

March 1, 1960

W. V. SPURLIN

2,926,637

PORTABLE INTERNAL COMBUSTION PERCUSSION TOOLS

Filed Feb. 15, 1956

4 Sheets-Sheet 1

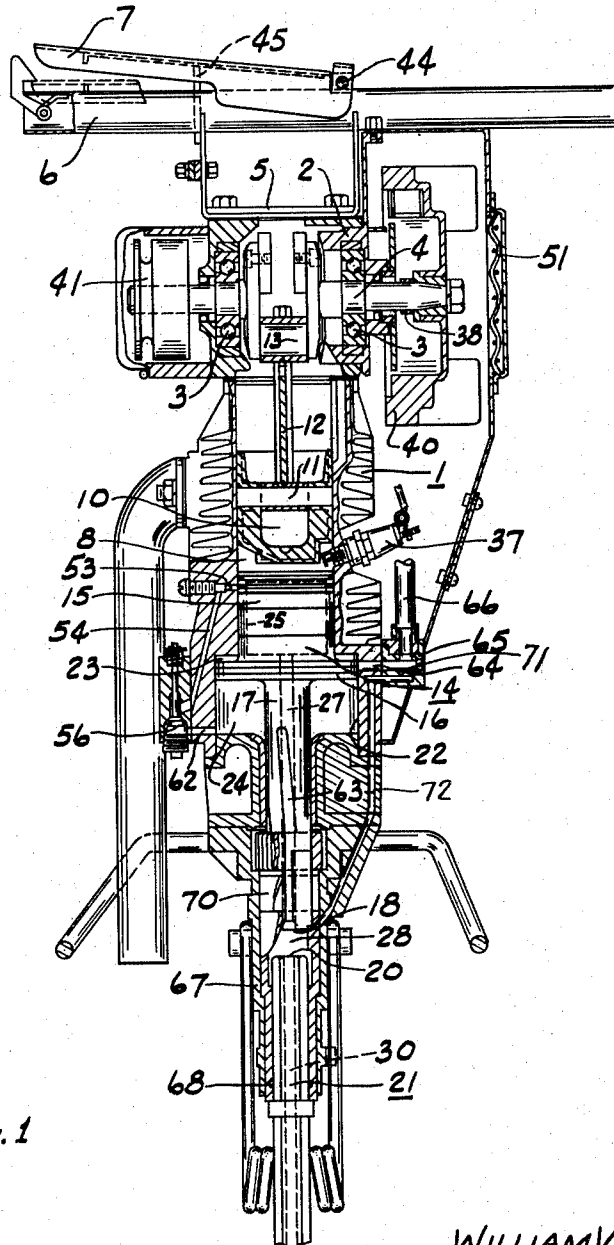


Fig. 1

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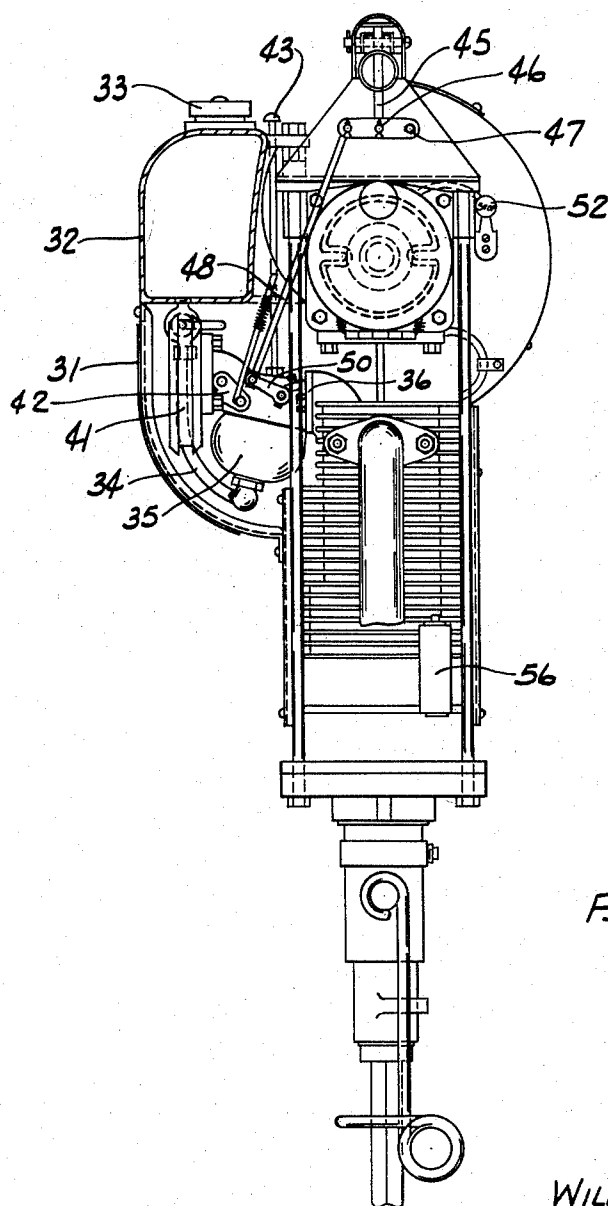


Fig. 2

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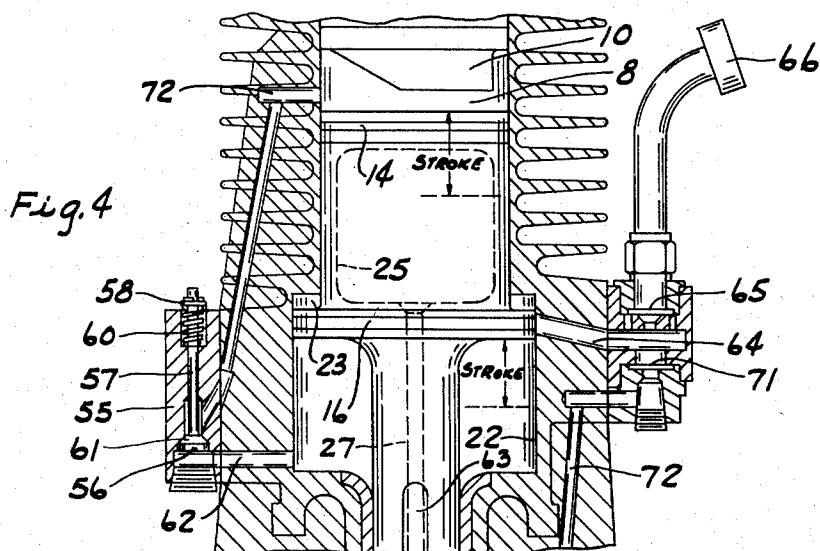
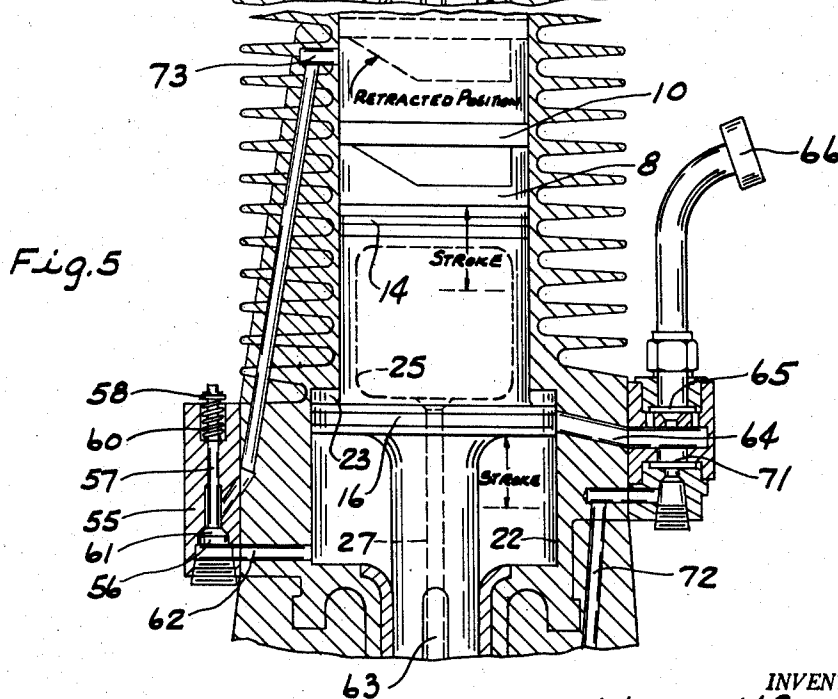
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4 Sheets-Sheet 4



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PORTABLE INTERNAL COMBUSTION PERCUSSION TOOLS

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Application February 15, 1956, Serial No. 565,660

5 Claims. (Cl. 123—7)

This invention relates generally to portable internal combustion percussion tools known as gasoline hammers, and more particularly to control of the operation of the working piston and the supply of a fluid under pressure for automatically blowing out the hole being drilled during operation.

Machines of this character have had different modes of control of the timing piston which in turn controls the working piston. Some of these modes are by means of controlling the exhaust gases, or the application of a centrifugal brake, or the application of a hand brake, or control through ignition. Each of these modes of control require some form of governor or a specific application by the operator. Such a device becomes worn or due to improper care fails to function until it is cleaned or serviced. One of the principal objects of this invention is the provision of a new mode of control of the operation of the working piston without the use of such governors.

Another object of this invention is the provision of an automatic control for the operation of a working piston through the means of a spring biased check valve in the passage line that conducts the combustion gases under pressure to the reaction chamber for the purpose of controlling the operation of the working piston.

Another object is the provision of the use of the combustion gases together with a compressed air generated by the piston for the purpose of aiding in the return of the working piston.

Another object is the provision of a hollow working piston and reaction piston which provides a receiving chamber for gas under pressure employed to blow out a hole being drilled by the internal combustion percussion tool.

Another object of this invention is the provision of a spring biased check valve in the combustion gas passageway from the combustion chamber to the reaction or bounce chamber which opens below the reaction piston but is controlled at its opposite end by the captive piston.

Another object of this invention is the provision of an internal combustion engine having a passageway from the combustion chamber to the reaction or bounce chamber controlled by a spring loaded check valve and both ends are controlled by either the captive piston or the working piston or its reaction piston.

Another object of this invention is the provision of a control for an internal combustion percussion tube which provides a passage for the products of combustion from the combustion chamber which is controlled by the working piston and provides a spring loaded check valve for determining by pressure the amount of the products of combustion admitted to the underside of the reaction piston.

Another object is the provision of a gas seal on the drill bit actuated by an internal combustion hammer which bit is hollow to receive the discharge of the gas

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under pressure generated by the internal combustion percussion tool.

Other objects and advantages appear hereinafter in the following description and claims.

5 The accompanying drawings show, for the purpose of exemplification without limiting the invention or claims thereto, certain practical embodiments illustrating the principles of the invention wherein:

Fig. 1 is a view in vertical section of the internal combustion percussion tool comprising this invention.

Fig. 2 is a view in side elevation of the structure shown in Fig. 1.

Fig. 3 is an enlarged sectional view showing the line for the combustion gases controlled by the working piston.

Fig. 4 is an enlarged sectional view showing no control for the inlet to the line for the combustion gases.

Fig. 5 is an enlarged sectional view showing the line for the combustion gases controlled by the captive piston.

Fig. 6 is a view showing a graph in the form of an indicator card.

Referring to Figs. 1 and 2, the internal combustion percussion tool comprises the cylinder 1 having attached to its upper end the crank case 2 which carries the bearings 3 that support the crankshaft 4. The upper end of the crankcase 2 is provided with a bracket 5 that has attached thereto the handle 6 and pivoted thereon is the fuel throttle control lever 7.

The cylinder 1 is provided with a combustion chamber 8 in which operates the engine piston 10, the wrist pin 11 to which the connecting rod 12 is attached. The other end is on the crank 13 of the crankshaft 4. In the other portion of the combustion chamber 8 is the working piston 14 which is made in two parts, the upper or combustion piston part 15 and the lower or reaction piston part 16. This piston is provided with a downwardly projecting stem 17 the end of which as indicated at 18 strikes the top 20 of the tool 21. The reaction piston 16 operates within the bounce chamber 22 which is divided into two parts, the upper or compression chamber 23 and the lower or reaction chamber 24.

The working piston 14 is provided with a hollow chamber 25 which acts as a portion of a compressor receiver that opens downwardly through the passage 27 to receiving chamber 28 at the striking end 18 of the working piston. The tool 21 also has passage 30 through which gases under pressure pass downwardly through the tool to where it opens into the bit, to blow the dust from the hole being drilled.

As shown in Fig. 2 this internal combustion percussion tool is provided with an outer casing 31 which encloses the gasoline tank 32 having a cap member 33 to supply fuel thereto. The fuel is carried from the tank 32 by means of the fuel line 34 to the carburetor 35 and thence it is supplied through a port 36 to the crankcase of the combustion chamber, and when the engine piston is drawn to its uppermost position this compressed and vaporized fuel is then allowed to pass to the combustion chamber where it is ignited by the spark plug 37 which is supplied with ignition from the magneto member 38 within the combustion fly wheel fan member 40 attached to one end of the crankshaft 4. The opposite end of the crankshaft 4 is provided with a starting pulley 41.

As shown in Fig. 2 the carburetor is provided with an inlet which is controlled by the choke lever 42 actuated by the choke button 43 adjacent the top of the hammer. The fuel control lever 7 is pivoted at 44 and is provided with a rod 45 that actuates the lever member 46 which is pivoted at 47 and actuates the lever 48 that controls the supply of fuel through the carburetor throttle lever 50.

As shown in Fig. 1, the fan is provided with an opening 51 in the housing to admit the air which is blown around

the cylinder to cool the same. It is also shown that the cylinder is provided with air cooled fins to aid in cooling. As shown in Fig. 2, a stop member 52 is provided to short-circuit to ground the plug to stop the operation of the engine.

As illustrated in Fig. 1 the cylinder combustion chamber 8 is provided with a port 53 which is connected to the passage 54 to the valve chamber 55, which is provided with a valve member 56 having a stem 57 that extends out of the chamber 55 and is provided with a washer 58 locked thereon and which compresses the calibrated spring 60 against the seat and thus holds the valve member 56 seated against the seat 61 to close the passage 54. When the pressure is sufficiently great to force the valve open against the pressure of the spring 60 the products of combustion are permitted to flow through the valve housing to the passage 62 to the under side of the reaction piston in the reaction chamber 22 of the bounce chamber. If the gases are sufficiently strong to raise the reaction piston to the position as shown in Fig. 3, they are then permitted to escape through the gland members 63 to the chamber 28, where they are mixed with the air supplied thereto under pressure and all these gases serve to pass down through the passage 30 for the purpose of cleaning the hole that is being drilled.

The reaction piston 16 is arranged to operate the compressor by closing the port 64 which is also controlled by the check valve disc 65. Thus when the reaction piston is pushed downwardly by the products of combustion the compression chamber 23 draws air through the inlet 66 past the valve 65 and through the port 64 into the compression chamber 23. When all of the air is drawn into this compression chamber and the working piston is moved upwardly on its bounce or return stroke and is aided by the pressure of the products of combustion through the valve 56, the air trapped in the compression chamber is not permitted to flow back out to the atmosphere by reason of the check valve 65 but is caused to flow through port 64, valve 71, passage 72, the receiving chambers 25 and 28 where it is collected with the products of combustion under pressure from the previous explosion and passes on down through the passage 30 through the bit for the purpose of blowing dust out of the hole being drilled. Thus the products of combustion, together with the compression of air created by the reaction piston in the compression chamber 23, function to provide a gas under pressure for the purpose of blowing out the hole.

It will be noted that when the reaction piston 16 closes the port to the passage 64 the entrapped space remaining in chamber 23 is the clearance space that produces a cushion. The air is compressed in this space thus preventing metal to metal contact between the reaction piston and the housing.

The nose casting 67 is provided with a seal member 68 which seals the hexagonally shaped tool member 21 and provides a ratchet member 70 which is actuated by the reciprocal movement of the working piston for the purpose of stepping the tool 21 in sequential steps to rotate the same while it is being reciprocated by the working piston.

The structure as shown in Fig. 3 illustrates in part a similar internal combustion percussion tool wherein the port 53 connects with the passage 54 and is blocked by the pressure biased check valve 56. However, the effect of the gland members 63 as outlets, are removed eliminating any outlet to chamber 22 thereby conserving energy stored in this chamber in the form of compressed gas. The gland members 63 are lowered so that they cannot exhaust chamber 22.

The compressed air passes out through the port 64 and the discharge valve 71 to the passageway 72 thence to the chamber 28. The check valve 71 permits the air to discharge from the passageway 64 but prevents any return thereof.

The passageway 64 also is provided with the inlet check

valve 65 which is opened to the atmospheric intake 66 as before. Thus the reaction piston 16 functions as a compressor.

In the structure as illustrated in Fig. 4, the passageway 54 is replaced by the passageway 72 which, in this instance, is connected to the check valve 56. However, this passageway is connected directly to the combustion chamber 8 and its passage is not valved or otherwise controlled by either the working piston 14 or the engine piston 10, and the valve 56 is actuated only by the pressure that is generated within the combustion chamber, and the check valve spring 60 is adjusted so as to withstand only that pressure that is effective on the reaction piston to return the working piston for the next working stroke, and also supply the products of combustion to aid in building up the pressure to blow out the hole being drilled. In all other respects this structure is the same as that shown in Fig. 3.

The structure as illustrated in Fig. 5 provides a combustion gas passage 73, the port of which is controlled by the engine piston 10. This passage 73 is likewise supplied to the check valve 56 in the same manner as that shown in Figs. 3 and 4; however, the engine piston controls the timing of the gases that are supplied to this check valve which in turn regulate the timing of the return of the working piston.

In either of the structures as illustrated in Figs. 3, 4, and 5 it was found that the check valve may be regulated to control the products of combustion from the combustion chamber whether it is open at all times to the combustion chamber 8 or whether it is valved either by the working piston of the engine piston for the purpose of maintaining proper timed sequential operation of the working piston without the use of the governor, all forms of the governors having thus been eliminated by the use of this simple pressure biased check valve.

The graph 74 as illustrated in Fig. 6 is a graph of the operation of the engine. The card is an ordinary internal combustion card illustrating the combustion stroke and the firing and the power stroke, the power obtained being proportional to the area between the solid curved lines of the graph. As shown by dotted lines, the check valve is operated by the pressure developed from the structures of Figs. 3 and 5 wherein the dotted line 75 illustrates the starting of the opening of the check valve commensurate with the development of pressure within the combustion chamber shortly after the fuel has been fired therein and until the line is opened by either piston which is that point wherein the dotted line 75 crosses the downward firing side of the card. This indicates the timing of the opening of the port by either the working piston or the captive piston, and when the dotted line crosses this pressure line as indicated, the pressure valve 56 closes because the pressure is slightly less than that of the spring. It is this operation between the time that the port opens as indicated on the chart until the passage is closed by the check valve that supplies a sufficient amount of the products of combustion under pressure to return the working piston and also add to the fluid pressure for blowing out the hole.

When the structure is employed as that illustrated in Fig. 1 the air from the compression cylinder passes through the discharge disc valve similar to the suction valve and flows through the drilled hole along the side of the cylinder to the nose casting. A sealed ring is provided in the shank of the casing as indicated at 68 in order to insure that all the air flows through the drilled steel tool to maintain pressure on the drilling dust when the hole is being drilled. This character of compression has been found to permit drilling holes at least thirteen feet deep in sandstone without the use of an auxiliary blower. The maximum depth obtained with production drills without such compression is ordinarily eighteen inches in this character of rock formation. The reason for this improved ability is the improved ability to build up air pressure acting on the drilling dust in the hole.

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The production drill generates a maximum pressure of only a few ounces, and functions only as a low pressure blower or fan. The compressor as shown in all of the views will produce a pressure of approximately 30 p.s.i.g. This pressure is sufficient to lift the cuttings from a hole with a maximum depth of thirteen feet.

The structure as illustrated in Fig. 3 is employed successfully as a rock drill wherein the continued operation together with the rotary and reciprocal movement of the bit is more important in continued operation than that of a paving breaker which might well be employed in the structure as illustrated in Fig. 5 wherein the ports of the passage 73 are valved by the engine piston 10. The utilization of the pressure developed by this machine, of course, has some reduction in the power delivered to the reciprocating working piston. However, the gain obtained by being able to clean the debris from the hole, point, or position of working edges of the bit through the bit itself offsets the reduction in pressure blows.

I claim:

1. A bounce chamber pressure control for an internal combustion percussion tool having a timing captive piston and a combined working and reaction piston operating in a common combustion chamber and in a bounce chamber which chambers are connected by a passage for the flow of products of combustion to the bounce chamber from whence the products of combustion escape after being effective for raising the combined working and reaction piston, characterized in that said bounce chamber provides a compression chamber above the reaction chamber, a second passage valved by said reaction piston and forming an inlet and an exhaust to said compression chamber, the valved inlet connected to said passage, a valved outlet connected to said passage, a bit actuated by said working piston and having a blow-out passage connected to said valved outlet passage, said second passage valved by said reaction piston to add the products of combustion from said bounce chamber to said blow-out passage.

2. An internal combustion percussion tool comprising a housing containing a combustion chamber and a larger bounce chamber connected therewith and a receiver chamber, a timing captive piston and a working piston reciprocable in said combustion chamber, a larger reaction piston on the end of said working piston and reciprocable in said bounce chamber and dividing it into a

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compression chamber and a reaction chamber, a percussion tool actuated by said working piston, a combustion gas passageway in said housing leading from said combustion chamber to the lower end of said reaction chamber, a check valve in said passageway having a spring to maintain said valve closed against the flow of the products of combustion from said combustion chamber to said reaction chamber until the products of combustion reach a predetermined pressure, a second passageway in said housing connected to said bounce chamber and valved by said reaction piston, a check valved atmospheric inlet connected to said second passageway, a check valved outlet connecting said second passage to said receiver chamber, and an exhaust from said receiver chamber to the percussion tool, the pressure exerted by said spring on said check valve in said combustion gas passageway being correlated with the combustion pressure to open said combustion gas passageway to said reaction chamber only during the period that said reaction piston opens said second passage to said compression chamber.

3. The internal combustion percussion tool of claim 2 characterized in that said combustion gas passageway opens into said combustion chamber and is controlled by the movement of the timing captive piston.

4. The internal combustion percussion tool of claim 2 characterized in that said combustion gas passageway opens into said combustion chamber and is controlled by the movement of the working piston.

5. The internal combustion percussion tool of claim 2 characterized in that said combustion gas passageway opens into said combustion chamber and is uncontrolled by either the captive piston or the working piston.

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