C. B. PAGE.

TWO-CYCLE ENGINE.

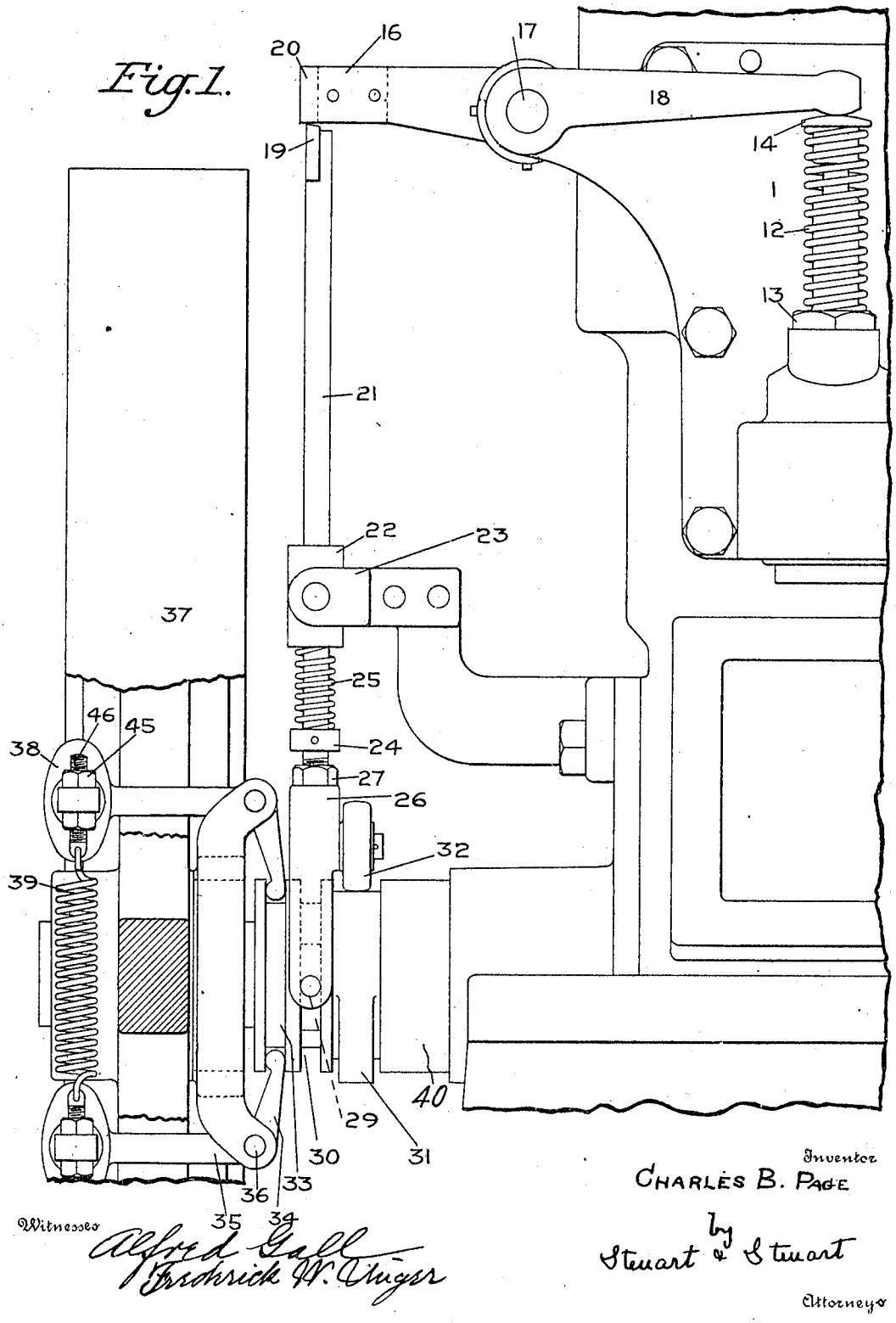
APPLICATION FILED OCT. 17, 1907.

956,993.

Patented May 3, 1910.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses

Alfred Gall

Frederick W. Unger

Inventor

CHARLES B. PAGE

by Stuart & Stuart

Attorneys

ANDREW B. GRAHAM CO. PHOTO-LITHOGRAPHERS, WASHINGTON, D. C.

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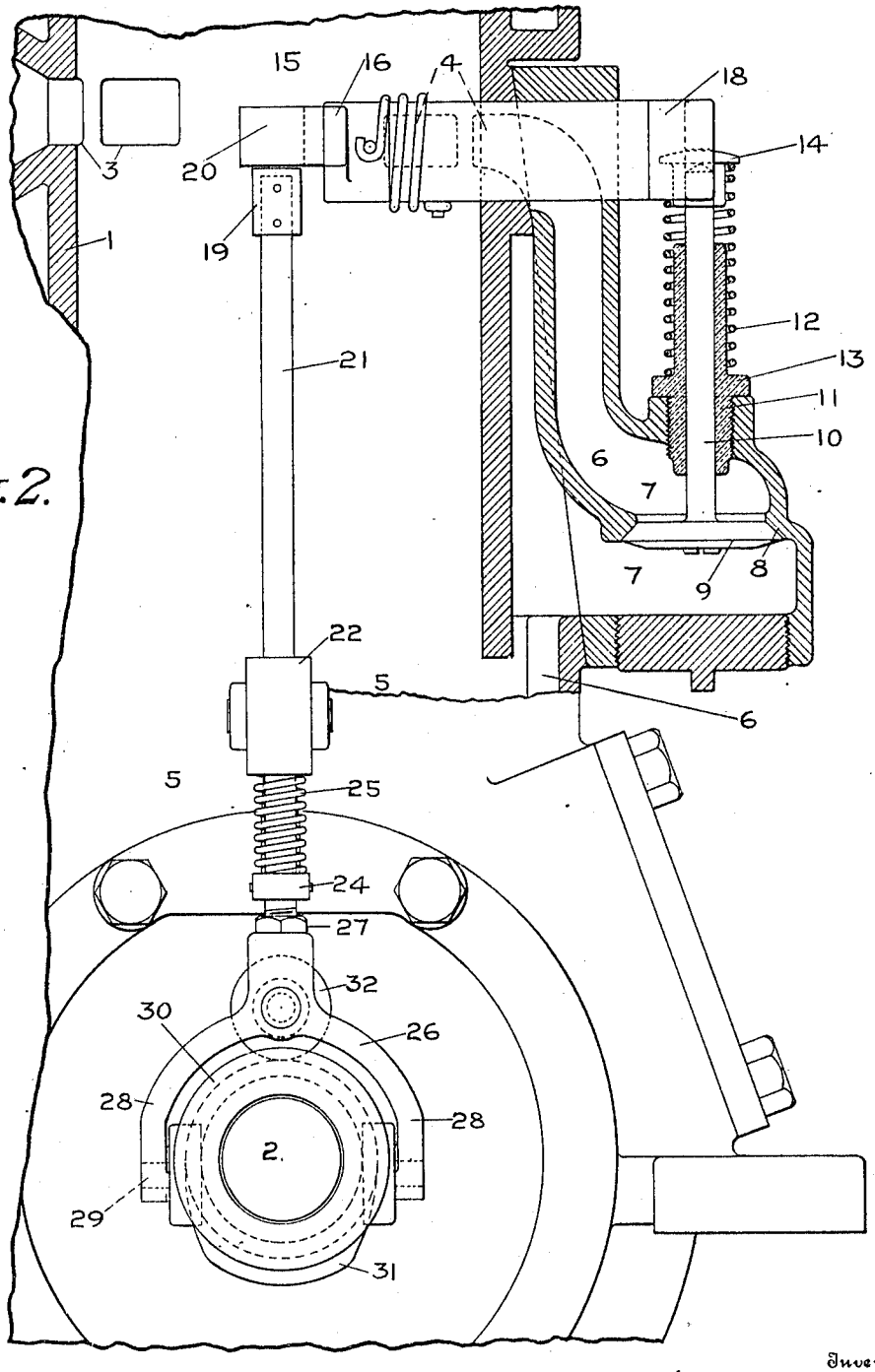

Fig. 2.

Witnesses
Alfred Gall
Frederick W. Unger

Inventor
CHARLES B. PAGE
by
Stuart & Stuart
Attorney

ANDREW B. GRAHAM CO., PHOTO-LITHOGRAPHERS, WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

CHARLES B. PAGE, OF BALTIMORE, MARYLAND.

TWO-CYCLE ENGINE.

956,993. Specification of Letters Patent. Patented May 3, 1910.

Application filed October 17, 1907. Serial No. 397,889.

To all whom it may concern:

Be it known that I, CHARLES B. PAGE, citizen of the United States of America, residing at the city of Baltimore, State of Maryland, have invented certain new and useful Improvements in Two-Cycle Engines, of which the following is a specification.

The present invention relates to two-cycle engines and has for its object the production of means for governing an engine of this type adapted to regulate the speed of the engine without reducing its efficiency.

Another result obtained by my invention is the production of a device, which is regular and positive in its operation, requiring little attention during long periods of use.

While the mechanism herein set forth regulates the speed by controlling the supply of fuel and air to the cylinder, the volume or quantity of the individual charges is not varied. When the speed of the engine increases beyond certain prescribed limits, the governor acts on the valve gear, which normally admits a charge to the cylinder or combustion chamber once during each revolution, and places it in an inoperative position. During this revolution no charge is admitted to the cylinder, and no explosion takes place. So long as the speed is maintained above the limit to which the governor is set, the valve gear is inoperative, and the admission valve remains closed. When the speed is reduced to that which the governor is adjusted to maintain, the valve gear is returned to its normal position and an explosion takes place during each revolution. This method of governing has an important advantage over that by which the charge is varied, in that it maintains the efficiency,—that is, the amount of power obtained from a given amount of fuel. As all gas engines are designed to give the maximum efficiency with a certain charge, varying the charge reduces the efficiency, but by entirely omitting the charge the fuel which would by the other method be consumed at reduced efficiency is saved. Another advantage is, that back firing, due to slow combustion, becomes less frequent when the charge is maintained constant.

The increased regularity and positiveness of operation of my valve gear is attained partly by features of construction to be later described, and partly by the placing of the admission valve. This valve, which is normally maintained closed by a spring, opens against the pressure of the compression chamber only, and is never subject to the pressure of the combustion chamber, is in the passage-way between the compression chamber and the cylinder, where it is not subject to the heat of combustion.

Referring to the drawings,—Figure 1 is an elevation of a two-cycle engine, showing the valve operating mechanism and governor. Fig. 2 is a vertical longitudinal cross-section of the engine taken through the valve chamber and transfer passage.

The engine to which the invention is applied is of the two-cycle type, that is, the air and fuel instead of being admitted to the cylinder at a pressure less than atmosphere, are supplied under greater pressure than atmosphere. By this means every other stroke becomes a working stroke. The cylinder (1) is shown as vertically disposed and contains the usual reciprocating piston and piston rod, by means of which the work performed in the cylinder is transmitted to the horizontal shaft (2). The walls of the cylinder are apertured at (3) to form an exhaust port for the burned gases and at (4) slightly below or back of the exhaust port to form an inlet port for the air and fuel. The latter are compressed by any convenient means, in this instance the piston performs this office during its backward stroke, compressing the fuel and air in the crank case or compression chamber (5) from which it is supplied to the inlet port by the transfer passage (6), which leads to this port from the compression chamber. This passage is enlarged intermediate of its length to form a valve chamber (7) having a conical valve seat (8), and a puppet valve (9) having a conical face adapted to coöperate with the seat. The valve and seat are so disposed that the valve opens against the pressure of the supply. The valve stem (10) is mounted in sliding bearings (11) on the engine frame, and a helical spring (12) engaging at one end a shoulder (13) on the stem bearing and at the other end a nut (14) on the stem tends to maintain the valve closed.

The valve is opened against the pressure of the spring and that of the gas in the compression chamber to admit fuel to the combustion chamber (15) by means of a lever intermediately pivoted at (17) and having two substantially horizontal arms, one of which (18) rests on the nut (14) on the upper end of the valve stem, and at the other

(16) is provided with a transversely extending actuator block (20). A hardened knife edge (19) mounted on the upper end of a vertically sliding rod (21) guided by the rocking bearing (22) engages the block. The bearing (22) is provided with laterally extending trunnions journaled in the bracket (23) on the engine frame. Secured to the rod (21) below the bearing sleeve (22) is a collar (24). A helical spring (25) encircles the rod, and is compressed between the bearing (21) and the collar (24), giving the rod a downward tendency. The lower extremity of the rod (21) is screw threaded and engages a tapped hole in the upper extremity of a bifurcated member (26) and is secured therein by means of a lock nut (27). The extremities of the arms (28) of the bifurcated member are provided with fingers (29) inwardly disposed and engaging a groove (30) in the hub of a cam (31), which is keyed to the shaft (2) and adapted to slide longitudinally thereon. Coöperating with the face of the cam (31) is a roller (32) mounted on the bifurcated member (26). A second circumferential groove (33) in the hub of the cam (31) is engaged by the inwardly disposed radial arms (34) of bell crank levers (35) pivotally mounted at (36) on the fly-wheel (37). The governor weights (38) are mounted at the extremities of the horizontal arms of the bell crank levers. A spiral spring (39) the tension of which is adjustable by means of a nut (45) and screw (46), connects the weights and tends to maintain the cam in its normal position resting against the shoulder (40) by imparting to the weights an inward tendency contrary to centrifugal force.

In the operation of the device, when the engine is running at normal speed, the valve (9) actuated by the lever (16 and 18), the rod (21), the follower (32) and the cam (31), is opened once in each revolution of the crank shaft to admit mixed air and fuel under pressure from the compression chamber to the cylinder. In this connection it should be noted that as the admission port is below, or behind the exhaust port, the supply-passage cannot be opened to the combustion chamber until the exhaust port is opened; therefore, as the pressure in the compression chamber is greater than that of the atmosphere, the hot gases are restrained from entering the transfer passage to heat and burn the admission valve. Also the valve is never subject to combustion pressure and a comparatively weak spring is sufficient to maintain it closed.

When the speed of the engine exceeds that which is deemed desirable, determined by the adjustment of the governor spring, the centrifugal tendency of the weights overcomes the pressure of the spring (39) and the levers (35) acting on the groove (33) in the hub of the cam (31) move that cam to the left (as seen in Fig. 1). The sides of the groove (30) engage the pins (29) of the bifurcated member (26) and thereby swing the rod (21) and the bearing (22) about the trunnions, so that the knife edge (19) moves out of engagement with the coöperating block (20) of the lever (16). When the rod (21) makes its next upward traverse, actuated by the cam (31), the block (20) being out of engagement with the rod, the actuator lever (16 and 18) is not moved, and the valve (9) remains closed. It is obvious that the admission valve will not be opened so long as the governor is in the position described. Therefore, the friction of the engine and the load must cause the speed to decrease. As the speed decreases, the governor weights are moved toward the axis of the fly-wheel by the spring (39), the cam is returned toward its normal position, and the knife edge (19) being again brought under the block (20), the lever (16) actuated by the rod (20) through the cam (31) is given a full oscillation, and the valve (19) is opened to its normal capacity, admitting a full charge of air and fuel to the combustion chamber.

The charge consumed by the engine at each working stroke is a constant. In governing, instead of varying the size of the charge when the governor acts to regulate the speed, no charge is admitted and no explosion takes place. As has been previously pointed out, this gives increased economy, as the fuel which would be burned to poor advantage in a reduced charge is saved, and as the mixture is maintained constant, back firing is rendered less frequent.

Having thus described my invention, what I claim and desire to secure by Letters Patent is,—

1. In a two-cycle engine, an exhaust port, an admission port behind the exhaust port, a compression chamber, a passage from the compression chamber to the admission port, a puppet valve in the passage opening toward the compression chamber, a valve gear normally opening the valve at each revolution, including a cam, a cam follower carried by a sliding rod, a pivotally mounted sliding bearing for the rod, a valve actuating member, a hit and miss connection, one member of which is carried by the sliding rod and the other by the valve actuating member, and a governor acting when the engine reaches an abnormal speed to move the cam and the cam follower, oscillating the sliding rod, moving the hit or miss gear out of contact, thereby placing the valve gear in in-operative position.

2. In a two-cycle engine, a cut-off valve in the transfer passage, valve gear normally adapted to open the valve at each revolution, including a cam, a sliding rod mounted to

oscillate about a transverse axis a cam follower carried by the rod, an actuating member normally engaged by the rod to open the valve at each revolution and means actuated by a change of speed for sliding the cam in the direction of its axis, thereby oscillating the sliding rod and moving it out of engagement with the actuator block.

3. In a two-cycle engine, a cut-off valve in the transfer passage, valve gear adapted normally to open the valve at each revolution, including a cam, a sliding rod mounted to oscillate about a transverse axis a cam follower, carried by the rod, a hit or miss gear, one member of which is carried by the sliding rod, and means actuated by the change of speed for sliding the cam axially thereby oscillating the sliding rod and placing the gear in in-operative position.

4. In a two-cycle engine, a cut-off valve in the transfer passage opening against supply pressure, valve gear normally operating to open the valve at each revolution, including a rotating cam, a sliding rod mounted to oscillate about a transverse axis a cam follower carried by the rod, and a hit or miss gear, one member of which is carried by the sliding rod and means actuated by change of speed for moving the cam thereby oscillating the lever, and placing the gear in in-operative position.

Signed by me at Baltimore, Maryland, this 16th day of October, 1907.

CHARLES B. PAGE.

Witnesses:
T. A. LEE,
NEWTON HALL.