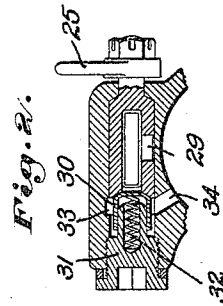
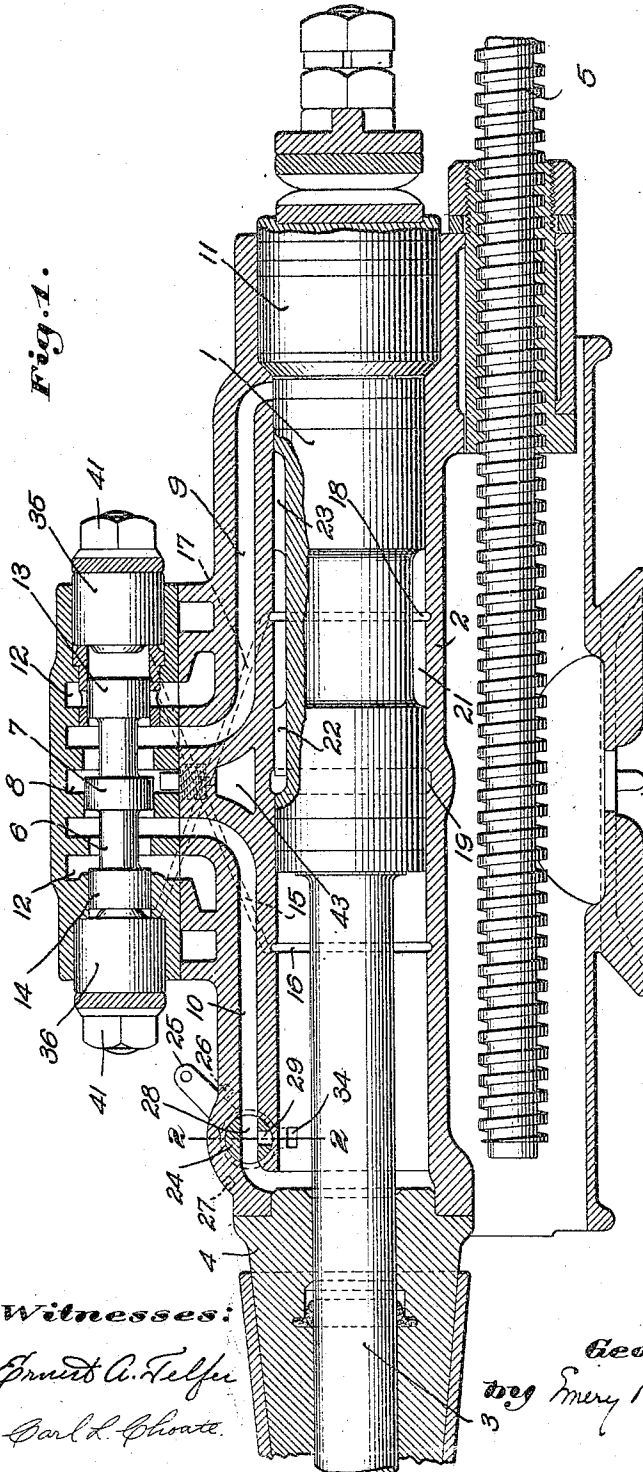


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ENGINE FOR ROCK DRILLS.
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1,063,194.

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ENGINE FOR ROCK-DRILLS.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, GEORGE H. GILMAN, a citizen of the United States, and a resident of Claremont, county of Sullivan, State of New Hampshire, (whose post-office address is Claremont, New Hampshire,) have invented an Improvement in Engines for Rock-Drills or the Like, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention relates to engines and more particularly, though not exclusively, to engines of the direct-acting type such as are used in connection with rock drills and other stone working machines.

My invention will be best understood by reference to the following description when taken in connection with the accompanying illustration of one specific embodiment thereof, while its scope will be more particularly pointed out in the appended claims.

In the drawings: Figure 1 is a sectional elevation taken through the cylinder and valve chamber of a rock drill embodying one form of my invention; and Fig. 2 is a transverse sectional elevation on the line 2-2 in Fig. 1.

Referring to the drawings and more particularly to Fig. 1, I have there shown for the purpose of illustrating the principal features of the invention, the piston 1 and cylinder 2 of a rock drill. The piston rod 3, which projects through the forward cylinder head 4 and the feed screw 5 are shown broken away, but these parts, as well as the cutting tool to which the forward end of the piston rod is attached and the tool holding chuck, may be of any suitable or well known construction and do not materially concern the herein-described invention.

Referring more particularly to the controlling valve 6 the latter is of the pressure-actuated piston type having a central head or spool 7 which alternately connects the supply chamber 8 with the ports 9 and 10, the former leading to the rear or head end of the cylinder immediately in front of the rear head or buffer 11, and the latter to the forward or tool end of the cylinder immediately behind the front cylinder head 4. The engine may be used with steam, air, or other pressure fluid. In the position of the valve

shown, the pressure fluid passes from the supply chamber 8 through the port 9 to the head end of the cylinder, acting to drive the piston forward, the port 10 being at the same time connected about the contracted or stem portion of the valve, with one end of the exhaust space 12. When the valve is reversed, the port 10 is connected with the supply chamber 8 and the head end port 9 with the opposite end of the exhaust space 12. To reverse the valve the latter is provided at opposite ends with the spools 13 and 14 which work in end chambers to which pressure is alternately admitted by the movement of the piston to throw the valve. The chamber containing the head 13 is connected by a passage 15 (see dotted lines) leading to the groove 16 in the walls of the cylinder, and the chamber containing the head 14 is connected by means of the passage 17 (see dotted lines) with the groove 18 in the cylinder walls. These grooves are alternately uncovered by the reciprocatory movement of the piston, the uncovering of a groove serving to admit pressure to that end of the valve chamber with which the said groove is connected, such admission of pressure fluid reversing the position of the valve. The fluid pressure is exhausted from that end of the valve chamber opposite the end to which pressure is admitted by means of a circumferential groove 19 in the walls of the cylinder midway the length thereof, such groove (see Fig. 1) having connection with the external atmosphere through the exhaust pipe or opening 20. The circumferential groove 19 communicates with a groove or reduced portion 21 in the walls of the piston by means of longitudinal grooves 22 and 23, so that one end or the other of the valve chamber is kept free from pressure fluid during substantially the full stroke of the piston. The spool 7 is of greater diameter than the spools 13 and 14 so that when the valve is thrown to one position or the other, for example the position shown in Fig. 1, it is there maintained by the excess pressure of the supply fluid against the central head over the pressure of the supply fluid against the smaller end head until the pressure fluid is admitted, as described, against the opposite end of the valve. This particular form of valve and the arrangement of controlling passages may be varied within wide limits,

or other forms of valves may be substituted without departing from the spirit of my invention hereinafter more fully described.

In the operation of a rock drill or the like it is frequently required to work the piston up and down in the cylinder without doing effective work and without permitting the piston to strike either the upper or the lower head, this being necessary, for example, to clear out the hole or impart proper alignment to the drill steel in the case of a deflected hole. The up or back stroke may be readily controlled on account of the weight and inertia of the tool or tools, but for the cushioning of the working stroke none of the many cushioning devices utilized therefor has been thoroughly satisfactory. In the illustrated form of tool I have provided a cushioning valve 24 located transversely the tool end port 10 and adapted to prevent the escape of fluid pressure from the forward end of the cylinder, thereby to cushion the forward or downward stroke of the tool, such valve, however, being so constructed that the pressure required to produce the necessary cushion is automatically built up and maintained. Referring to Figs. 1 and 2, the valve 24 is mounted in a chamber transversely the cylinder walls and is provided with the exterior handle 25 by means of which it may be set in the position shown in Fig. 1 against the stop 26 or turned to a position approximately ninety degrees therefrom against the stop 27. The valve is intersected by the transverse passage 28 and is also provided with the passage 29 at right angles thereto. In the position shown in Fig. 1, pressure-fluid passes freely through the transverse passage 28 to and from the forward end of the cylinder. When, however, it is desired to cushion the forward stroke of the piston, the valve is turned to its opposite position, bringing the passage 29 into registration with that portion of the port 10 leading to the valve chamber and cutting off the opposite portion of the port and the forward end of the cylinder from direct communication with the valve chamber. In this position of the valve the pressure fluid cannot escape from the forward end of the cylinder except through leakage and the piston will work back and forth incapable of delivering a full working blow to the stone. In order automatically to build up and maintain the pressure in the forward end of the cylinder, pressure fluid is permitted to enter the same at such times as the port 10 is connected with the pressure-fluid supply and when the pressure in front of the piston falls below a predetermined amount. For this purpose the valve 24 has an axial passage (see Fig. 2) communicating with the passage 29 and opening at the end thereof opposite the handle 25 whereat it forms a seat for a check valve 30. The latter is

guided upon the reduced end of the threaded plug 31, employed to close the end of the cushioning valve chamber, and is pressed against its seat by means of the coiled spring 32. When the valve lifts, it admits pressure fluid from the axial passage to a groove 33 and thence through the port 34 to the cylinder in front of the piston.

The operation of the cushioning valve is as follows: When the piston moves back on its return stroke, the controlling valve 6 has a relation which is opposite to that shown in Fig. 1. At that time the pressure fluid supply is connected to the port 10, but the latter is disconnected from the forward end of the cylinder excepting through the check valve 30. As the piston moves back the small amount of pressure-fluid trapped in the forward end of the piston expands. As soon as the pressure of the cylinder falls below the supply pressure, however, the check valve 30 lifts and permits passage of pressure fluid from the port 10 and the supply space to the forward end of the cylinder. The pressure-fluid will, therefore, be admitted through the check valve 30 until the valve 6 reverses the position and connects the port 10 to the exhaust. The pressure-fluid in front of the piston, however, being unable to escape is trapped thereat and forms a high pressure cushion checking the forward movement of the piston. The weight of the drill steels and the fact that the pressure-fluid at the top of the piston acts against the full area thereof, while at the bottom of the piston it acts against a lesser area only, causes a forward or downward movement of the piston to take place against the cushion. This movement, however, is quickly checked by the cushion and the piston is returned, this effecting the desired reciprocatory movement of the tool. The cushion thus automatically built up will also be automatically maintained for as its pressure tends to drop by reason of leakage or any other cause, the check valve will lift on the back stroke of the piston and allow the passage of an additional amount of pressure-fluid to the forward end of the cylinder. This permits the tool to be run indefinitely on the cushion without attention. Since the cushioning valve is located between the valve chamber and the cylinder and at substantially the exit point in the exhaust port from the cylinder, the clearance space allowed the cushion is reduced to a minimum. The moment the piston starts on its downward movement it meets a cylinderful of pressure fluid at pipe line pressure, which pressure-fluid must undergo increasing compression for every increment of advance by the piston. This, together with the fact that there is little or no clearance, makes it impossible for the piston to strike the lower head.

While I have herein shown and described

for purposes of illustration one specific form of the invention, it is to be understood that the same is not limited to the details of construction or relative arrangement of parts, but that extensive deviations may be made therefrom without departing from the spirit thereof.

Claims:

1. In a direct-acting engine, the combination with a piston and a cylinder having two passages leading to one end of the cylinder, of a check-valve in one of said passages adapted to admit pressure fluid to and restrict the exhaust from said end of the cylinder, and means for cutting off said cylinder end from the exhaust through the second passage while opening the cylinder to the admission through said check valve and the first passage.

2. In a direct-acting engine, the combination with a piston and a cylinder having two passages leading to one end of the cylinder, a normally inoperative inwardly opening check valve in one of said passages, and means for cutting off said cylinder end from the exhaust through the second passage, while rendering said check-valve operative.

3. In a direct-acting engine the combination with a piston and cylinder of a valve for alternately admitting pressure-fluid to, and exhausting the same from, the opposite ends of the piston, a normally inoperative check valve, and means for cutting off a cylinder end from the exhaust while opening the cylinder to the admission through the said check valve.

4. In a direct-acting engine, the combination with a piston and a cylinder having two passages leading to one end of the piston, of an inwardly opening check-valve, and means whereby one of said passages may be closed and at the same time the other opened through said check-valve.

5. In a direct-acting engine, the combination with a piston and a cylinder having two ports located at two different points longitudinally of the cylinder, of an inwardly opening check-valve for the port most remote from the end of the cylinder, and a manually operable valve for closing the other port.

6. In a direct-acting engine, the combination with a piston and a cylinder having two ports located at two different points longitudinally of the cylinder, of a normally inoperative check-valve for the port most remote from the end of the cylinder, and manually operable means for closing the other port and rendering said check-valve operative.

7. In a direct-acting engine the combination with a cylinder, of a piston, a valve, a port leading to one end of the cylinder and adapted to be connected alternately with

the admission and the exhaust through said valve, a check valve controlling communication with and opening toward said cylinder, and valve means adapted to close said port from direct communication with said cylinder and to open the said port to said cylinder through said check valve.

8. In a direct-acting engine, the combination with a piston and cylinder of a valve for alternately admitting pressure fluid to, and exhausting the same from, the opposite ends of the piston, a normally inoperative check valve adapted to admit pressure fluid to and restrict the exhaust from one end of the cylinder, and manually operable means for cutting off a cylinder end from the exhaust and simultaneously rendering said check valve operative.

9. In a direct acting engine, the combination with a piston and cylinder of a valve for alternately admitting pressure fluid to, and exhausting the same from, the opposite ends of the piston, a check valve, and a manually operable valve for cutting off a cylinder end from the exhaust while opening the same to the admission through said check valve, said check valve being carried by said manually operable valve.

10. In a direct-acting engine, the combination with a piston and cylinder, of a valve for alternately admitting pressure fluid to, and exhausting the same from, the opposite ends of the piston, a manually operable valve for cutting off one end of the cylinder from the exhaust to form a cushion for the piston when moving in one direction, and a check valve carried by said manually operable valve adapted to open said cylinder end to the access of additional pressure fluid supply to augment said cushion on the return movement of the piston.

11. In a direct-acting engine, the combination with a piston and cylinder, of a valve for alternately admitting pressure fluid to, and exhausting the same from, the opposite ends of the piston, a manually operable valve provided with passages and a check valve permitting the entrance of pressure fluid through the passages and into the cylinder end, but cutting off the exhaust of pressure fluid from said cylinder.

12. In a direct-acting engine, the combination with a piston and cylinder, of a controlling valve, a port leading from one end of the cylinder and alternately connected with the admission and exhaust spaces through said controlling valve, a check valve opening toward the cylinder space, and a valve provided with passages for permitting, when in one position, the direct admission of pressure fluid to and exhaust from said cylinder end through said port, and which in another position cuts off such direct com-

munication and establishes an indirect inward communication between said port and cylinder end by way of said check valve. valve.

- 5 13. In a direct-acting engine, the combination with a piston and a cylinder having a main port and a supplementary port leading from one end of the cylinder, of a controlling valve for controlling the admission and exhaust to and from said main
10 port, a cushioning valve provided with a main passage adapted normally to permit the admission of pressure fluid to and exhaust from the cylinder by way of said main
15 port, and provided with a supplementary passage normally out of register with said main port, manually operable means for

moving said valve into position to cut off the direct communication between the cylinder and main port through said main passage, 20 and establish an indirect communication between said cylinder and main port by way of said supplementary port, and means acting, in the latter position of said cushioning valve, to admit pressure fluid to but prevent escape of fluid from the cylinder by way of said supplementary port. 25

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

GEO. H. GILMAN.

Witnesses:

THOMAS B. BOOTH,
ROBERT H. KAMMLER.