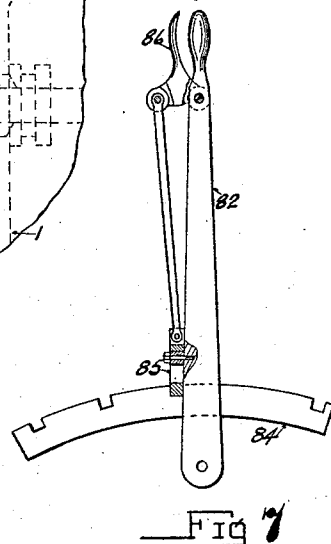
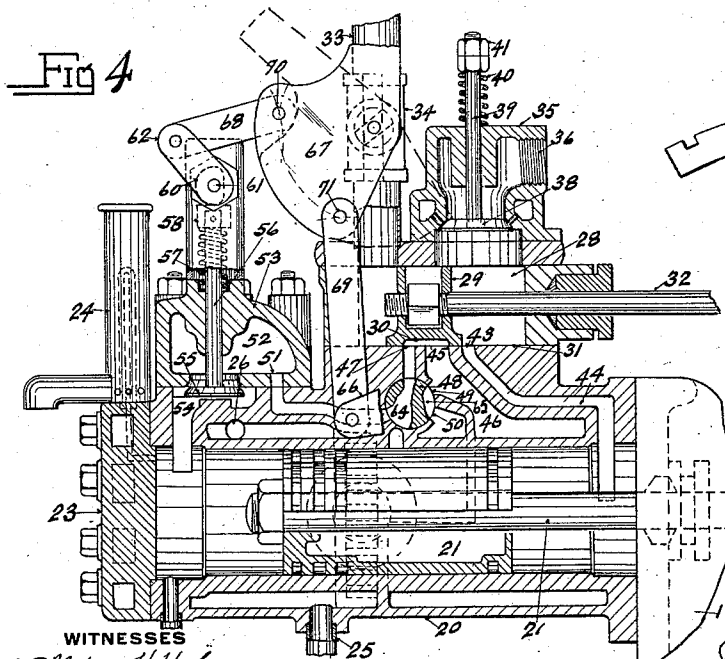
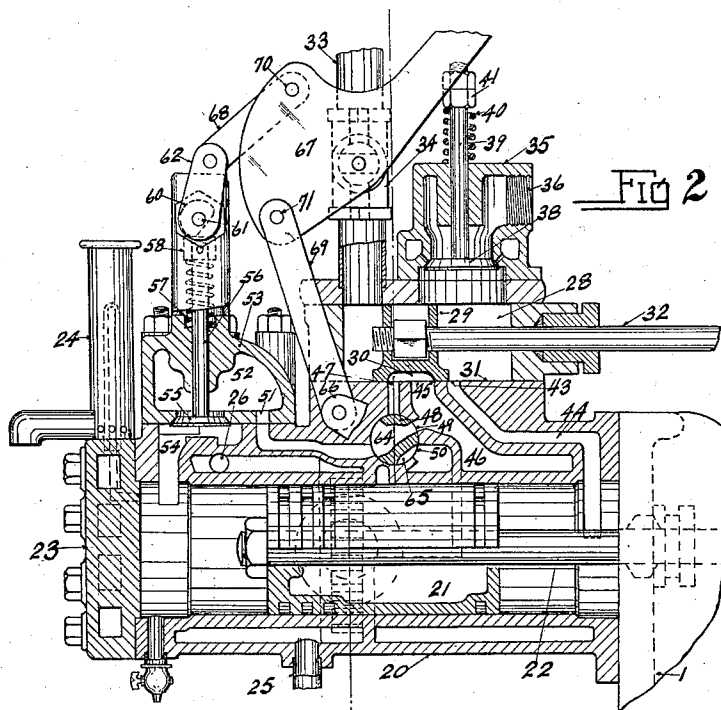


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A. BARRETT, EXECUTOR OF J. BARRETT, DEO'D.
REVERSING GAS ENGINE.
APPLICATION FILED FEB. 14, 1911.

1,065,860.

Patented June 24, 1913.

2 SHEETS—SHEET 2.



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JOSIAH BARRETT AND ARTHUR BARRETT, OF BELLEVUE, PENNSYLVANIA; ARTHUR BARRETT EXECUTOR OF SAID JOSIAH BARRETT, DECEASED; SAID EXECUTOR ASSIGNOR, BY MESNE ASSIGNMENTS, OF ONE-HALF TO SAID ARTHUR BARRETT.

REVERSING GAS-ENGINE.

1,065,860.

Specification of Letters Patent.

Patented June 24, 1913.

Application filed February 14, 1911. Serial No. 608,567.

To all whom it may concern:

Be it known that we, JOSIAH BARRETT and ARTHUR BARRETT, both residents of Bellevue, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Reversing Gas-Engines, of which the following is a specification.

This invention relates to explosive or internal combustion engines, and the object of the invention is to provide an engine of this character which can be operated not only as an internal combustion engine with an explosive mixture, but also as a pressure engine with a pressure fluid of any character, such as steam, compressed air or compressed gas, and which can be reversed and controlled like an ordinary steam engine.

The invention comprises the construction, arrangement and combination of parts hereinafter described and claimed.

In the accompanying drawings Figure 1 is in part a side elevation and in part a vertical longitudinal section of an engine embodying the invention showing the valves in the position they occupy when the engine is being operated as an explosive or internal combustion engine, and showing the reversing link mechanism in full lines in one position and in dotted lines in the reverse position; Fig. 2 is a longitudinal section through the cylinder and valve portion of Fig. 1 on an enlarged scale showing the engine operating as an explosive engine; Fig. 3 is a detail showing the slide valve in another position; Fig. 4 is a view like Fig. 2 showing the valves in the position they occupy when the engine is being operated by a fluid pressure medium just prior to the admission of the fluid pressure medium, the converting lever and fluid valve controlled thereby being in its midway position; Fig. 5 is a detail view showing the slide valve in another position; Fig. 6 is in part an elevation and in part a transverse section on the line 6-6, Fig. 1, showing the connections from the cylinder to the storage tank; and Fig. 7 is a detail view on an enlarged scale of one of the controlling levers.

In the drawings 1 indicates a suitable bed frame which is illustrated as of a common type of small steam engine, being provided

near one end with bearings for the main crank shaft 2 and with guides 3 for the usual cross head, to which is connected one end of the connecting rod 5, whose opposite end is connected to crank 6 of the main shaft 2. This main shaft is also provided with eccentrics 7 and 8 receiving eccentric straps 9 and 10 respectively, which are connected respectively by means of rods 11 and 12 to the usual reversing link mechanism, indicated at 13 and 14, of a steam engine. The usual reversing lever 15 is shown fulcrumed at 16 and having an arm 17 which is connected to the member 14 of the reversing links. The reversing links could be connected directly to the slide valve, but we show the usual rocking arm 18 fulcrumed at 19, and which is a part of the reversing link mechanism; all as is common in the reversing link mechanism of steam engines. Such reversing link mechanisms are well known and their operations and functions will be understood without further description or illustration. The function and operation of the parts so far described are that of any ordinary type of reversing steam engine, and are not modified by the improvements hereinafter described.

The cylinder of the engine is indicated at 20, this being secured to one end of the bed frame 1 by tap bolts or the like. Working in this cylinder is a piston 21 to which is connected the piston rod 22, which in turn at its outer end is connected to cross head 4. The outer end of the cylinder is closed by a suitable head 23 through which projects the ignition device, either an electric sparking device, or what is known as a hot tube, the latter being shown and indicated generally at 24. The cylinder is suitably cored for water cooling, the cooling water inlet being at 25 and the outlet at 26.

On top of the cylinder 20 is a suitable chest 28 which corresponds to the usual steam chest of a steam engine and in which there is a slide valve 29 of a common type, provided with the usual cavity 30 and sliding on seat 31 and having adjustably connected thereto a rod 32 which extends outwardly through a stuffing box in the wall of the chest and is pivotally connected to the upper end of rocking lever 18 of the link

reversing mechanism, substantially the same in all particulars as the connection of the slide valve of a steam engine with the reversing mechanism. The valve 29 is shown
 5 as a single valve and is intended as typical of all forms of steam engine slide valves, there being a plurality of valves in some engines in order to secure quicker cut off. The slide valve 29 controls certain ports in
 10 the valve seat 31 for the admission of the power mediums to the cylinder and from the cylinder to the exhaust, as will hereinafter more fully appear.

Communicating with the chest 28 is a pipe
 15 33 for the supply of any fluid pressure medium, such as steam, compressed air or compressed gases. This is controlled by any suitable throttle valve 34. On top of the chest is a small casing 35 provided at 36 with an
 20 air inlet and at 37 with the connection of the gaseous fuel thereto, either gas, oil or the like. The casing 35 has a connection through its bottom with the interior of chest 28 and this opening is controlled by a check
 25 valve 38 provided with a stem 39 which extends up through the top of the casing 35 and is surrounded by a coiled spring 40 which is interposed between the top of casing 35 and nuts 41 on the end of the valve
 30 stem, and which spring normally holds valve 38 to close the opening from casing 35 to chest 28. The valve 39 is opened by suction produced by the engine piston as hereinafter described, to admit the mixture of
 35 air and gas from casing 35 to chest 28, whence it will pass into the cylinder 20 as will hereinafter appear.

In the seat 31 is a port 43 which connects through cored passage 44 with the forward
 40 end of cylinder 20. Another port 45 in valve seat 31 communicates with a chamber 46 cored in the cylinder walls and of suitable capacity to act as an equalizer for the precompressed explosive mixture. There is also a third
 45 port 47 in valve seat 31. Cored out in the cylinder casing is a suitable cylindrical seat for a rotary converting valve 48, which controls port 47 leading from valve seat 31, port 49 leading into the chamber 46, exhaust port
 50 50, and a passage 51 leading to the outer or explosion end of the cylinder. The passage 51 does not open directly into the end of the cylinder, but indirectly through the chamber 52 in a suitable casing 53 bolted on top of
 55 the cylinder. From the chamber 52 a passage 54 leads into the outer end of the cylinder. This passage is controlled by means of an upwardly seating check valve 55 provided with a stem 56 which is surrounded by a
 60 spiral spring 57 acting between the top of casing 53 and the nut or collar 58 on said stem and serves to normally keep the valve 55 seated. In position to act against the upper end of stem 56 is a cam or eccentric
 65 60 rotatably mounted on the spindle 61 and

having connected thereto a crank arm 62 by means of which said cam can be rotated to depress the valve stem 56 against the action of spring 57 and open valve 55. Various other means may be substituted for
 70 the cam or eccentric 60 for opening the valve 55.

The valve 48 is in effect a gas and air converting valve. It is provided with a through passage 64 and with a recess 65 on one side.
 75 It is rotatable in its seat and provided with a crank or arm 66 by means of which it can be rotated.

The throttle or pressure medium valve 34, the converting valve 48 and the check valve 55 are all controlled from a single lever 67.
 80 This lever is secured to the rotary pressure medium valve 34, the spindle of the latter acting as the fulcrum of said lever. Said lever is connected by link 68 to the crank
 85 arm 62 on cam 60 and by another link 69 to the crank arm 66 of the converting valve 48. The pivotal points 70 and 71 of these links are located on the lever 67 on an arc with reference to the fulcrum of said lever
 90 for a purpose hereinafter described.

The exhaust from the cylinder 20 when the engine is running as an explosive engine, is through an annular series of ports
 95 73 which communicate by means of a cored out passage with the exhaust outlet 50. The exhaust of burned gases occurs when the piston uncovers ports 73, as is common practice with explosive engines.

In the cylinder in advance of the exhaust
 100 ports 73 is a port 74 which is connected by pipe 75 with storage tank 76, to which the pipe 33 is also connected. In pipe 75 is a check valve 77 seating toward the engine cylinder. The purpose of this is to permit
 105 the burned gases to escape while under pressure into the storage tank 76 before the exhaust 73 is opened and thereby store in tank 76 gases under sufficient pressure to operate the engine by a pressure medium, or at least
 110 to start and reverse the same. The storage tank however can be used for storing compressed air derived from a compressor of any suitable kind, or steam may be used for reversing and starting the engine. The
 115 nearer the opening 74 is to the ignition head of the cylinder the greater will be the pressure which can be stored up in tank 76, due to the fact that the gas escapes from the cylinder through pipe 75 into the tank when
 120 at a very high tension.

The levers 15 and 67 may be operated either directly at the engine or at a distance, the latter practice particularly being valuable in the oil regions where it is desirable
 125 to control the engine by a man stationed at the derrick. For the latter purpose these levers have respectively connected thereto rods 80 and 81 leading to the point from which the engine is to be controlled and
 130

there connected each to an operating lever similar to 82, each of which levers is used in conjunction with a suitable segment, such as shown at 84 for receiving a suitable spring pressed locking dog 85 operated from a hand grip 86, as is usual in machinery of various kinds, and serving to lock the operating levers in their various positions.

The operation of the engine is as follows:—We will first describe its operation when used with an explosive mixture. In this condition the several valves and levers 67 are in the position shown in Figs. 1 and 2. In this position the check valve 55 is seated by spring 57; the valve 48 is in position to connect port 49 with passage 51, and all other ports leading from the seat of valve 48 are blanked. The engine acts as a two cycle engine. On the reverse stroke of the piston, that is, its rearward or in-stroke, the suction caused thereby opens valve 38, thereby drawing in a supply of air and gas from casing 35 into chest 28, and since the slide valve has uncovered port 43, the charge passes through passage 44 into the forward end of the cylinder. On the forward or out stroke of the piston this charge is compressed and driven back through passage 44 and thence through the cavity 30 in slide valve 29, which has moved over to the position shown in Fig. 3, and thence into chamber 46, through port 49, through the passage 64 in the valve 48 and thence through passage 51 into the chamber 52. The forward or out stroke of the piston continues until the exhaust ports 73 open when the drop in pressure produced in the inner or rear end of the cylinder allows valve 55 to open and permits a charge of the mixture to pass into the rear or explosion end of the cylinder. On the return or rearward stroke of the piston this charge is compressed, causing valve 55 to close, and when fully compressed is ignited. This same reverse movement of the piston draws in another supply of air and gas into the forward end of the cylinder, and these operations are continued as long as a supply of air and gas continues. On the forward stroke of the piston a portion of the burned gases pass through pipe 75 to the storage tank 76, as heretofore described. The check valve 77 prevents the return of these gases to the cylinder.

When operating with a fluid pressure medium the position of the valves is as shown in Fig. 4. In this condition the throttle valve 34 is open, the check valve 55 is depressed by cam 60 so that it is constantly open, and the valve 48 is moved to such position that passage 64 connects port 47 in valve seat 31 with passage 51 leading to the outer end of the cylinder, while the cavity 65 of valve 48 connects port 49 with exhaust port 50. The slide valve 29 then

operates to admit the fluid pressure medium from chest 28 alternately to the two ends of the cylinder, and its cavity 30 alternately connects ports 43 and 47 with port 45 leading to the exhaust port 50. The two positions of the slide valve are shown in Figs. 4 and 5. Consequently the engine acts exactly like any ordinary double acting steam engine.

In order to reverse the engine when operating under fluid pressure it is merely necessary to reverse the link mechanism 13—14 by moving lever 15, exactly the same as when reversing any steam engine.

If it is desired to reverse the engine when acting as an explosive engine, the reversing link mechanism is moved to reverse position and then lever 67 is moved to momentarily place the valves in the position shown in dotted lines on Fig. 4, so that the fluid pressure medium momentarily actuates the piston and secures the reversing of the engine, whereupon lever 67 can immediately be put back to the position shown in Fig. 1, and the engine carried over by momentum of the fly wheel will take in a charge of explosive mixture and continue to run as an explosive engine.

In starting the engine, lever 67 is moved to the left viewing Fig. 2, whereupon the engine starts with the fluid pressure medium, exactly like any ordinary steam engine. As soon as started, the lever 67 is moved to the position shown in Fig. 1, which cuts off the supply of fluid pressure medium and places the valves in the position they occupy for the operation with gas, when the engine will continue to run as an explosive engine.

Reference has heretofore been made to the connection of links 68 and 69 to lever 67 on an arc. This is for the purpose of enabling the lever 67 to be placed to its neutral or midway position, as shown in full lines on Fig. 4, in which position check valve 55 and gas and air converting valve 48 are in the positions they occupy when the engine is operating with a fluid pressure medium, but at this time the throttle valve 34 is not yet open. The further movement of lever 67 to the left opens valve 34, but by reason of the particular location of pivotal points 70 and 71 of links 68 and 69 on lever 67, such further movement of lever 67 does not appreciably disturb the positions of cam 60 and valve 48. Consequently in the reversing of the engine when operating under gas, the link mechanism 13—14 is first reversed, the lever 67 is then brought to its midway position, thereby changing valve 48 and opening check valve 55, then a further additional movement opens valve 34, whereupon the fluid pressure is admitted with all of the valves in proper position to direct the fluid to that end of the cylinder necessary to

reverse the engine, and varying the throttle opening does not disturb the position of the other valves.

The by-pass 75 from the engine cylinder stores in reservoir 76 burned gases under sufficient pressure to serve as a starting and reversing medium of the engine, and also to entirely operate said engine for a short period of time in case of exhaustion of the gaseous fuel. When operating continuously as a fluid pressure engine some other source of fluid pressure medium must, of course, be provided.

The point of intake of the working medium, whether a fluid pressure medium or an explosive mixture, is controlled by the slide valve 29, and the movement of this can be controlled so as to vary the point of intake exactly as in any steam engine, that is by merely operating lever 15 to raise or lower the link reversing mechanism more or less as desired. This, obviously, alters the movements of slide valve 29 exactly as in any steam engine and, obviously, controls the point of intake of the fluid pressure medium to the cylinder. It also controls in practically an equal degree the amount of explosive mixture drawn into the forward end of the cylinder. Consequently the speed or power of the engine can be controlled either when operated by a fluid pressure medium or with an explosive mixture, exactly as in the case of an ordinary steam engine.

The engine described is in effect a two cycle explosive engine, and can be started, reversed and controlled with practically the same facility as an ordinary steam engine. The construction and arrangement of parts is simple, can be easily manipulated, and the parts are not liable to derangement. It is obvious that instead of the slide valve such as shown at 29 the same effect could be produced by a piston valve, or by means of a rotary valve.

In certain cases where a series of cylinders, two or more are required, as in an automobile or marine engine direct connected to a single continuous crank shaft, it may be necessary to have only one of these cylinders equipped with the reversing mechanism and converting valves. The other cylinders to be of the ordinary two cycle type which when started by the first cylinder will of course continue to run in the direction in which they are started.

What we claim is:

1. In an explosive engine, the combination of a cylinder, a reciprocating piston in said cylinder, a supply connection for the explosive mixture and connections between the ends of the cylinder so arranged that the piston on one stroke draws a charge into the outer end of the cylinder and on its next stroke compresses said charge and forces it to the explosion end of the cylinder, while

the piston is moving to the out-stroke position, a valve for controlling the admission of the mixture to the cylinder, a connection from the main shaft to said valve for operating the latter, and means in said connection for controlling the time of intake.

2. In an explosive engine, the combination of a cylinder, a reciprocating piston therein, a supply connection for the explosive mixture and connections between the ends of the cylinder so arranged that the piston on one stroke draws a charge into the outer end of the cylinder and on its next stroke compresses said charge and forces it to the explosion end of the cylinder while the piston is moving to the out-stroke position, a reciprocating valve arranged to control the admission of the mixture to the cylinder, a connection from the main shaft to said valve for reciprocating the same, and means in said connection for varying the time of cut-off.

3. In an explosive engine, the combination of a cylinder, a supply connection for the explosive mixture to one end of the cylinder, a reciprocating piston in the cylinder, connections between the ends of the cylinder whereby the movement of the piston in one direction draws a charge into one end of the cylinder and the movement of the piston in the opposite direction compresses said charge and forces it to the other end of the cylinder, a valve for controlling the admission of the mixture to the cylinder, connections from the main shaft to said valve for controlling the intake, and reversing link mechanism in said connections.

4. In an explosive engine, the combination of a cylinder, a supply connection for the explosive mixture to one end of the cylinder, a reciprocating piston in the cylinder, connections between the ends of the cylinder whereby the movement of the piston in one direction draws a charge into one end of the cylinder and the movement of the piston in the opposite direction compresses said charge and forces it to the other end of the cylinder, a reciprocating valve for controlling the admission of the mixture to the cylinder, connections from the main shaft to said valve for reciprocating the same, and reversing link mechanism in said connections.

5. In an engine, the combination of a cylinder, a supply connection thereto for an explosive mixture, another connection thereto for a fluid pressure medium, a valve for regulating the time of intake of both of said mediums to the cylinder, and constantly operative connections from the main shaft for actuating said valve.

6. In an engine, the combination of a cylinder, a connection thereto for an explosive mixture, another connection thereto for a fluid pressure medium, a valve controlling the admission of both of said mediums to

the cylinder, constantly operative connections from the main shaft to said valve for actuating the same, and means in said connection for varying the time of intake to the cylinder.

7. In an engine the combination of a cylinder, a connection thereto for an explosive mixture, another connection thereto for a fluid pressure medium, a valve for controlling the admission of both of said mediums to the cylinder, constantly operative connections from the main shaft to the engine for actuating said valve, and reversing link mechanism in said connections.

8. In an engine, the combination of a cylinder, a connection for a fluid pressure medium thereto, a connection for an explosive mixture thereto, a constantly operative valve for controlling the admission of both of said mediums to the cylinder, and reversing mechanism in the actuating means for said valve.

9. In an engine, the combination of a cylinder, a chest connected thereto, connections for a fluid pressure medium and for an explosive mixture to said chest, a reciprocating valve in said chest arranged to control the admission of both of said mediums to the cylinder, and constantly operative means for actuating said valve from the reciprocation of the main piston.

10. In a two-cycle explosive engine, the combination of a cylinder, a reciprocating piston therein, and a valve actuated from the reciprocation of said piston and arranged on the in-stroke of the piston to admit an explosive mixture to the outer end of said cylinder and on the out-stroke of the piston to open a continuous passage for the explosive mixture from the outer end of the cylinder directly to the explosion end thereof.

11. In a two cycle explosive engine, the combination of a cylinder, a valve actuated from the reciprocation of the main piston and arranged in one position to admit the explosive mixture to one end of the cylinder and in another position to connect the two ends of the cylinder, whereby the explosive mixture is driven to the explosion end of the cylinder, and means in the actuating mechanism of said valve for varying the time of closing of intake.

12. In a two cycle explosive engine, the combination of a cylinder, a valve actuated from the reciprocation of the main piston and arranged in one operation to admit the explosive mixture to one end of the cylinder and in another position to connect the two ends of the cylinder, whereby the explosive mixture is driven to the explosion end of the cylinder, and reversing link mechanism in the actuating mechanism for said valve.

13. In an engine, the combination of a cylinder, a connection for a fluid pressure

supply, a connection for an explosive mixture supply, a valve actuated from the reciprocation of the main piston for controlling the admission of both of said mediums to the cylinder, and another valve arranged in one position to connect the two ends of the cylinder for the explosive medium and in another position to connect both ends of the cylinder with the power medium source and to the exhaust.

14. In an engine, the combination of a cylinder, a chest thereon, supply connections to said chest for an explosive medium and for a fluid pressure medium, a valve actuated from the reciprocation of the main piston for controlling the intake of said mediums to the cylinder, a gas and air converting valve arranged in one position to connect the two ends of the cylinder and in another position to connect the chest with the explosion end of the cylinder and the exhaust port from the chest with the exhaust outlet from the cylinder.

15. In an engine, the combination of a cylinder, a chest thereon, supply connections to said chest for an explosive medium and for a fluid pressure medium, a valve actuated from the reciprocation of the main piston for controlling the intake of said mediums to the cylinder, a gas and air converting valve arranged in one position to connect the two ends of the cylinder and in another position to connect the chest with the explosion end of the cylinder and the exhaust port from the chest with the exhaust outlet from the cylinder, a check valve in the passage from the converting valve to the explosion end of the cylinder, and a lever controlling the converting valve.

16. In an engine, the combination of a cylinder, a chest thereon, a fluid pressure connection and an explosive medium connection to said chest, a valve in the chest controlling ports leading to the opposite ends of the cylinder, connections for operating said valve from the reciprocation of the main piston, a converting valve controlling the connection from the chest to the explosion end of the cylinder and the connection to the exhaust, a check valve in the passage from said converting valve to the explosion end of the cylinder, and means controlling said check valve, said converting valve and the fluid pressure supply throttle valve.

17. In an engine, the combination of a cylinder, connections for both a fluid pressure and an explosive mixture to said cylinder, a valve controlling the fluid pressure supply, a valve arranged to vary the connections from the source of supply to the cylinder, a check valve in one of said connections, a lever controlling the fluid pressure supply, said check valve and said converting valve, and connections between said lever and said valves arranged to fully open

the check valve and to fully move the converting valve before opening the fluid pressure valve and by further movement to open the latter without disturbing the former two
5 valves.

18. In an engine, valve mechanism so arranged that in one position thereof the engine operates as a pressure engine, and in the other position thereof the engine operates
10 as an internal combustion engine, the said valves being arranged to be moved from the one position to the other and vice versa without stopping the engine, and lever mechanism for moving said valve mechanism
15 from one position to another and to actuate the pressure medium admission

valve, said lever mechanism being so arranged that it places the valve mechanism in position for admitting fluid pressure medium to the engine before opening the fluid
20 pressure medium admission valve, and by a further movement in the same direction controls the position of the fluid pressure medium admission valve without changing the position of said valve mechanism. 25

In testimony whereof, we have hereunto set our hands.

JOSIAH BARRETT.
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Witnesses:

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."