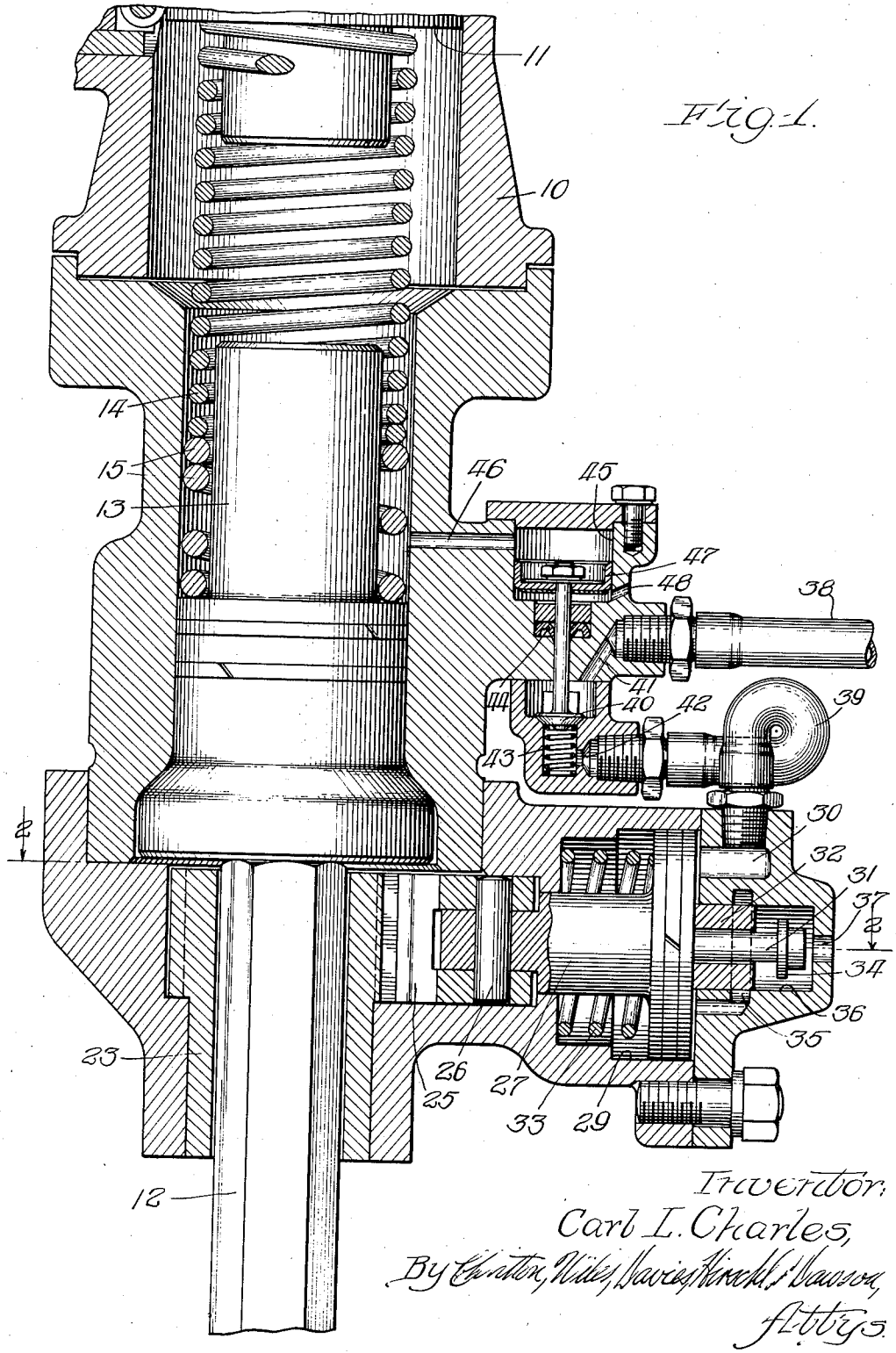
Dec. 17, 1940. C. L. CHARLES 2,225,531

DRILL ROTATING DEVICE

Filed Aug. 4, 1937 2 Sheets-Sheet 1

Fig. 1.



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DRILL ROTATING DEVICE

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Fig. 2.

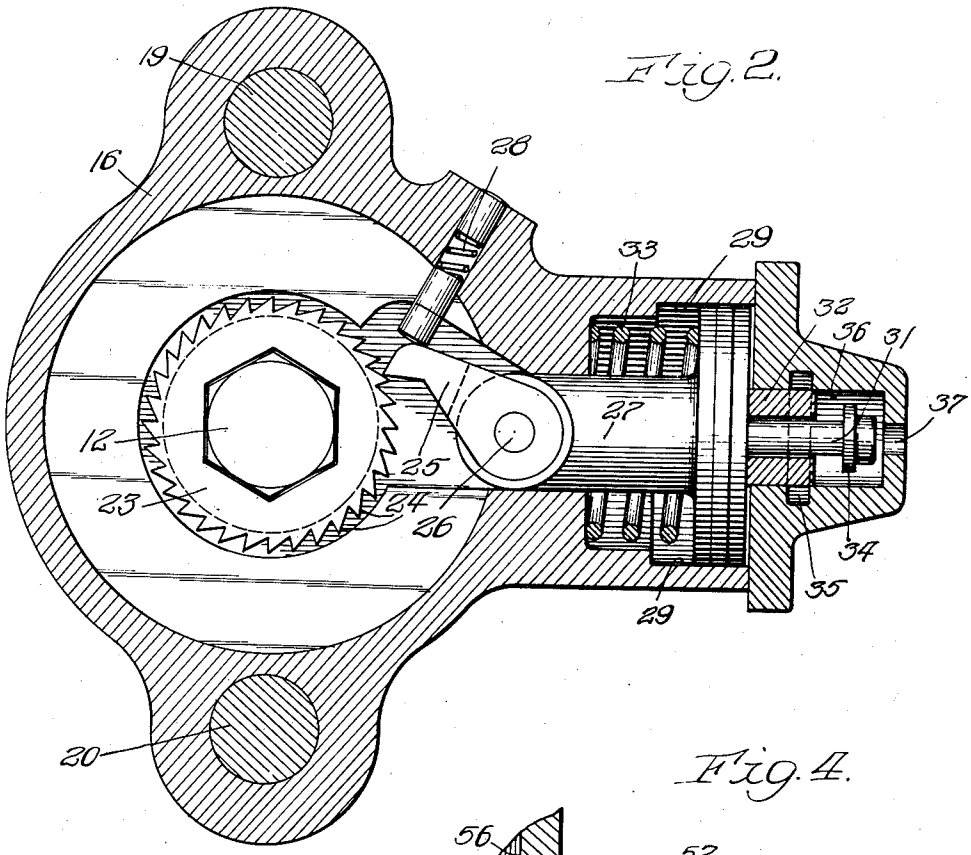


Fig. 3.

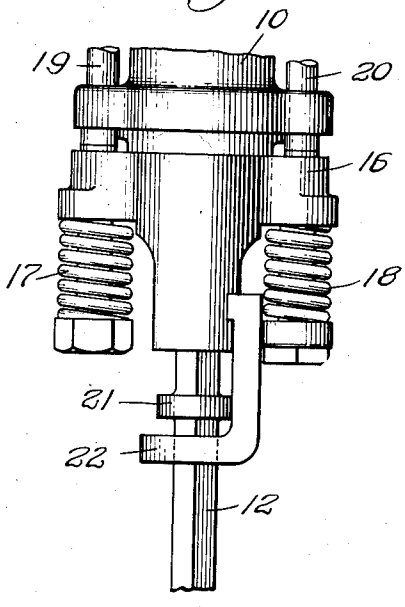
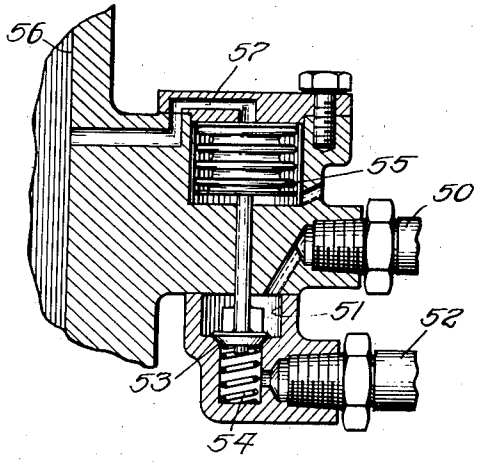


Fig. 4.



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UNITED STATES PATENT OFFICE

2,225,531

DRILL ROTATING DEVICE

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Application August 4, 1937, Serial No. 157,403

5 Claims. (Cl. 121—7)

This invention relates to an internal combustion percussive drill, and more particularly to such a drill wherein means is provided for rotating the tool.

One feature of this invention is that it provides positive tool rotating means; another feature of this invention is that the rotation is accomplished by a motor independent of the motor doing the drilling; still another feature is that rotation of the tool is effected in steps, each step or partial rotation taking place between successive impacts of a tool; other features and advantages of this invention will be apparent from the following specification and the drawings, in which:

Fig. 1 is a fragmentary vertical sectional view of an internal combustion drill embodying this invention; Fig. 2 is a transverse sectional view along the line 2—2 of Fig. 1; Fig. 3 is a side elevation of the bottom of the drill; and Fig. 4 is a fragmentary vertical sectional view of a modified form of the control means.

In order to accomplish impact drilling, as for example deep drilling in rock, it is necessary to rotate the tool in order to prevent it from jamming in the hole. Such rotation, moreover, should be accomplished between impacts on the tool, since it is practically impossible to rotate a tool at the same time that it is being driven into rock or the like. While such rotation is relatively simple in drills wherein the impacts are accomplished pneumatically, it presents serious problems in connection with an internal combustion drill. This is particularly true where the drill is of the free piston type, spring returned, since in such case there is no source of considerable power on the upstroke of the piston to effect rotation of the drill by conventional rifle bar methods.

The present invention accomplishes tool rotation in steps, between successive impacts on the tool, by a second motor independent from that doing the drilling, which motor is so controlled as to effect rotation only between impacts.

In the particular embodiment of the invention illustrated herewith in Figs. 1 to 3, an internal combustion percussive drill is shown as comprising a cylinder 10 having reciprocable therein a piston 11. This piston is adapted to impart periodic impacts to a tool 12 through an anvil 13 when the drill is operated. The drill is of the type wherein means is provided for supplying a combustible charge to the cylinder beneath the piston, where it is partially compressed on the down or working stroke of the piston, and then transferred to the combustion space thereabove; where appropriate ignition means may fire it at the desired time to drive the piston downwardly. The piston is returned by the springs 14 and 15 therebeneath in the cylinder, as shown. The general operation of such an internal combustion motor for delivering periodic impacts to the tool is not further shown or described here, since it is similar to that shown in Mould Patent 1,997,072.

A tool guide 16 is yieldingly mounted beneath the cylinder, being here shown as adjacent thereto, by springs 17 and 18 and tie rods 19 and 20 extending longitudinally of the drill. Some means for absorbing the shock of the impact is necessary when the drill is raised from working position, since then the tool does not accomplish this. The tool guide here accomplishes this function by being yieldingly or resiliently connected to the bottom of the cylinder, since when the drill is raised and the tool 12 drops until the annular shoulder 21 thereon engages the tool holder 22, the bottom of the anvil 13 rests against the tool guide and impacts delivered to the anvil by the piston 11 are absorbed by the tool guide. In order to accomplish this the tool guide, of course, moves up and down somewhat on the tie rods.

The tool guide is here shown as having mounted therein a rotatable member 23, which rotatable member has nonrotatably splined therein the tool 12, here shown as hexagonal. Ratchet means is provided for effecting step by step rotation of the member 23, here being shown as comprising teeth 24 and a cooperating pawl 25. The pawl is pivotally mounted, as by the pin 26, on a longitudinally movable member or piston 27, movement of which is accomplished by means to be hereafter described, and is urged against the teeth 24 by the spring 28. Movement of the piston or member 27 toward the rotatable member 23 operates, through interaction of the pawl and teeth, to effect a partial rotation of the member 23. This rotation, with respect to the view shown in Fig. 2, would be counterclockwise. When the piston 27 moves outwardly again the pawl returns, slips over one or more teeth 24 and is in position to effect a further partial rotation upon the succeeding inward movement of the piston 27.

The piston 27 has an enlarged portion which reciprocates within a cylinder 29, and is sealed against the walls thereof to prevent passage of fluid therearound. The piston cylinder and associated mechanism form a motor adapted to be

actuated by fluid under pressure admitted thereto through the port or opening 30. The piston carries therewith an extended stem 31, on which is slidably splined a spool valve 32. Upon admission of fluid under pressure through the opening 30 the piston 27 moves inwardly against the pressure of the return spring 33, the spool valve 32 not moving until the head 34 on the rod 31 contacts it, which is near the end of its working stroke. As soon as the spool valve moves inwardly it uncovers the annular port 35, permitting exhaust of the fluid within the cylinder 29 to the chamber 36, from which it is vented to atmosphere through the opening 37. As soon as no further fluid under pressure is supplied to the inlet opening 30 the piston 27 moves outwardly under the urging of the spring 33, the spool valve 32 now remaining in a position which keeps the outlet port 35 open until it is contacted by the head of the piston, the last part of the piston travel moving it to the position shown in Figs. 1 and 2. Thus, periodic or step by step rotation of the tool is accomplished by this motor at intervals determined by the admission of fluid under pressure thereto. Fluid under pressure, such as compressed air, is supplied from a source external of the hammer through a flexible conduit or hose 38 to control means carried on the cylinder of the hammer, and from this control means is transferred through the flexible hose 39 to the motor inlet opening 30. The control means regulating the admission of fluid under pressure to the motor is preferably located on the cylinder 10, so that it may be actuated by and in accordance with reciprocation of the piston 11, and thus some sort of flexible connection is necessary between the control means and the motor inlet, since the latter is movable with respect to the former.

The control means is here shown as comprising a valve member 40 interposed between the inlet 41 and outlet 42 of the valve chamber, through which the fluid passes on its way from the conduit 38 to the conduit 39. The fluid pressure existing in the conduit 38 is exerted against the top or upper face of the valve 40, and a spring 43 is provided to substantiallly balance this pressure. That is, the spring should have an upward thrust only a little less than the pressure exerted downwardly by the fluid on the valve, so that the actuating means connected to the valve to effect movement thereof does not have to overcome too great resistance. The valve is here shown as having a stem which extends up through packing means 44 into a chamber or cylinder 45, which chamber opens into the cylinder beneath the piston through a port 46. The cylinder 45 has therein a movable piston 47, arranged to open and shut the valve 40 in accordance with its movement. The cylinder 45 beneath the piston 47 is open to atmosphere through the vent port 48.

Downward movement of the piston 11 on its working stroke, at the end of which the impact is delivered to the tool 12, creates a pressure in the space in the cylinder therebeneath, which pressure is transmitted through the port 46 to the cylinder or chamber 45, resulting in downward movement of the piston 47 which causes the valve 40 to block transmission of fluid to the motor inlet 30. The motor thereupon exhausts, as previously described, and the rotatable member 23 is standing still when the tool 12 receives the impact from the piston. As the piston moves upwardly, however, as a result of the rebound and the urging of the springs 14 and 15, a vacuum is created in the cylinder therebeneath, and thus in the chamber 45. This results in upward movement of the piston 47, opening the passage through the control means to permit fluid under pressure to flow from the external source to the motor inlet 30 and effect inward movement of the piston 27, which in turn causes a partial rotation of the tool 12 through the means heretofore described. As soon as the piston 11 starts downward movement as a result of combustion of the charge, however, the valve 40 is again closed and the tool is again standing still when it receives the succeeding impact. Thus partial or step by step rotation of the tool is accomplished between impacts by the motor means, control being effected through the valve 40.

In the modified form of control means illustrated in Fig. 4 fluid is supplied under pressure through the conduit 50, whence it passes through the valve chamber 51 and out the conduit 52 to the motor inlet. The valve 53 and spring 54 are arranged similarly to the preceding modification, but the stem of the valve 53 is here shown as connected to the bottom plate of a Sylphon bellows 55, the interior of this bellows being open to pressure within the cylinder 56 through the port 57. The sealing means 44 may be here dispensed with, and the frictional contact between the piston 47 and the walls of its cylinder is also absent, so that considerable frictional resistance to valve movement is eliminated. Full advantage may thus be taken of the changes in pressure created in the cylinder 56 beneath the piston, to insure positive operation of the valve 43, and thus of the tool rotating means, at desired intervals.

While I have described certain embodiments of my invention, it is to be understood that it is capable of many modifications. Changes therefore in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims.

I claim:

1. An internal combustion percussive drill of the character described, including: a cylinder; a piston reciprocable therein; a tool guide resiliently mounted beneath said cylinder; a tool carried by said guide and adapted to receive periodic impacts from said piston during operation of said drill; motor means carried by said tool guide for rotating said tool; control means for said motor carried by said cylinder; and flexible means connecting said motor and said control means.

2. An internal combustion percussive drill of the character described, including: a cylinder; a piston reciprocable therein and adapted to create pressure beneath it on its impact stroke; a tool adapted to receive periodic impacts from said piston during operation of said drill; fluid motor means for rotating said tool; means for admitting to said motor fluid under pressure from a source independent of said drill; valve means controlling said admission; a chamber opening into said cylinder beneath said piston; a member movable in said chamber, in at least one direction in response to the pressure in said cylinder, and connected to said valve means to effect operation thereof; and spring means urging the valve means and member in the opposite direction, whereby rotation of said tool is effected between succeeding impacts.

3. An internal combustion percussive drill of

the character described, including: a tool; a cylinder; a reciprocable member in the cylinder adapted to impart periodic impacts to said tool during operation of said drill; a rotatable member having said tool splined therein; ratchet means adapted to effect step-by-step rotation of said last mentioned member; a fluid motor for actuating said ratchet means; a source of fluid under pressure adapted to be admitted to said motor; valve means for controlling said admission; a movable member for operating said valve means, said movable member being in a space opening into the cylinder below the reciprocable member, and actuated by fluid pressure created by movement of said reciprocable member to cause said valve means to move in one direction; and means for moving said valve means in the other direction, whereby a step by step rotation of said tool is effected.

4. An internal combustion percussive drill of the character described, including: a tool; a reciprocable member adapted to impart periodic impacts to said tool during operation of said drill; motor means for rotating said tool; control means for effecting tool-rotating movement of said motor; actuating means for the control means; spring means for moving the actuating means in one direction; and drive means connecting the reciprocable member and the actuating means to effect movement of the latter in the other direction, the connection including a passage for fluid under pressure, whereby rotation of said tool is effected.

5. An internal combustion percussive drill of the character described, including: a cylinder; a piston reciprocable therein; a tool adapted to receive periodic impacts from said piston during operation of said drill; fluid motor means for rotating said tool; means for admitting to said motor fluid under pressure from a source independent of said drill; valve means controlling said admission; a spring urging the valve means in an opening direction such as to effect operation of the fluid motor; and means open to the cylinder and actuated by pressure created on the impact stroke of the piston for moving the valve means in closing direction against the urging of the spring, whereby rotation of the tool is effected only between succeeding impacts.

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