J. B. BROWN.

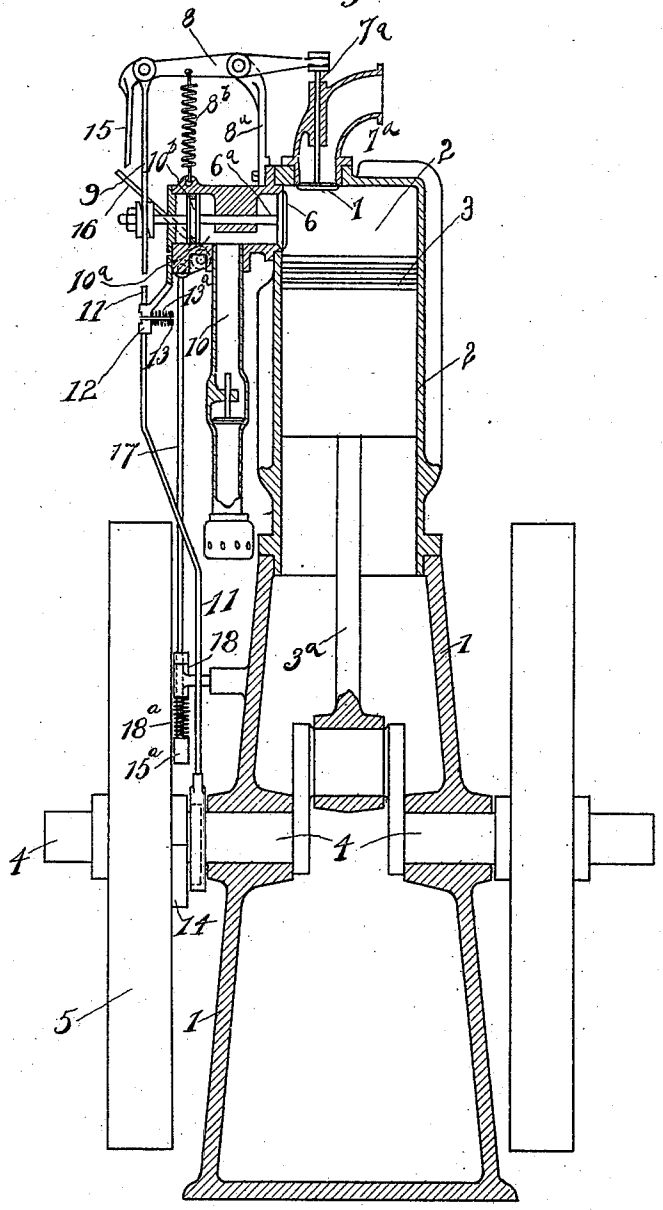
EXPLOSIVE ENGINE.

APPLICATION FILED MAR. 4, 1908. RENEWED NOV. 2, 1910.

977,779. Patented Dec. 6, 1910.

3 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

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3 SHEETS—SHEET 2.

Fig. 2.

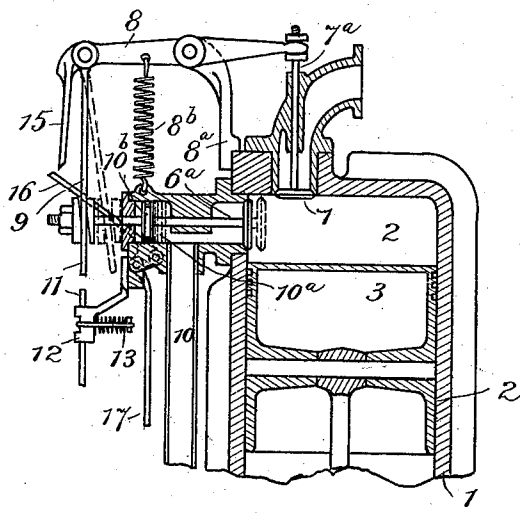
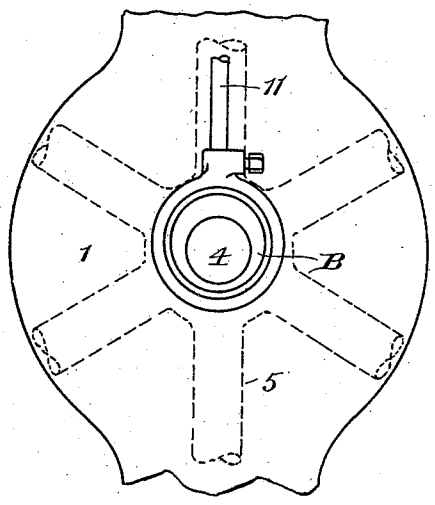


Fig. 3.



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3 SHEETS—SHEET 3.

Fig. 4.

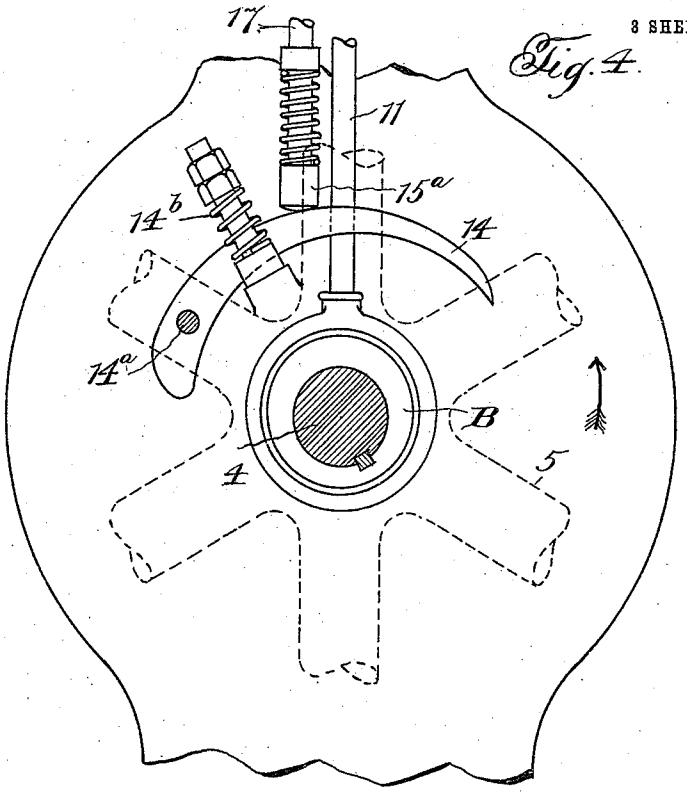
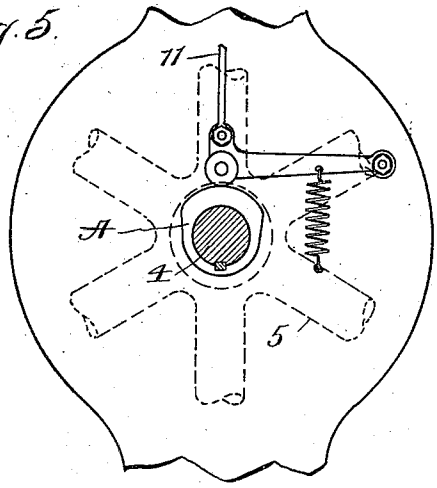


Fig. 5.



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UNITED STATES PATENT OFFICE.

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EXPLOSIVE-ENGINE.

977,779. Specification of Letters Patent. Patented Dec. 6, 1910.

Application filed March 4, 1908, Serial No. 419,219. Renewed November 2, 1910. Serial No. 590,385.

To all whom it may concern:

Be it known that I, JESSE B. BROWN, a citizen of the United States, residing at Belding, in the county of Ionia and State of Michigan, have invented certain new and useful Improvements in Explosive-Engines, of which the following is a specification.

This invention relates to explosive engines.

The object of the invention is to provide novel means for operating the inlet and exhaust valves and regulating the speed of the engine.

More particularly, the invention has reference to that type of engines having mechanically operated valves, and includes positive means for governing the exhaust valve and at the same time controlling the supply valve, and comprehends in connection with said means the regulation of the speed of the engine.

Novel details in the construction and arrangement of parts will be more particularly pointed out in the specific description following, which for a clear understanding of the invention should be considered in connection with the accompanying drawings forming a part hereof, and wherein a preferable embodiment of the invention is disclosed for the purpose of illustration.

In the said drawings, Figure 1 is a front elevation of an engine with my improvements applied, parts being shown in section; Fig. 2 is a sectional view showing the valve mechanism enlarged; Figs. 3 and 5 are side elevations showing modifications of the operating mechanism; and Fig. 4 is a side elevation disclosing the automatic governing mechanism.

Referring now more particularly to the drawings, wherein like reference characters designate corresponding parts throughout the several views, 1 designates the frame of an engine, having connected thereto, a cylinder 2.

3 is a power piston, 3^a the connecting rod and 4 the crank shaft upon which is mounted the balance wheel 5, as is usual in this type of engines.

6 is the inlet valve and 7 the exhaust valve. Secured to the latter and extending without the casing is a valve stem 7^a operatively connected at one end to an elongated lever 8 which latter is in turn pivotally connected to a downwardly projecting operating rod 9. The lever 8 is preferably prolonged beyond the point of connection and the operating lever 9 is preferably bent at an angle so as to form a downwardly extending projection which is preferably made of such a length that when the valve 7 is in a closed position a line passing through the pivotal support of the lever 8, the extremity of the projection 15, and the pivotal support of the lever 16, will form substantially a right angle, but it is evident that the details of this construction may be materially modified without departing from my invention. The lever 8 is pivotally supported intermediate its ends on a bracket 8^a projecting upwardly from the cylinder 2, and the spring 8^b secured respectively to the lever 8 and said frame 1 normally tends to hold the valve 7 to its seat.

10 is an elongated chamber extending longitudinally of the cylinder and communicating with the transverse chamber 10^a and mounted to one side of the connection between said chambers and within the transverse chamber is a piston 10^b connected to move with the stem 6^a of the valve 6. The said stem 6^a extends through and without the chamber 10^a and is joined to the operating rod 9 adjacent its lower end in a manner permitting the rod to have relative sliding movement.

11 is the actuating rod having at its lower end a connection with the crankshaft in a manner to be hereinafter described and permitting reciprocating movement to said rod, which latter, it will be noted, is when the rod 9 is in normal position and the inlet valve closed, in alinement with said rod 9 and will engage the same to impart upward movement to the latter. The parts are so arranged that the engagement between the rods 9 and 11 takes place just as the piston is starting on its upward stroke, and the exhaust valve remains open during the whole of the upward stroke of the piston. The rod 11 is slidably mounted in a bracket 12 secured to the frame 1. The seat in said bracket for the rod 11 is open whereby the rod is capable of lateral movement and a spring pressed binding link 13 normally holds the link to said seat. A spring 13^a is mounted between the bracket 12 and a cap or washer 12^b, and said cap or washer has a slot adapted to receive the end of the link 13. A wedge member 12^c with a series of notches is inserted between the rod 11 and the link 13 and by engaging said link 13 in the different notches of the wedge 12^c an adjustment of the spring is obtained.

Assuming now that the rod 11 is given a constant reciprocating movement by means of a cam (A Fig. 5) or eccentric (B Fig. 3) on the crank shaft 4 and the rods 9 and 11 are in alinement the actuating rod 11 as it rises will strike the operating rod and open the exhaust valve 7. On the contrary, if the inlet valve 6 is open the operating rod, by reason of its connection with the stem 6^a will be out of alinement and the rod 11 will pass by the said operating rod 9 without striking it. As the valve 6 closes the rod 9 will abut against the rod 11 and force it out of position, the spring 13^a yielding and tending to draw the rod 11 back to its seat in the guide. Now as soon as the movement of the cam or eccentric permits the rod 11 to descend, the closing of the valve 6 is effected by the pressure of the gas inside the cylinder on the valve 6 and on the piston 10^b.

It is evident that by regulating the tension of the spring 13^a you likewise regulate the degree of resistance to the closing of the valve and the proportion of the charge forced into the auxiliary chamber 10, thereby regulating the degree of compression and consequently the force of the explosion. The parts are so constructed and arranged that the valve 6 will be kept closed by the force of the explosion and can only open at each alternate revolution of the engine. The cam or eccentric on the shaft 3 is so adjusted as to impart upward movement to the rod 11 at the same time that the piston moves upward but slightly in advance thereof so as to open the exhaust valve 7 on the return after each explosion since at this time the inlet valve will be closed and the rods 9 and 11 in alinement. When the next upward movement of the rod 11 commences, however, that is, after taking in a new charge, the inlet valve 6 will be open and the rod 9 out of alinement with it and the rod 11 will, therefore, pass thereby as above described without opening the exhaust valve.

Suitable means may be provided for preventing the formation of a vacuum behind the piston 10^b such as would preclude the opening of the valve 6. In the instance illustrated, it will be observed that the piston stem 6^a is devoid of packing beyond the piston 10^b with the result that the chamber outside of the piston acts as a dash pot and does not materially resist the opening of the valve but only moderates the jerk that it might otherwise give. The fitting being loose and devoid of packing, prevents any serious vacuum formation.

In addition to the means before referred to for controlling the speed of the engine, by controlling the force of the explosion, it is found desirable to introduce a supplementary governing mechanism for automatically governing the actuation of the lever 8. and consequently regulating the speed of the engine by causing it to miss explosions. Said means comprises a governing cam applied directly to the balance wheel or by any other means caused to revolve with the engine shaft. This cam when the speed of the engine increases, beyond the normal, operates through the medium of intermediate connections, to lock the lever 8, in its raised position, thereby maintaining the exhaust valve 7, open and preventing the drawing into the cylinder of a new charge. This governing mechanism comprises a segmental shaped member or cam, 14, pivoted at one end, 14^a, preferably to one of the spokes of the balance wheel 5, but which may be mounted in any desired way so as to revolve with the engine shaft; a spring 14^b connecting respectively with said governing cam and wheel, tending to hold the cam inward; a friction roller, or pin, 15^a, mounted at the lower end of a rod, 17, which passes slidably through a guide 18, mounted on a frame of the engine; a lever 16, preferably L shaped, pivotally mounted intermediate to its extremities on the frame of the engine, and having one extremity pivotally connected to the rod 17 and the other adapted to engage with the extremity of the rod 15. The rod 17 is normally kept pressed downward by a spring 18^a but if the speed of the engine increases beyond the normal, the extremity of the cam will move outward and will strike the friction roller on the end of the rod 17 thus raising the lever 16 at substantially the same time as the exhaust valve is opened by the rod 9, so that the extremity of the lever 16 will engage with the extremity of the projection 15, and prevent the valve 7 from closing in time to take in a new charge and this condition will continue until the speed again drops to the normal, when the lever, 16, will drop to the position shown in Fig. 1 and the engine will again act in the normal manner, taking a charge at each alternate revolution.

It being noted that the balance wheel 5 revolves in the direction indicated by the arrow in Fig. 4, the cam 14 will be forced outward by centrifugal force due to its inertia, since in its normal position the point of the cam is in advance and slightly outside of the bar 14^a.

What I claim is—

1. In an explosive engine, having a main cylinder with an inlet port and valve and an exhaust port and valve, an operating rod for the exhaust valve, and an actuating rod operatively connected with a cam or eccentric on the engine shaft, and means whereby said actuating rod will be separated from the operating rod when the inlet valve is open, but is adapted to contact with said rod when the inlet valve is closed the relative positions of the rods being governed by the position of the inlet valve.

2. In an explosive engine, a main shaft having a cam thereon, an actuating rod having at its lower end a cam lever engaging directly with said cam, an inlet valve for the engine, an exhaust valve for the engine, an operating rod for the exhaust valve and means whereby the actuating rod may move relative to and with said operating rod, according to the movement of the inlet valve.

3. In an explosive engine, a main cylinder having an inlet valve, an exhaust valve, an operating rod for the latter, a reciprocating rod adapted to move into and out of contact with and actuate said operating rod to open and close the exhaust valve according to the opening and closing of the inlet valve, and a yieldable guide for the actuating rod permitting the same to move out of alinement with the operating rod and permitting the inlet valve to close when the rods are out of alinement.

4. In an explosive engine, a main cylinder, an inlet valve, an exhaust valve, an operating rod for the latter, an actuating rod for the exhaust valve, and slidable connection between the stem of the inlet valve and said operating rod whereby independent reciprocating movement may be imparted to the operating rod and exhaust valve without disturbing the position of the inlet valve.

5. In an explosive engine, a main cylinder, an inlet valve, an exhaust valve, an operating rod for the latter, an actuating rod for the exhaust valve, and slidable connection between the stem of the inlet valve and said operating rod whereby independent reciprocating movement may be imparted to the operating rod and exhaust valve without disturbing the position of the inlet valve, and means for maintaining the actuating and operating rods in position to hold the exhaust valve open when the speed of the engine exceeds the normal.

6. In an explosive engine, the combination of a main cylinder having an inlet and exhaust valve, an operating rod for the latter operatively connected with the inlet valve to move therewith and have independent relative movement, a reciprocating rod for the operating rod arranged normally in line with the operating rod whereby it will actuate the latter to open and close the exhaust valve, and means whereby upon the opening of the inlet valve the operating rod will be moved with said valve and out of the path of the reciprocating rod.

7. In an explosive engine, the combination of a main cylinder having an inlet and exhaust valve, an operating rod for the latter operatively connected with the inlet valve to move therewith and have independent relative movement, a reciprocating rod for the operating rod arranged normally in line with the operating rod whereby it will actuate the latter to open and close the exhaust valve, and means whereby upon the opening of the inlet valve the operating rod will be moved with said valve and out of the path of the reciprocating rod, and a yieldable support for the actuating rod permitting the same to move laterally by the closing of said inlet valve.

8. In an explosive engine, the combination of a main cylinder, an inlet valve and exhaust valve, an operating rod for the exhaust valve, an actuating rod for the operating rod adapted to reciprocate and impart movement to the operating rod to open and close the exhaust valve, one of said rods having an operative connection with the inlet valve whereby according to the movement of the latter the rods will be alternately brought into and out of alinement.

9. In an explosive engine, the combination of a main cylinder, an exhaust valve, an operating lever connected to said exhaust valve, a revolving wheel and a swinging governor, comprising a cam pivotally mounted so as to revolve with said shaft, a lever having one extremity adapted to engage with the extremity of said operating lever, and the other operatively connected to one extremity of a rod, the other extremity of which is adapted to engage with said cam.

10. In an explosive engine, the combination of a main cylinder, an exhaust valve, an actuating rod, a revolving wheel, and a governor comprising a cam shaped swinging arm pivoted at one end to the wheel and adapted to engage said rod, the swinging arm being constructed and arranged whereby it is forced outwardly by the centrifugal force due to its inertia.

11. In an explosive engine, the combination of a main cylinder, an exhaust valve, an operating lever connected to said exhaust valve, a revolving wheel and a swinging governor comprising a cam pivotally mounted so as to revolve with said wheel, the free end of the cam being normally in advance in the rotation of the wheel, a lever adapted to engage the operating lever and a rod operatively associated with said lever adapted to engage with said cam.

In testimony whereof I affix my signature, in presence of two witnesses.

JESSE B. BROWN.

Witnesses:

W. D. BALLOU,

R. A. REYNOLDS.