No. 661,686. Patented Nov. 13, 1900.

A. BALL & T. OFFICER.

ENGINE FOR ROCK DRILLS.

(Application filed Mar. 22, 1900.)

(No Model.)

Fig. 1.

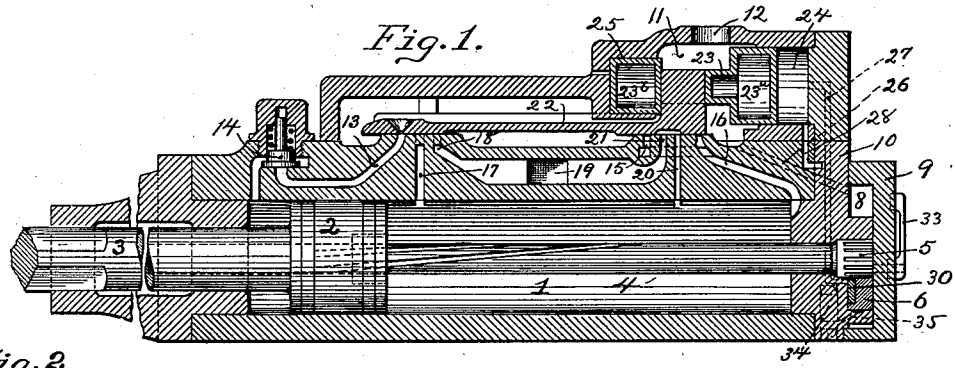


Fig. 2.

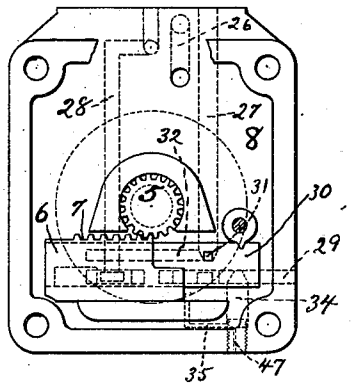


Fig. 3.

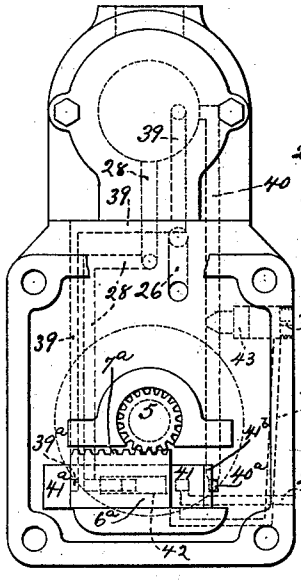


Fig. 4.

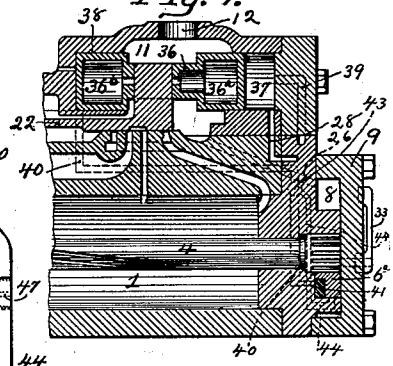


Fig. 7.

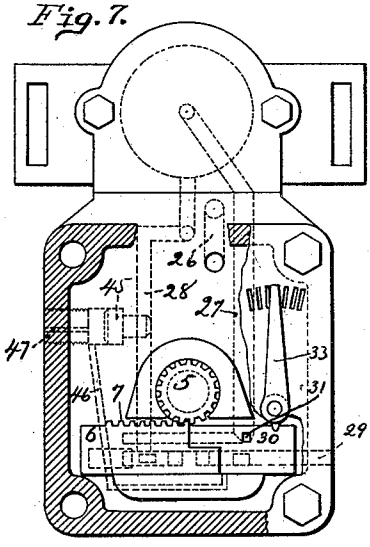


Fig. 5.

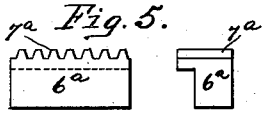


Fig. 6.

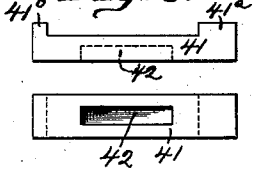
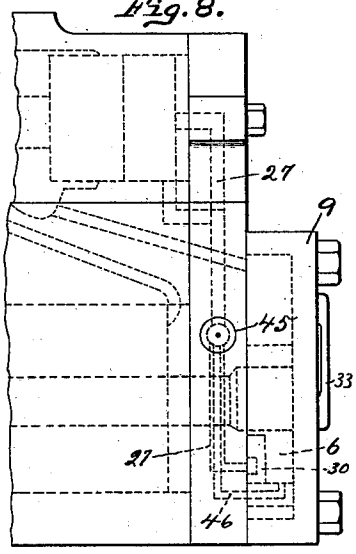


Fig. 8.



Witnesses:

Walter Famariss

Harry J. Wiseman

Inventors:

Albert Ball and

Thomas Officer

By Kay & Totten

Attorneys.

UNITED STATES PATENT OFFICE.

ALBERT BALL AND THOMAS OFFICER, OF CLAREMONT, NEW HAMPSHIRE, ASSIGNORS TO THE SULLIVAN MACHINERY COMPANY, OF SAME PLACE AND CHICAGO, ILLINOIS.

ENGINE FOR ROCK-DRILLS.

SPECIFICATION forming part of Letters Patent No. 661,686, dated November 13, 1900.

Application filed March 22, 1900. Serial No. 9,678. (No model.)

To all whom it may concern:

Be it known that we, ALBERT BALL and THOMAS OFFICER, residents of Claremont, in the county of Sullivan and State of New Hampshire, have invented a new and useful Improvement in Engines for Rock-Drills; and we do hereby declare the following to be a full, clear, and exact description thereof.

Our invention relates to direct-acting fluid-pressure engines—such, for example, as those employed for operating drills or other reciprocating tools; and has for its object to provide a simple and efficient means for so governing the speed of travel of the piston when the tool is doing no work as to avoid injury to the engine and discomfort to the user of the same, such means being readily applied to engines of the construction heretofore used without any material reorganization of the mechanism.

The type of engine to which our present invention is applicable embodies a fluid-pressure-actuated device for operating the main valve which controls the admission of air to and the exhaust of air from the main cylinder.

Our invention consists in a means for so controlling the fluid-pressure applied to the device for actuating the main valve as to regulate the supply of live fluid to the main cylinder, and thus prevent the engine from racing when it is doing no useful work. The means employed for regulating the fluid-pressure applied to the device for operating the main valve is preferably actuated by live fluid at approximately the normal working pressure.

The fluid employed for operating engines in accordance with our present invention may be either steam, air, or other gas under pressure; but for convenience of description we shall designate the operating fluid as "air," since that is the agent most generally employed in engines of this general character.

It has been proposed prior to our present invention to automatically govern the speed of the main operating-pistons of direct-acting engines by means of the air compressed in front of the piston in connection with an auxiliary valve upon which such compressed air acts, such a means being set forth in Patent No. 603,358, granted to the Sullivan Machinery Company May 3, 1898, as assignee of Albert Ball. In Patents Nos. 615,234 and 615,236, granted to the Sullivan Machinery Company December 6, 1898, on applications filed by us are set forth other means for regulating and governing the operation of pistons of engines of the type to which our present invention pertains, and reference may be had to the said patents for detailed description of such parts of the engine as are not specifically described herein.

In an application filed of even date herewith we have set forth and claimed a governing means in which live fluid at approximately the normal working pressure is utilized for actuating a governing-valve to throttle the supply of air to the main cylinder of the engine when the main piston exceeds its normal stroke. Our present invention also contemplates the employment of a governing-valve operated by live fluid at approximately the normal working pressure; but instead of throttling the supply of air to the main cylinder we propose to throttle the supply of air to, or the exhaust from, the cylinder in which the actuating-piston for the main valve operates, thus retarding the movement of such main valve, and consequently retarding the movement of the main piston.

Our invention is illustrated in the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section of an engine provided with one form of our invention. Fig. 2 is a rear end elevation of the engine, the outer cap-plate being removed in order to show the reversing-valve mechanism, the main valve, its operating device, and the casing for said parts being also removed. Fig. 3 is an end elevation similar to Fig. 2, but showing the casing for the main valve and its operating device in position and embodying a modified construction. Fig. 4 is a vertical longitudinal section of the rear end of an engine embodying the form of our invention shown in Fig. 3. Fig. 5 comprises a rear and a side elevation of the reversing-

valve, embodying the construction shown in Figs. 3 and 4. Fig. 6 embodies a plan view and a front elevation of a valve-plate that cooperates with the reversing-valve shown in Fig. 5. Fig. 7 is a view, partially in end elevation and partially in section, of an engine provided with a further modification of our invention; and Fig. 8 is a side elevation of the rear portion of the engine shown in Fig. 7.

Referring now particularly to Figs. 1 and 2, the engine comprises the following parts, which are substantially the same, except as will be specifically pointed out, as those shown and described in our Patent No. 615,236, hereinbefore referred to: The main cylinder 1 of the engine contains a reciprocating piston 2, from which projects a piston rod or stem 3, to the outer end of which is attached the drill or other tool which is operated by the engine. The rifle-bar 4, of the usual construction, is provided at its outer end with a pinion 5, which operates a reversing-valve 6 by means of a rack 7 on the upper edge thereof, this pinion and valve being located in a chamber 8, formed by a cap 9, bolted to the rear end plate 10 of the cylinder 1. The rotation or partial rotation of the rifle-bar 4 is effected by means of a nut in the piston 2 as the piston is moved back and forth in the cylinder, as is usual in engines of this character. The live air for operating the piston is admitted to an air-chest 11 through a port 12 and from the air-chest 11 through a port or passage 13 to the front end of the cylinder, a spring-actuated valve 14 being so located in this passage as to be raised by the air admitted through the port or passage 13, but preventing the return of air through that passage, and thus insuring the formation of a compressed-air cushion for the piston at the front end of the cylinder. Admission of live air from the air-chest 11 to the rear end of the cylinder is through ports 15 and 16, and the exhaust from the front end is through ports 17 and 18 and the main exhaust-port 19 and from the rear end of the cylinder through the ports 20 and 21 and the main exhaust-port 19. The valve 22 for controlling the admission and exhaust is connected to and operated by a differential piston device 23, the end 23^a of which operates in a cylinder 24, formed at one end of the air-chest 11, and the smaller end 23^b of which operates in a cylinder 25, formed in the other end of the valve-chest 11. The chamber 8 receives live air from the chest 11 through a passage 26, and air is supplied to the cylinder 24 from the chamber 8 through a passage 27. The exhaust from the cylinder 24 is through a passage 28, a bridging-groove in the reversing-valve 6, and an exhaust-passage 29, opening to the atmosphere. The plate 30, provided with a port 31 and a longitudinal groove 32, communicating therewith, is the same in construction and operation as the corresponding device shown in our Patent No. 615,236, and the same means for setting the plate in order to regulate the normal stroke of the main piston may be employed, such means being indicated at 33 in Fig. 1 and shown in part in Fig. 2. All of the parts thus far described are constructed and arranged to operate in the manner set forth in the patent just mentioned, and their operation need not, therefore, be here described. In order to govern the speed of the main piston when the tool operated thereby is doing no work, we propose to regulate the speed of the double piston 23 by the following means: A plug-valve 34, preferably having a conical or frusto-conical inner end, as indicated in the drawings, is located in such position as to be projected into the exhaust-passage 29 and thus throttle the exhaust from the cylinder 24, whereby the return of the piston 23 to the reverse position to that which it occupies in Fig. 1 of the drawings will be retarded. This valve 34 is actuated by live fluid introduced behind it through the passage 35, the opening between which and the chamber 8 is uncovered by the reversing-valve 6 when the latter is moved to a point beyond the normal limit of its movement by reason of a stroke of the main piston beyond its normal.

Referring now to Figs. 3, 4, 5, and 6, the several parts of the engine, except as hereinafter specified, are the same as in those illustrated in Figs. 1 and 2, and the description of the duplicate parts heretofore given may be read in connection with these figures. Instead of employing a differential piston device for operating the main valve 22 we here employ a double piston 36, the ends 36^a and 36^b of which are of the same diameter, as are also, of course, the corresponding cylinders 37 and 38. A passage 39 extends from the cylinder 37 to the chamber 8, and a similar passage 40 extends from the cylinder 38 to the chamber 8, the former opening into the chamber through a port 39^a and the latter through a similar port 40^a. The passages 26 and 28 are the same in location and function as the parts designated by the same reference-numerals in connection with the figures already described. For the purpose of controlling the application of fluid-pressure to the piston 36 we provide a reversing-valve 6^a, that has on its upper edge a rack 7^a for coöperation with the pinion 5 on the end of the rifle-bar 4 in the same manner as in the construction previously described; but this valve 6^a has no bridging-groove for the ports, as in the construction shown in Figs. 1 and 2. The slide-plate 41, employed in connection with the reversing-valve 6^a, is provided at its respective ends on one side with shoulders or lugs 41^a and 41^b and in the side opposite these lugs with a bridging groove or recess 42. As the reversing-valve is moved in the one direction or the other by the pinion 5 it strikes against the corresponding lug on the slide-plate 41 and moves the said plate so as to admit live air to the corresponding cylinder 37 or 38, as the case may be, through the corresponding port 39^a or 40^a

in the passage 39 or 40, at the same time closing the other of these ports. When the plate 41 is moved so as to close the port 39^a, it puts the passage 28 in communication with the exhaust-passage 29, and thus exhausts the cylinder 37 and permits the live air admitted to cylinder 38 through port 40^a and passage 40 to move the piston to its rearward position.

In order to retard the movement of the main piston when its stroke exceeds the normal, we provide a differential valve 43 for partially closing either the passage 39 or the passage 40, the valve being shown in Figs. 3 and 4 as located so as to throttle the air in the passage 40. This valve is of the differential type, because the pressure actuating it to effect the throttling of the air-supply to the cylinder 37 or the cylinder 38, as the case may be, is substantially the same as that which it throttles. This pressure of live air is applied to the rear of the valve through a passage 44, the end of this passage which opens into the chamber 8 being uncovered by the reversing-valve when the latter moves to a greater than the normal distance, as is indicated in Fig. 3. The utilization of this form of the invention may be made in connection with either of the live-air passages 39 and 40, as has already been stated, or it may be employed in connection with both of them if desired, though its utilization with one of the said passages only will probably be all that is required in any case.

Referring now to Figs. 7 and 8, the valves, ports, and passages are the same as those shown in Figs. 1 and 2, except that a differential valve 45 is employed in connection with the passage 28, leading from the cylinder 24 to the reversing-valve 6. The passage 46, leading to the space behind the valve 45, is in communication at its other end with the chamber 8 when the valve 6 moves an abnormal distance, so as to uncover such opening. The throttling action in this case is substantially the same as that in the construction shown in Figs. 1 and 2, except that it takes place between the cylinder and the reversing-valve, whereas in the construction first described the throttling takes place in the passage 29, leading from the valve 6 to the atmosphere. In each of the modifications described a small opening 47 is preferably provided from the chamber in which the throttling-valve is located to the atmosphere, in order that when the supply of live air to such chamber is cut off the air previously introduced therein to actuate the valve may exhaust therefrom and permit the return of the throttling-valve to its inoperative position.

The form and location of the parts utilized in practicing our invention may be varied from what is specifically shown and described without departing from our invention, and we therefore desire it to be understood that the invention is not limited in these respects except in so far as limitations are specifically embodied in the claims.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. In a direct-acting, fluid-pressure engine, the combination with a cylinder provided with inlet and exhaust ports, of a main valve for controlling the same, a piston working in said cylinder, a fluid-pressure-actuated device for operating said main valve, a controller for said fluid-pressure-actuated device and means for rendering said controller active when the piston exceeds its normal stroke.

2. In a direct-acting, fluid-pressure engine, a cylinder provided with inlet and exhaust ports, of a main valve for controlling the same, a main piston working in said cylinder, an auxiliary piston for operating said main valve, means for applying fluid-pressure to said auxiliary piston, a controller for said auxiliary piston and means for actuating said controller when the main piston exceeds its normal stroke.

3. In a direct-acting, fluid-pressure engine, the combination with a cylinder provided with inlet and exhaust ports, of a main valve for controlling the same, a main piston working in said cylinder, an auxiliary cylinder having inlet and exhaust ports and a piston in said auxiliary cylinder for operating the main valve, means operated by the main piston for controlling the inlet and exhaust ports of said auxiliary cylinder and means for partially closing one of said ports when the main piston exceeds its normal stroke.

4. In a direct-acting, fluid-pressure engine, the combination with a cylinder provided with inlet and exhaust ports, of a main valve, a main piston working in said cylinder, an auxiliary cylinder having inlet and exhaust ports and a piston in said auxiliary cylinder for operating the main valve, a governing-valve for said auxiliary piston and a reversing-valve and ports and passages for effecting the operation of the governing-valve when the main piston exceeds its normal stroke.

In testimony whereof we, the said ALBERT BALL and THOMAS OFFICER, have hereunto set our hands.

ALBERT BALL.
THOMAS OFFICER.

Witnesses:
FRANK A. BALL,
JOHN H. COSSITT.