

2,887,989

Filed July 3, 1958

FIG. 1

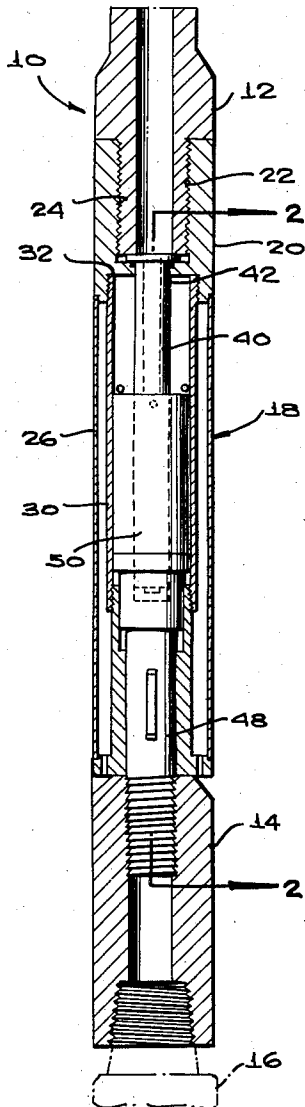


FIG. 3

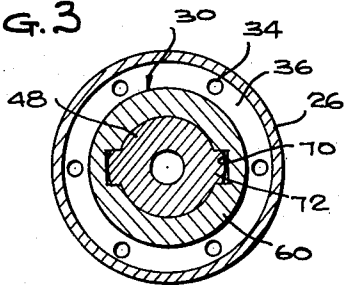
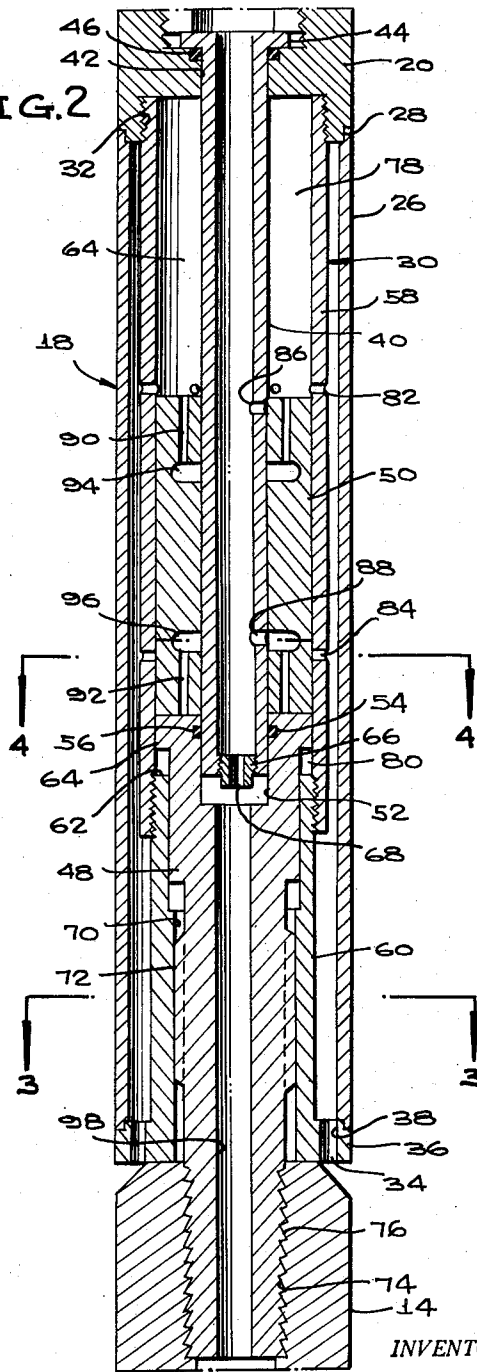


FIG.2



INVENTOR.

RICHARD O. DULANEY
BY

McMorrow, Serman & Davidson
ATTORNEYS

May 26, 1959

R. O. DULANEY

2,887,989

PNEUMATIC ROTARY DRILL HAMMER

Filed July 3, 1958

2 Sheets-Sheet 2

FIG. 4

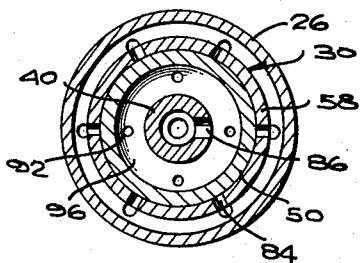


FIG. 5

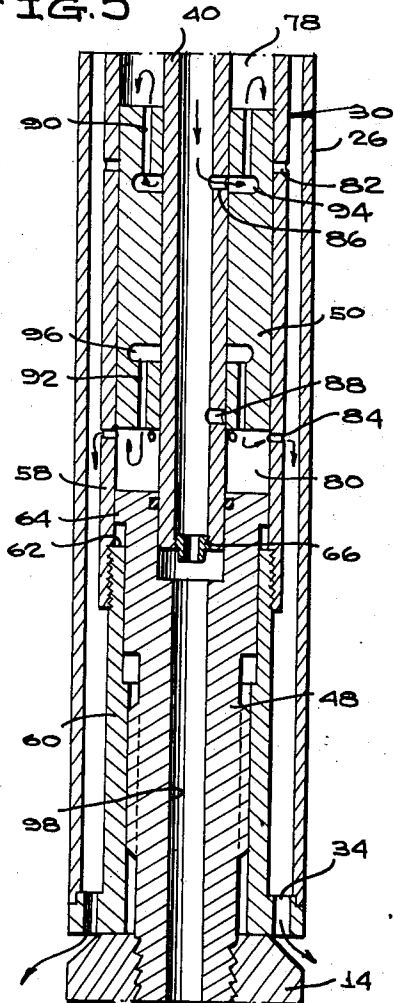
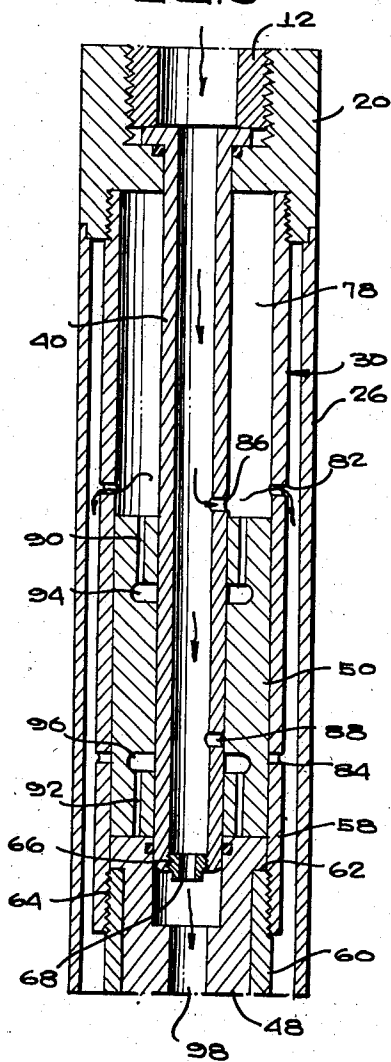


FIG. 6



INVENTOR.
RICHARD O. DULANEY
BY

McMoran, Berman + Davidson
ATTORNEYS

1

2,887,989

PNEUMATIC ROTARY DRILL HAMMER

Richard O. Dulaney, Fort Worth, Tex.

Application July 3, 1958, Serial No. 746,371

3 Claims. (Cl. 121—17)

The present invention relates to well drilling equipment generally and in particular to a pneumatic rotary drill hammer.

An object of the present invention is to provide a pneumatic rotary drill hammer which lends itself to rapid and efficient drilling of a well hole through rock strata, rubble, and the like.

Another object of the present invention is to provide a pneumatic rotary drill hammer operated by compressed air, the blast of air leaving the hammer being used for clearing away the chips from the drill bit in a highly efficient manner.

Another object of the present invention is to provide a pneumatic rotary drill hammer which is automatic in operation when the drill bit encounters a surface to be drilled, one rugged in construction, one having a minimum of parts readily fabricated and assembled, and one which is economically feasible.

These and other objects and advantages of the present invention will be fully apparent from the following description when taken in conjunction with the annexed drawings, in which:

Figure 1 is a view in section of the pneumatic rotary drill hammer of the present invention shown interposed between the lower end of the drill pipe and a tool holder, a drill bit being shown in dotted lines;

Figure 2 is a drill on an enlarged scale, taken on the line 2—2 of Figure 1;

Figure 3 is a view taken on the line 3—3 of Figure 2;

Figure 4 is a view taken on the line 4—4 of Figure 2;

Figure 5 is a view similar to Figure 2, with portions broken away, showing the hammer in raised operating position; and

Figure 6 is a view similar to Figure 5, showing the hammer in lowered or closed position.

Referring in greater detail to the drawings in which like numerals indicate like parts throughout the several views, the reference numeral 10 designates a well drilling apparatus including a drill pipe 12, the lower end portion of which is shown in Figure 1, a tool holder 14 and a drill bit 16, shown in dotted lines, attached to the lower end of the tool holder 14. Normally, the upper end portion of the tool holder 14 receives the lower end portion of the drill pipe 12. The pneumatic drill pipe hammer of the present invention is designated generally by the reference numeral 18 and includes an upstanding coupling 20 having a threaded bore 22 extending inwardly from the upper end thereof receiving the threaded lower end portion 24 of the drill pipe 12.

An upstanding outer shell 26 is positioned below and in longitudinal alignment with respect to the coupling 20 and has the portion adjacent its upper end circumposed about and secured to a reduced portion on the lower end of the coupling 20, as at 28 in Figure 2.

An upstanding inner shell 30 is positioned within and spaced from the outer shell 26 and has its upper end dependingly secured to the coupling 20, the upper end

2

of the inner shell 30 being provided with external threads engaging internal threads on the bore 32 extending inwardly from the lower end of the coupling 20. The space between the outer shell 26 and the inner shell 30 constitutes an exhaust chamber having communication through exhaust ports 34 to the atmosphere, the ports 34 being on the lower end of the outer shell and inner shell juncture, the inner shell being provided with an outwardly extending flange 36 through which the ports 34 extend and the flange 36 having a reduced upper end portion, as at 38, embracingly received within the lower end portion of the outer shell 26, as shown most clearly in Figure 2.

An upstanding hollow tube 40 is positioned within the inner shell 30 and has its upper end extending into a counterbore 42 provided in the lower end portion of the coupling 20. The upper end of the tube 40 is provided with a flange 44 which rests upon the bottom of the bore 22 in the coupling 20. A resilient washer 46 is seated on the shoulder provided in the bottom of the bore 22 and is circumposed about the upper end portion of the tube 40 below the flange 44 and seals the tube 40 to the coupling 20. When assembled on the drill pipe of the lower end portion, the lower end of the drill pipe 12 bears against the upper face of the flange 44 and fixedly secures the tube 40 to the coupling 20.

An upstanding plunger 48, having both the upper and lower ends open, extends into the inner shell 30 through the lower end of the inner shell 30 and has the portion adjacent the upper end in supporting relation with respect to a piston 50 which is movable upwardly and downwardly within the inner shell 30. The portion of the plunger 48 adjacent the lower end projects beyond the lower end of the inner shell 30 and the outer shell 26 and has means thereon for attaching of a working tool, embodying the tool holder 14 and the drill bit 16.

A cavity 52 extends inwardly of the upper end of the plunger 48 and the portion of the tube 40 adjacent its lower end extends into the cavity 52. A groove 54 extends about the inner wall of the cavity 52 inwardly of the upper end and provides a seat for a sealing ring 56 which sealingly engages the tube 40.

The inner shell 30 is fabricated of two sections 58 and 60 with the upper section 58 provided with internal threads on its lower end portion and the lower section 60 provided with external threads on its upper end portion engaging the threads on the section 58 and providing a shoulder 62 on which rests a flange 64 provided on the upper end of the plunger 48. The plunger 48 is slidable for a limited distance within the inner shell 30 from the position of rest in which the flange 64 is seated upon the shoulder 62, as shown in Figure 6, to the position in which the flange 64 is spaced above the shoulder 62, as shown in Figures 2 and 5. The portion of the tube 40 adjacent the lower end is provided with a plug 66 removably threaded into the lower end portion of the tube 40, the plug 66 being provided with a restricted orifice 68 connecting the interior of the tube 40 with the cavity 52.

The inner wall of the inner shell section 60 is provided with opposed grooves 70 receiving complementally formed splines 72 provided on the plunger 48 intermediate the ends of the latter. The splines 72 and the grooves 70 connect the tool holder 14 and plunger 48 to the coupling 20 for rotation with the latter responsive to rotation of the drill pipe 12 by the conventional drilling apparatus on the ground surface. The tool holder 14 and the lower projecting end portion of the plunger 48 are provided with complementally arranged threads 74 and 76, as in Figure 2, detachably securing the tool holder 14 to the projecting end portion of the plunger 48.

3

The space within the inner shell 30 between the upper end of the piston 50 and the lower end of the coupling 20 provides an upper chamber 78 and the space below the piston 50, when the latter is raised above the upper end of the plunger 48, and the upper end of the plunger 48 within the inner shell 30 provides a lower chamber 80.

The upper section 58 of the inner shell 30 is provided with spaced outlet ports 82 and 84 alternately connecting in communication the chambers 78 and 80, respectively, with the space between the inner shell 30 and the outer shell 26, such space constituting an exhaust chamber open to the atmosphere through the ports 34.

The inner tube 40 is provided with inner ports 86 and 88 spaced below and above the outlet ports 82 and 84, respectively. The piston 50 is provided with separate spaced passageways 90 and 92 extending inwardly from the upper and lower ends with the piston 50, respectively, and terminating in annular passages 94 and 96, respectively, opening inwardly of the inner surface of the piston 50 and alternately registrable with the inlet ports 86 and 88. The plunger 48 is connected to a bore 98 extending longitudinally therethrough connecting the cavity 52 with the open upper end of the tool holder 14 for the passage therethrough of air under pressure to clean the chips away from the drill bit 16.

In operation, with the coupling 20 secured to the lower end portion of the drill pipe 12, the drill pipe 12 is lowered into the well hole with the plunger 48 in the position in which the flange 64 rests upon the shoulder 62, due to the action of gravity. The piston 50 also rests upon the upper end of the plunger 48 by reason of gravity until the bottom of the hole is reached at which time the drill bit 16 forces the tool holder 14 and the plunger 48 upwardly within the inner shell 30. This effects the movement of the piston 50 upwardly from the position shown in Figure 6 in which the compressed air is divided between the orifice 68 in the plug 66 and the inlet ports 86 and outlet ports 82 for escape to the atmosphere through the exhaust ports 34. The raised position of the piston 50 is shown in Figure 2 in which the ports 86 are closed and the inlet ports 88 are in communication with the passages 96, permitting the flow of air from the tube 40 through the passageways 92 into the space between the lower end of the piston 50 and the upper end of the plunger 48. This forces the piston 50 upwardly to the position shown in Figure 5 in which the outlet ports 82 are closed by the piston 50 and the outlet ports 84 are open and in communication with the lower chamber 80. The flow of air is now from the interior of the tube 40 into the inlet ports 86, through the passage 94 and passageways 90 to the upper chamber 78, resulting in the forcing of the piston 50 downwardly and exhausting the air from the chamber 80 through the outlet ports 84 into the space between the outer shell 26 and the inner shell 30 to the exhaust ports 34 and thence to the area of the drill bit 16.

The alternate covering and uncovering of the inlet ports 86 and 88 and the outlet ports 82 and 84 by the piston 50 results in rapid reciprocating movement of the piston 50 within the inner shell 30 and effects the striking of the piston 50 on the upper end of the plunger 48 which impact is transmitted to the drill bit 16.

Upon raising of the drill pipe 12, the drill bit 16 and the attached plunger 48 resumes its position of rest with the flange 64 resting upon the shoulder 62, inactivating the piston 50.

What is claimed is:

1. In an air hammer for a well drilling apparatus, an upstanding coupling adapted to be secured to the lower end of a drill pipe, an upstanding shell positioned below said coupling and having the upper end dependently secured to said coupling, a piston movable upwardly and downwardly within said shell, an upstanding open-ended plunger extending into said shell through the lower end of the latter and having the portion adjacent the upper end supporting the lower end of said piston and having

4

the portion adjacent the lower end projecting beyond the lower end of said shell, said plunger being connected to said shell for limited reciprocating movement therein, means on the projecting lower end portion of said plunger for attachment of a working tool thereto, and an upstanding hollow tube positioned within said shell and having the upper end extending into and fixedly secured to the lower end of said coupling, said tube extending through said piston and having the portion adjacent the lower end extending into a cavity provided in the upper end of said plunger, the lower end of said tube being provided with a restricted orifice opening into said cavity, said piston being slidable on said tube, there being spaced outlet ports in said shell and spaced inlet ports in said tube communicating with the space between said tube and said shell, said piston having separate spaced passageways alternately in communication with said inlet and outlet ports responsive to upward and downward movement of said piston.

2. In an air hammer for a well drilling apparatus, an upstanding coupling adapted to be secured to the lower end of a drill pipe, an upstanding outer shell positioned below and in longitudinal alignment with respect to said coupling and having the upper end secured to said coupling, an upstanding inner shell positioned within and spaced from said outer shell and having the upper end dependently secured to said coupling, the space between said outer and inner shells defining an exhaust chamber, said chamber being in communication with the atmosphere, a piston movable upwardly and downwardly within said inner shell, an upstanding open-ended plunger extending into said inner shell through the lower end of the latter and having the portion adjacent the upper end supporting the lower end of said piston and having the portion adjacent the lower end projecting beyond the lower end of said inner shell, said plunger being connected to said inner shell for limited reciprocating movement therein, means on the projecting lower end portion of said plunger for attachment of a working tool thereto, and an upstanding hollow tube positioned within said inner shell and having the upper end extending into and fixedly secured to the lower end of said coupling, said tube extending through said piston and having the portion adjacent the lower end extending into a cavity provided in the upper end of said plunger, the lower end of said tube being provided with a restricted orifice opening into said cavity, said piston being slidable on said tube, there being spaced outlet ports in said inner shell communicating with said exhaust chamber and spaced inlet ports in said tube communicating with the space between said tube and said inner shell, said piston having separate spaced passageways alternately in communication with said inlet and outlet ports responsive to the upward and downward movement of said piston.

3. In an air hammer for a well drilling apparatus, an upstanding coupling adapted to be secured to the lower end of a drill pipe, an upstanding outer shell positioned below and in longitudinal alignment with respect to said coupling and having the upper end secured to said coupling, an upstanding inner shell positioned within and spaced from said outer shell and having the upper end dependently secured to said coupling, the space between said outer and inner shells defining an exhaust chamber, said chamber being in communication with the atmosphere, a piston movable upwardly and downwardly within said inner shell, an upstanding open-ended plunger extending into said inner shell through the lower end of the latter, a shoulder provided on the inner wall of said inner shell intermediate the ends of the latter, a flange carried by the upper end of said plunger and normally engaging and supported on said shoulder, said plunger being connected to said inner shell for limited reciprocating movement from the position in which said flange engages said shoulder to a position in which said flange is out of engagement with and spaced about said

shoulder, means on the projecting lower end portion of said plunger for attachment of a working tool thereto, and an upstanding hollow tube positioned within said inner shell and having the upper end extending into and fixedly secured to the lower end of said coupling, said tube extending through said piston and having the portion adjacent the lower end extending into a cavity provided in the upper end of said plunger, the lower end of said tube being provided with a restricted orifice opening into said cavity, said piston being slidable on said tube and normally resting upon the upper end of said plunger when said flange is in engagement with said shoulder, there being spaced outlet ports in said inner shell communicat-

ing with said exhaust chamber and spaced inlet ports in said tube communicating with the space between said tube and said inner shell, said piston having separate spaced passageways alternately in communication with said inlet and outlet ports responsive to the upward and downward movement of said piston.

References Cited in the file of this patent

UNITED STATES PATENTS

458,291	Drawbaugh	Aug. 25, 1891
711,859	Holden	Oct. 21, 1902
1,122,630	Peck	Dec. 29, 1914