.

A small hole 5' in the front cover plate 5 registers air to the rear of the piston forcing it in forward position so that positive starting action results when the throttle valve is opened. In off position the valve 7 rests on the front cover plate 5, due to the fact that the tool is held in a vertical position when operating or before starting, so as to insure the ring valve engaging either one or the other of the inner faces of the rear or front cover plates respectively, depending on the starting position of the tool, for proper operation.

The valve assembly 3 is placed in the counter bore shown at the rearward end of the cylinder 1 and the two cover plates 5 and 6 and the annular valve box 7 are held in firm proper position therein by a spring ring 22 which is known in the art and on the market as a "Bellevue" spring ring. This spring ring is substantially frustro-conical in shape, as shown in Figure 6 of the drawings, and it fits between the rear cover plate 6 and the head 14 of the tool so that when the head 14 is clamped to the cylinder 1 by means of the bolts 23 the Bellevue spring ring will be compressed and firmly hold the parts of the valve structure 3 in place.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown, but that they may be widely modified within the invention defined by the claims.

What is claimed is:

1. In a percussive tool, a cylinder provided with a pressure air passage leading into its forward end, a piston movable in said cylinder, and a valve structure in the axial line of said cylinder for controlling movement of said piston, said valve structure comprising an annular valve box, a forward cover plate and a rear cover plate, said cover plates spaced to form a pressure air chamber, said rearward cover plate provided with a passage to permit air to enter said chamber and with a valve control passage for permitting pressure air to flow into the forward end of the cylinder, said forward cover plate provided with valve controlled ports opening into the pressure air chamber and into the rear end of said cylinder for delivery of pressure air into the rear end of the cylinder, and a ring valve of uniform diameter and uniform thickness throughout its length in said annular box for reciprocatory movement therein, said ring valve disposed coaxially with

4

said passage for pressure air in the rear cover plate to seat itself endwise against the inner surfaces of said forward and rearward cover plates, respectively, to control the flow of pressure air through said valve controlled ports.

2. In a percussive tool, a cylinder provided with a pressure air passage leading into its forward end, a piston movable in said cylinder, and a valve structure in the axial line of said cylinder for controlling movement of said piston, said valve structure comprising an annular valve box, a forward cover plate and a rear cover plate, said cover plates spaced to form a pressure air chamber, said rearward cover plate provided with a passage to permit air to enter said chamber and with a valve control passage for permitting pressure air to flow into the forward end of the cylinder, said forward cover plate provided with valve controlled ports opening into the pressure air chamber and into the rear end of said cylinder for delivery of pressure air into the rear end of the cylinder, and a ring valve of uniform diameter and uniform thickness throughout its length in said annular box for reciprocatory movement therein, said ring valve disposed coaxially with said passage for pressure air in the rear cover plate to seat itself endwise against the inner surfaces of said forward and rearward cover plates, respectively, to control the flow of pressure air through said valve controlled ports, said forward and rearward cover plates having undercut flanges on their inner surfaces, said undercut flanges extending into said air pressure chamber and said ring valve, the maximum diameter of said undercut flanges being slightly less than the interior diameter of said ring valve so as to provide restricted air passages from said pressure air chamber to said valve controlled ports.

3. In a percussive tool, a cylinder provided with a pressure-air passage leading into its forward end, a piston movable in said cylinder, and a valve structure for controlling movement of said piston, said valve structure comprising an annular valve box, a forward cover plate and a rear cover plate, said cover plates spaced to form a pressure-air chamber, said rearward cover plate provided with a passage to permit air to enter said chamber and with a valve controlled passage for permitting pressure air to flow into the forward end of the cylinder, said forward cover plate provided with valve controlled ports opening into the pressure-air chamber and into the rear end of said cylinder for delivery of pressure air into the rear end of the cylinder, and a ring valve in said annular box for reciprocatory movement therein for seating against the inner surfaces of said forward and rearward cover plates, respectively, to control the flow of pressure air through said valve controlled ports, said forward and rearward cover plates having undercut flanges on their inner surfaces and extending into said pressure-air chamber and enclosed within said ring valve, the maximum diameter of said undercut flanges being slightly less than the interior diameter of said ring valve so as to provide restricted air passages from said pressure-air chamber to said valve ports.

4. In a percussive tool, a cylinder provided with a pressure air passage leading into its forward end, a piston movable in said cylinder, and a valve structure in the axial line of said cylinder for controlling movement of said piston, said valve structure comprising an annular valve box, a forward cover plate and a rear cover plate, said cover plates spaced to form a pressure air chamber, said rearward cover plate provided with a passage

5

to permit air to enter said chamber and with a valve control passage for permitting pressure air to flow into the forward end of the cylinder, said forward cover plate provided with valve controlled ports opening into the pressure air chamber and into the rear end of said cylinder for delivery of pressure air into the rear end of the cylinder, and a ring valve of uniform diameter and uniform thickness throughout its length in said annular box for reciprocatory movement therein, said ring valve disposed coaxially with said passage for pressure air in the rear cover plate to seat itself endwise against the inner surfaces of said forward and rearward cover plates, respectively, to control the flow of pressure air through said valve controlled ports, and means formed on said cover plates which cooperate with said ring valve to provide restricted passages for pressure air from said pressure air chamber to said valve controlled ports.

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