Nov. 19, 1957 R. O. DULANEY 2,813,516

PNEUMATIC ROTARY DRILL HAMMER

Filed April 22, 1955 2 Sheets-Sheet 1

FIG. 1.

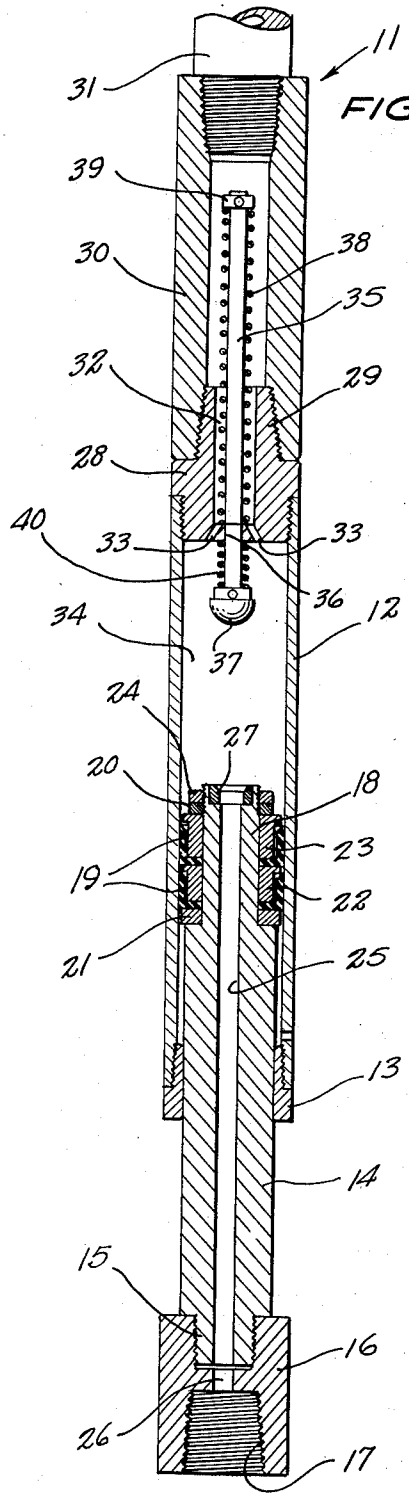
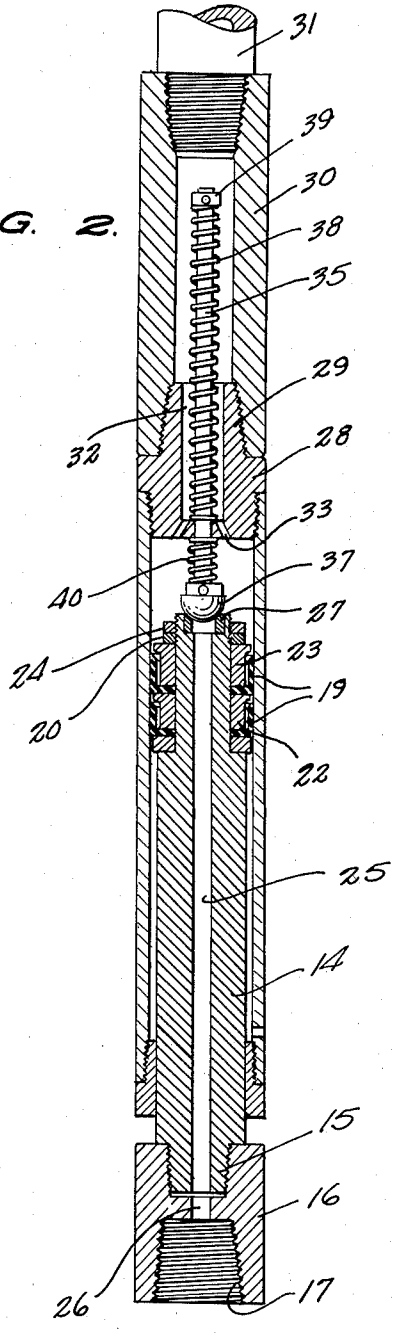


FIG. 2.



INVENTOR.
RICHARD O. DULANEY,
BY
McMorrow, Berman + Davidson
ATTORNEYS.

Nov. 19, 1957 R. O. DULANEY 2,813,516

PNEUMATIC ROTARY DRILL HAMMER

Filed April 22, 1955 2 Sheets-Sheet 2

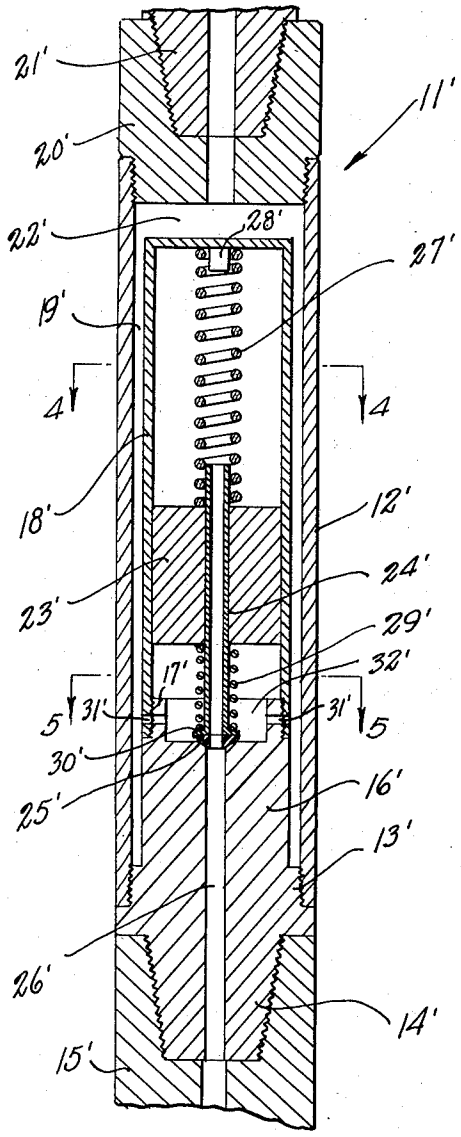


FIG. 3.

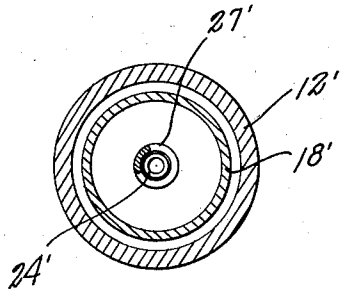


FIG. 4.

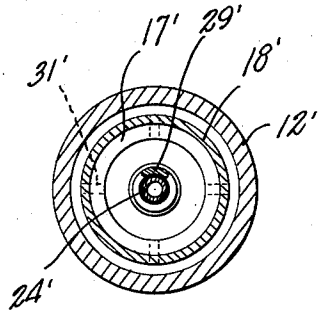


FIG. 5.

INVENTOR.
RICHARD O. DULANEY,
BY
McMorrow, Berman & Davidson
ATTORNEYS.

United States Patent Office 2,813,516 Patented Nov. 19, 1957

2,813,516

PNEUMATIC ROTARY DRILL HAMMER

Richard O. Dulaney, Fort Worth, Tex.

Application April 22, 1955, Serial No. 503,120

5 Claims. (Cl. 121—30)

This invention relates to percussion drilling tools, and more particularly to an improved percussion or impact tool operated by fluid pressure and being particularly adapted for use in drilling earth bores for water, oil, gas or the ike.

A main object of the invention is to provide a novel and improved pneumatic percussion tool for use in drilling earth bores, said tool being simple in construction, being reliable in operation, and providing economical utilization of compressed fluid, such as compressed air, employed with the device, whereby the compressed fluid is utilized for moving the drill cuttings after it has been employed to produce a percussion stroke of the drill.

A further object of the invention is to provide an improved fluid actuated impact tool which is inexpensive to fabricate, which is rugged in construction, and which is easy to assemble, whereby it may be readily taken apart and reassembled when required.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawings, wherein:

Figure 1 is a vertical cross sectional view taken through an improved fluid pressure operated percussion tool constructed in accordance with the present invention, shown with the hammer element elevated with respect to the anvil element thereof and with the compressed air release passage open.

Figure 2 is a vertical cross sectional view of the tool shown in Figure 1, shown with the valve element engaged with its seat, whereby the fluid pressure release passage is closed and whereby the tool is prepared for a percussive stroke thereof.

Figure 3 is a vertical cross sectional view taken through a modified form of fluid actuated impact tool constructed in accordance with the present invention.

Figure 4 is a horizontal cross sectional view taken on the line 4—4 of Figure 3.

Figure 5 is a horizontal cross sectional view taken on the line 5—5 of Figure 3.

Referring to the drawings, and more particularly to Figures 1 and 2, 11 generally designates an improved fluid actuated impact tool according to this invention, said tool comprising the hammer casing 12 which has threadedly secured in its bottom end the annular hammer element 13. Slidably received in the hammer element 13 is the anvil shaft 14, said anvil shaft having a reduced lower end portion 15 on which is threadedly secured the anvil member 16, said anvil member being provided in its bottom portion with the internal threads 17, whereby it may be threadedly secured to a subjacent section of drill pipe.

The anvil shaft 14 is formed with a reduced top portion 18 on which are secured a plurality of sealing cups 19 of deformable resilient material, such as rubber or the like, said cups sealingly engaging the inside surface of the hammer casing 12 and being secured on the reduced member 18 by a clamping nut 20. As shown, a bearing

collar 21 is provided on the shoulder beneath the lowermost sealing cup 19, and an annular guide collar 22 is engaged around the member 18 and received in the first sealing cup 19. The second sealing cup 19 rests on the top surface of the collar 22 and receives another guide collar 23 similar to the guide collar 22. The clamping nut 20 engages the top surface of the annular guide collar 23 and is secured in clamping position by a lock nut 24 threaded on the top end of the reduced member 18 and securing the nut 20 against loosening.

The anvil shaft 14 is formed with the axial bore 25 which registers with a central bore 26 formed in the hammer element 16. At the top end of the shaft 14, an annular valve seat 27 is provided communicating with the bore 25.

Designated at 28 is a flanged nipple member which is threaded into the top end of the hammer body 12 and which has an externally threaded, upwardly tapering top portion 29 threadedly engaged in a coupling sleeve 30. Threadedly engaged in the top end of the coupling sleeve is a fluid pressure supply conduit 31, connected, for example, to a suitable source of compressed air.

The nipple member 28 is formed with the axial chamber 32 communicating with passages 33 leading to the space 34 between the nipple member 28 and the top end of the anvil body 14. Designated at 35 is a shank member which is slidably supported in an axial position in a suitable aperture 36 centrally formed in the bottom wall of the nipple member 28, the shank member 35 having secured to its bottom end a hemispherical, downwardly facing valve element 37 adapted to sealingly engage on the valve seat 27. A coiled spring 38 surrounds the upper portion of the shank 35, bearing between the bottom wall of the cylindrical recess 32 and a collar 39 secured on the top end of the shank 35, and another coiled spring 40 surrounds the lower portion of the shank 35, bearing between the bottom wall of nipple 28 and the valve element 37. Thus, the valve element 37 is resiliently connected to the hammer body 12 and is sealingly engageable on the valve seat 27 when the hammer body is lowered relative to the anvil element 16, for example, to the position thereof shown in Figure 2.

The hammer body 12 and elements supported thereon are of substantial weight being thus biased downwardly toward the anvil element 16. Thus, the hammer body 12 tends to assume the position thereof shown in Figure 2, wherein the valve element 37 is seated on the seat 27, closing off the passage 25 which leads down into the drill bore. When fluid under pressure, for example compressed air, is admitted through the conduit 31 into the space 34 through the recess 32 and passages 33, the compressed fluid acts downwardly on the valve element 37 and simultaneously acts upwardly on the hammer body 12, assuming the anvil element 16 to be supported in a stationary position by the underlying material. As the hammer body 12 is elevated relative to the anvil element 16, a point is reached where the valve 37 disengages from the seat 27, suddenly establishing communication between the space 34 and the passage 25, whereby the compressed fluid in the space 34 is allowed to escape downwardly into the drill bore through the passage 25. The release of the hammer body 12 causes the hammer body to suddenly drop and deliver an impact on the anvil element 16, providing the desired percussive action. At the same time, the valve element 37 sealingly engages the seat 27, whereby the above described cycle may be repeated, as long as fluid under pressure is supplied through the conduit 31.

Referring now to the form of the invention shown in Figures 3, 4 and 5, the improved impact tool is designated generally at 11' and comprises a main casing 12' which is

threadedly secured at its lower end on a flanged nipple 13', said nipple having an externally threaded bottom end 14' which is threadedly engaged in the top end of a subjacent drill casing segment 15'. The nipple 13' has a reduced top portion 16', said top portion 16' having a further reduced top end 17' on which is threadedly secured an elongated, generally cylindrical cup member 18' which is substantially flush with the reduced portion 16' of nipple 13' and defines therewith an annular space 19' with respect to the casing 12'. Threadedly secured on the top end of the casing 12' is a bushing 20' to which is threadedly secured the fluid supply conduit 21', as shown. Compressed fluid, such as compressed air or the like, is thus admitted into a space 22' above the top wall of the cup member 18' which communicates with the annular space 19'.

Designated at 23' is a hammer member which is slidably disposed inside the cylindrical cup 18' and which is adapted to deliver an impact on the top of the element 17' at the upper end of the nipple 13'. Extending axially through the hammer member 23' and slidable therein is a conduit element 24' which is provided at its bottom end with an annular valve element 25' of resilient deformable material adapted to sealingly engage on the top end of the central bore 26' of nipple member 13'.

The tubular conduit 24' is of sufficient length so that under all conditions of operation of the tool, the top end of said conduit 24' projects above the top surface of the hammer member 23'. Designated at 27' is a coiled spring whose lower end receives the top portion of the conduit 24' and whose upper end receives a depending axial stud 28' provided in the top wall of the cup member 18', thus centering the spring 27'. Designated at 29' is a coiled spring which surrounds the lower portion of the conduit member 24', the lower end of the spring 29' being secured to the flange 30' in which the sealing element 25' is secured, and the top end of the spring 29' being secured to the bottom surface of the hammer member 23'. Thus, the spring 29' may be considered as exerting a normal biasing force urging the hammer member 23' toward the anvil element 17', this being aided by the normal biasing force exerted by the coiled spring 27' on the top surface of the hammer member 23'. The spring 29' is of course sufficiently compressible to allow the hammer 23' to engage the anvil element 17' with the desired impact.

Suitable passages 31' are provided, establishing communication between the space 19' and the interior space 32' between the hammer member 23' and the anvil element.

Normally, the springs 29' and 27' coact to bias the valve element 25' toward seating engagement with the top end of the bore 26'. When fluid under pressure enters the space 19' and is admitted through the passages 31' into the space 32', said fluid acts downwardly on the valve element 25' and simultaneously acts upwardly on the hammer element 23', causing said hammer element to be elevated and producing tension in the spring 29' which ultimately exerts sufficient upward force on the valve element 25', which is firmly secured in the flange 30', to unseat the valve element. This suddenly establishes communication between the space 32' and the escape bore 26', allowing the fluid to discharge from the space 32', whereby the springs 29' and 27' coact to move the hammer element 23' downwardly with considerable force, producing the desired impact of the hammer element 23' on the annular anvil element 17'. At the same time, the valve element 25' again seats on the top end of the bore 26', allowing the cycle to be repeated.

It will be noted that in both of the above described modifications of the invention, the fluid under pressure employed for operating the impact tool is also employed to act on the drill cuttings in the drill bore, since the fluid under pressure is discharged downwardly into the bore simultaneously with each impact of the hammer element of the tool. The compressed fluid continues down the drill stem to the bottom of the drill hole and acts on the cuttings to force the cuttings upwardly to the surface in the well known manner.

It will be noted that since the hammer element 23' is actuated by the action of the springs 29' and 27', the device of Figures 3, 4 and 5 may be employed for horizontal drilling as well as vertical drilling.

While certain specific embodiments of an improved fluid actuated impact tool for use in drilling earth bores have been disclosed in the foregoing description, it will be understood that various modifications within the spirit of the invention may occur to those skilled in the art. Therefore, it is intended that no limitations be placed on the invention except as defined by the scope of the appended claims.

What is claimed is:

1. In a fluid actuated impact tool, an anvil member having a fluid release bore extending therethrough, a hammer member, sleeve means axially secured to said hammer member and slidably and sealingly receiving said anvil member and slidably connecting said hammer member to said anvil member for reciprocation relative thereto, said hammer member being formed to deliver an impact to said anvil member, a valve member resiliently connected to and depending from said hammer member and being at times sealingly engageable at its lower end with the top end of said fluid release bore, and fluid pressure conduit means arranged to convey fluid under pressure to the space between said hammer member and anvil member and to elevate said hammer member sufficiently to lift said valve member off the top end of said fluid release bore, whereby to release said hammer member for impact with said anvil member.

2. In a fluid actuated impact tool, an anvil member having a fluid release bore extending therethrough, a hammer member, sleeve means axially secured to said hammer member and slidably and sealingly receiving said anvil member and slidably connecting said hammer member to said anvil member for reciprocation relative thereto, said hammer member being formed to deliver an impact to said anvil member, a valve member aligned with said bore, said valve member depending from and being slidably and resiliently connected to said hammer member, means urging the lower end of said valve member toward sealing contact with the top end of said fluid release bore when the hammer member is adjacent the anvil member, and fluid pressure conduit means arranged to convey fluid under pressure to the space between said hammer member and anvil member and to elevate said hammer member sufficiently to lift said valve member off the top end of said fluid release bore, whereby to release said hammer member for impact with said anvil member.

3. In a fluid actuated impact tool, an anvil member having a fluid release bore extending axially therethrough, a hammer member, sleeve means axially secured to said hammer member and slidably and sealingly receiving said anvil member and slidably connecting said hammer member to said anvil member for reciprocation relative thereto along the axis of said bore, said hammer member being formed to deliver an impact to said anvil member after the hammer member has been elevated relative to the anvil member and then released, a valve member aligned with said bore, said valve member depending from and being slidably and resiliently connected to said hammer member, means urging the lower end of said valve member toward sealing contact with the top end of said fluid release bore when the hammer member is adjacent the anvil member, and fluid pressure conduit means arranged to convey fluid under pressure to the space between said hammer member and anvil member and to elevate said hammer member sufficiently to lift said valve member off the top end of said fluid release bore, whereby to release said hammer member for impact with said anvil member.

4. In a fluid actuated impact tool, an anvil member having a fluid release bore extending axially therethrough

and having an annular valve seat at its top end, a hammer member, sleeve means axially secured to said hammer member and slidably and sealingly receiving said anvil member and slidably connecting said hammer member to said anvil member for reciprocation relative thereto along the axis of said bore, said hammer member being formed to deliver an impact to said anvil member after the hammer member has been elevated relative to the anvil member and then released, a valve member aligned with said bore, said valve member depending from and being slidably and resiliently connected to said hammer member, spring means urging the lower end of said valve member toward sealing contact with said annular valve seat when the hammer member is adjacent the anvil member, and fluid pressure conduit means arranged to convey fluid under pressure to the space between said hammer member and anvil member and to elevate said hammer member sufficiently to lift said valve member off said annular valve seat, whereby to release said hammer member for impact with said anvil member.

5. In a fluid actuated impact tool, an anvil member having a fluid release bore extending axially therethrough and having an annular valve seat at its top end, a hammer member, sleeve means axially secured to said hammer member and slidably and sealingly receiving said anvil member and slidably connecting said hammer member to said anvil member for reciprocation relative thereto along the axis of said bore, said hammer member being formed to deliver an impact to said anvil member after the hammer member has been elevated relative to the anvil member and then released, a valve member aligned with said bore, said valve member depending from and being slidably and resiliently connected to said hammer member, means urging the lower end of said valve member toward sealing contact with said annular valve seat, spring means urging said hammer member toward said anvil member when the hammer is adjacent the anvil member, and fluid pressure conduit means arranged to convey fluid under pressure to the space between said hammer member and anvil member and to elevate said hammer member sufficiently to lift said valve member off said annular valve seat, whereby to release said hammer member for impact with said anvil member.

References Cited in the file of this patent

UNITED STATES PATENTS

1,892,517 Pennington ---------- Dec. 27, 1932