No. 682,583. Patented Sept. 10, 1901.

S. W. ZENT.

MULTIPLE CYLINDER EXPLOSIVE ENGINE.

(Application filed Aug. 10, 1897.)

(No Model.) 2 Sheets—Sheet 1.

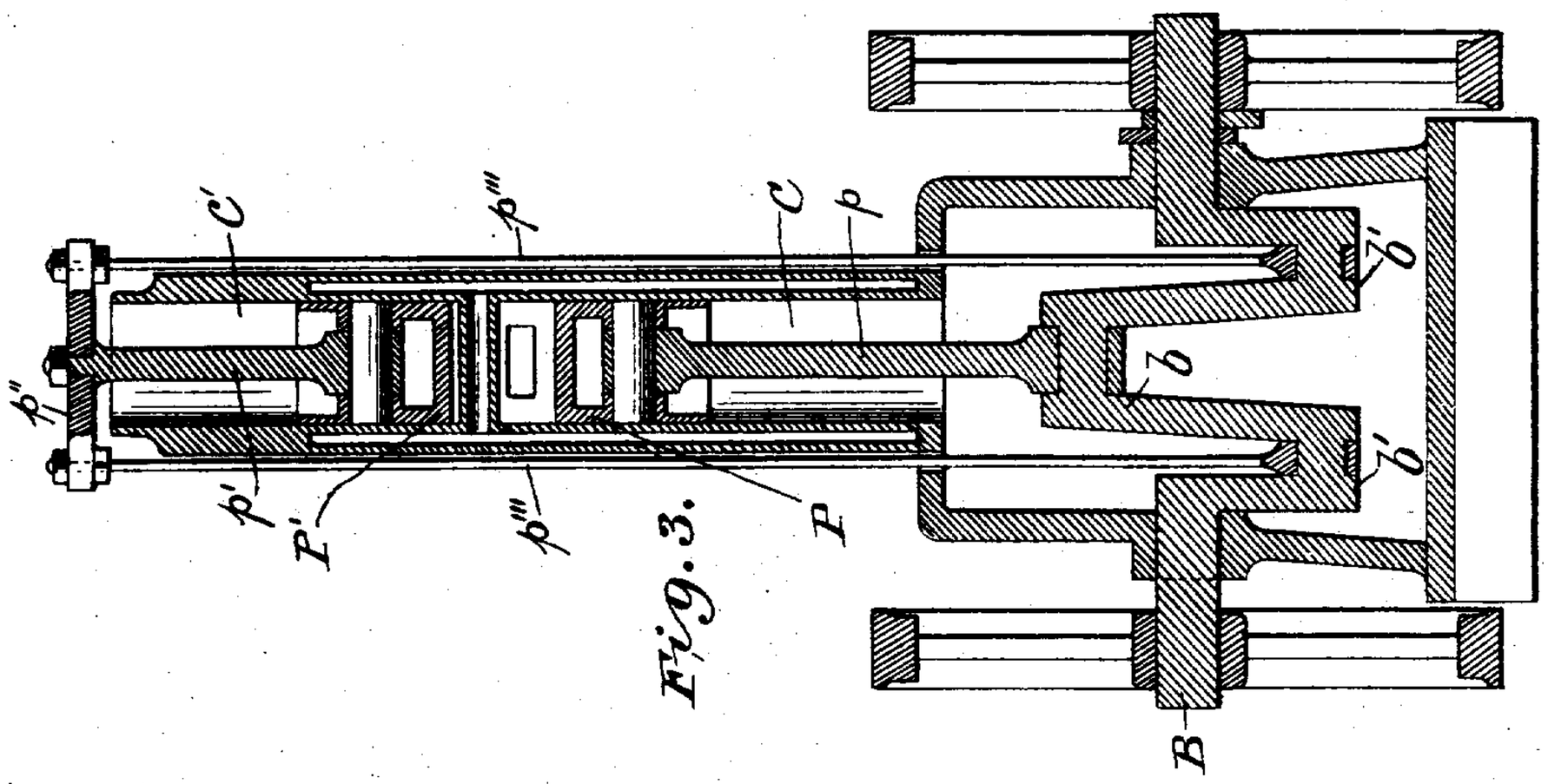

Fig. 3.

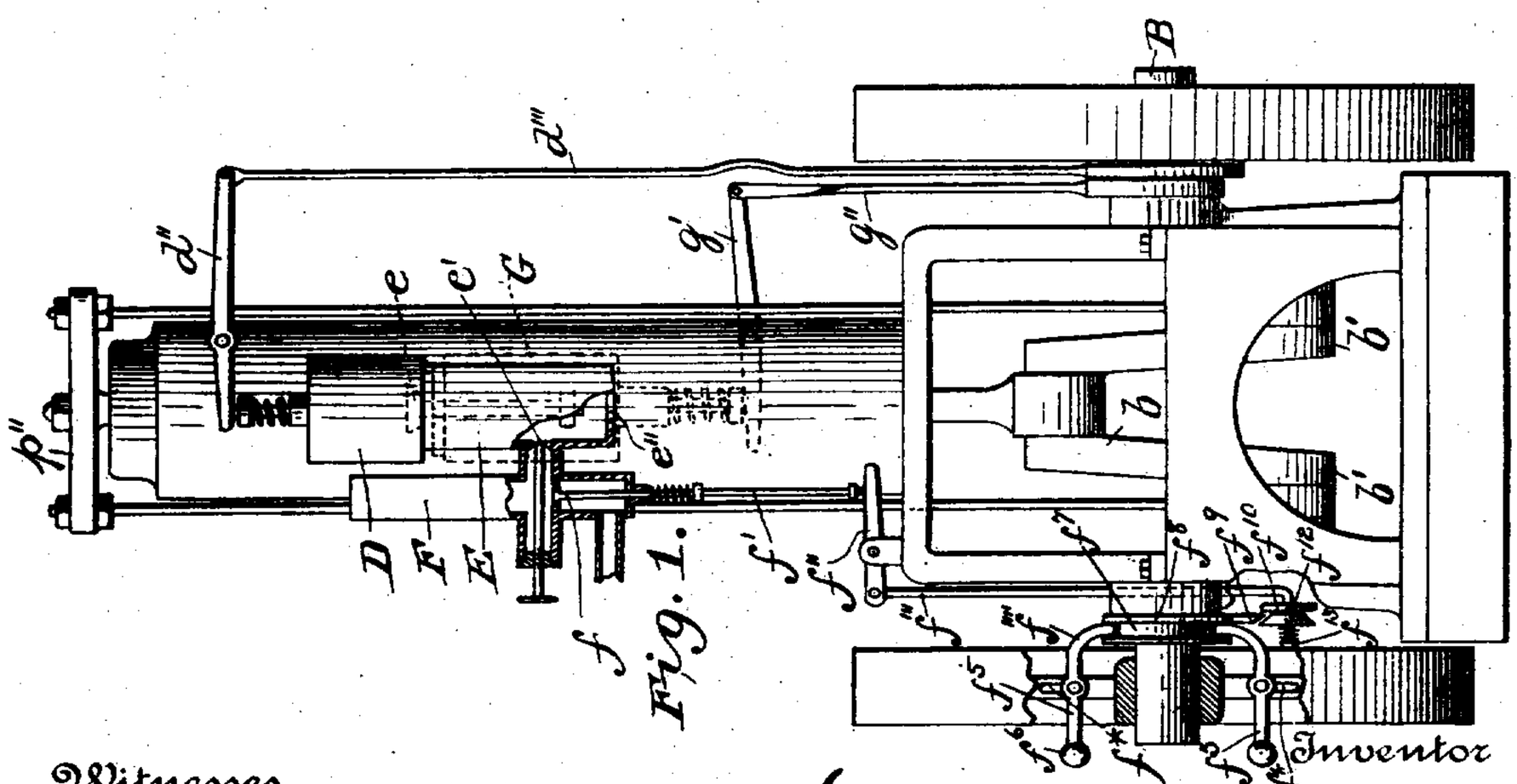

Fig. 1.

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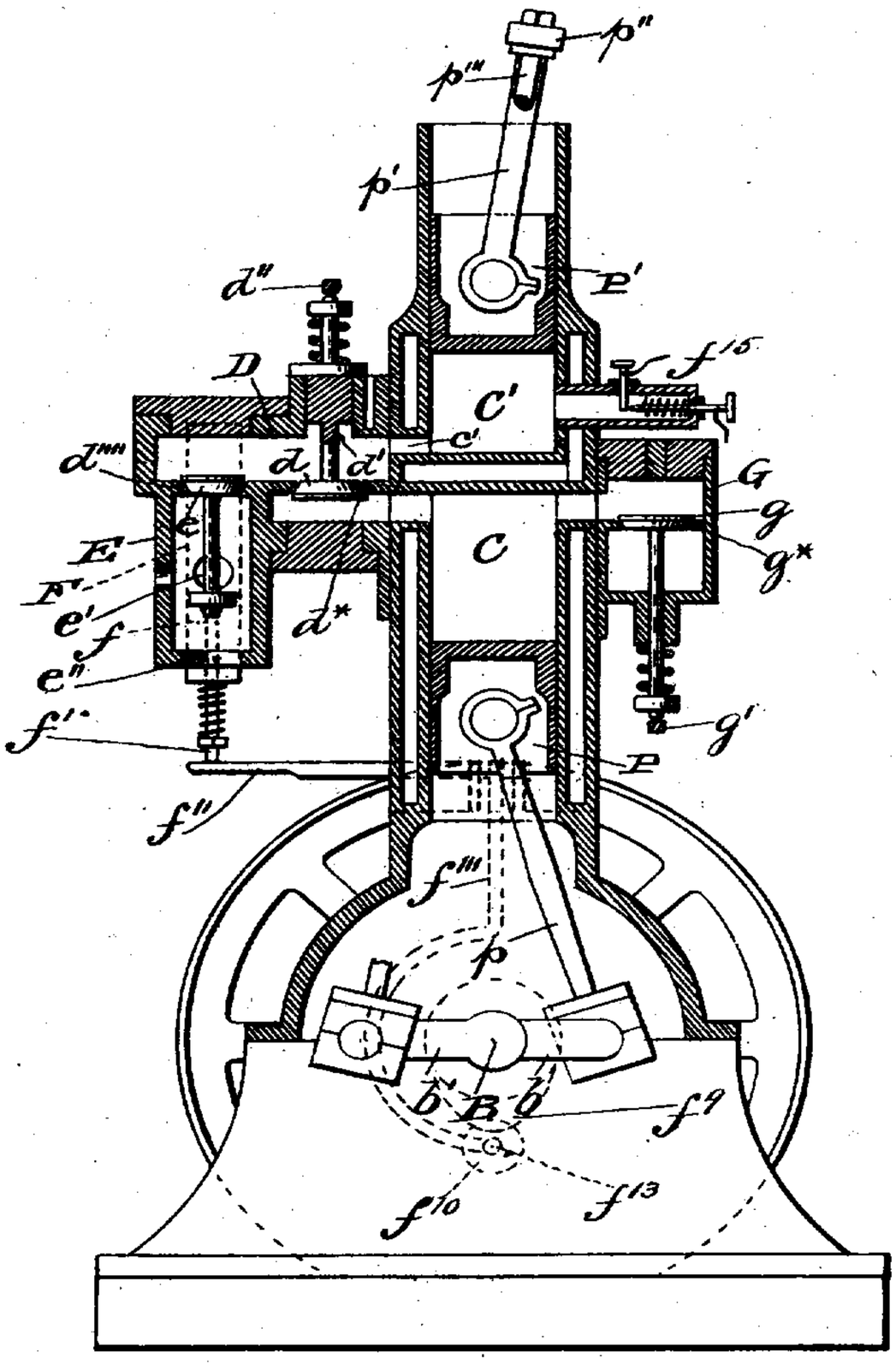
Fig. 2.



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UNITED STATES PATENT OFFICE.

SCHUYLER W. ZENT, OF MARION, OHIO.

MULTIPLE-CYLINDER EXPLOSIVE-ENGINE.

SPECIFICATION forming part of Letters Patent No. 682,583, dated September 10, 1901.

Application filed August 10, 1897. Serial No. 647,752. (No model.)

To all whom it may concern:

Be it known that I, SCHUYLER W. ZENT, a citizen of the United States, residing at Marion, in the county of Marion and State of Ohio, have invented certain new and useful Improvements in Gasolene-Engines, of which the following is a specification.

My invention relates to gas-engines, and has for one of its objects to provide an engine having two cylinders so connected that the explosion shall be simultaneous in both.

Another object of my invention is to provide an engine in which the explosion takes place with every revolution.

Another object of my invention is to provide an engine in which the explosion in the two cylinders shall be balanced.

Another object of my invention is to provide an engine in which the motion of the two pistons shall be balanced.

These objects I accomplish in the manner and by the means hereinafter more fully described in detail, and particularly pointed out in the claims, reference being had to the accompanying drawings, in which the same reference-letters indicate like parts in all the figures.

Figure 1 is a front elevation of my invention. Fig. 2 is a side central vertical section of same. Fig. 3 is a front central vertical section of same.

My invention consists of an engine having two cylinders C and C′, placed upright one above the other, with a partition C^2 between them. The upper and lower cylinders C C′ and pistons P P′ are shown of the same size; but, if desired, the upper cylinder C′ and piston P′ may be made of greater length than the lower cylinder and piston for the purpose of allowing the piston in the upper cylinder a longer stroke than the piston in the lower cylinder to allow sufficient time for the residue or charge in the upper cylinder to burn out. The pistons P and P′ are fitted to the cylinders C and C′, respectively. The piston-rod p is pivotally connected with the crank b of the crank-shaft B, and the piston-rod p' is rigidly secured to or made integral with the cross-piece p'', to the ends of which cross-piece p'' the connecting-rods p''' p''' are pivotally connected. The other ends of said connecting-rods p''' p''' are pivotally connected with the cranks b' b' of the crank-shaft B. The said cranks b', which, as before stated, are connected to the piston P′, are longer than the crank which connects with piston P, and in view of this fact the piston P′ has a greater length of stroke than the piston P, and this difference in stroke allows sufficient time for the residue of the charge in the cylinder C′ to burn out before the piston P′ arrives at the end of its stroke. Just at the head of the upper cylinder C′ is a small opening c' into the valve-chamber D, in which is the spring-valve d, having the stem d' operated by the arm d'', which is pivotally mounted on the outside of said engine and worked by the rod d''', which is connected with an eccentric on the crank-shaft B, so adjusted that the arm d'' will open the valve d a little before the pistons P and P′ have made their full travel toward the partition or head C^2 of the cylinders C and C′, and close the valve d as the pistons P and P′ begin to withdraw from the point at which the piston-heads are nearest together and almost instantly after the explosion has taken place. The valve-chamber D has an opening d'''' into the valve-chamber E, in which the suction-valve e works. The chamber E has a needle-valve e' for the admission of gasolene and an opening e'' in its bottom for the admission of air. The gasolene is admitted either by pump or gravity. The admission of gasolene through the needle-valve e' is controlled by a spring-valve f in valve-chamber F, connected with the rod f', which is lifted by the arm f''', one end of which is connected with the rod f'''', having a roller f^{10} at its lower end. The point f^9 on the sleeve f^8 of the governor is adapted to contact with the roller f^{10} and move it downward at each revolution of said sleeve when the engine is moving at its normal speed; but should the speed become excessive the sleeve will be drawn toward the balance-wheel and beyond or out of line with the roller f^{10}, and consequently would fail to contact with the same, and as this would stop the operation of the valve f the gasolene-feed would stop, and consequently the speed of the engine would be decreased and the governor would move the point f^9 of the sleeve again into contact with the pulley f^{10}, and thereby again operate the valve f and resume the feed-

ing of gasolene. Just at the head of the cylinder C is on one side an opening connected with the valve-chamber D when the valve d is opened, and on the other side is an opening into the exhaust-valve chamber G, in which is a spring exhaust-valve g, operated by the arm g', which is pivotally mounted on the outside of said engine and one end of which is connected by the rod g'' with an eccentric on the crank-shaft B and so adjusted that the valve g is opened when the pistons P and P′ are farthest apart. An electric sparker f^{15} or the ordinary firing-tube in use on gasolene-engines may be used to explode the gasolene in the upper cylinder C′.

The operation of my improved engine is as follows: The parts of said engine being in the relative positions shown in Figs. 1 and 2, the engine is started, which causes the pistons to move away from each other, the upper piston P′ moving upward and the lower piston P moving downward, and as the upper piston P′ moves upward it lifts the valve e by suction from its seat and draws the mixed gasolene and air through the opening or port d'''' at the top of chamber E, thence through the opening c' into the upper cylinder C′. As the pistons move toward each other, the upper piston P′ moving downward and the lower piston P moving upward, the rod d''' is moved upward by means of the eccentric at the lower end thereof mounted on shaft B, which causes the end of arm d'' to press the valve d downward off of its seat, and when the upper piston has made about three-quarters of its downward stroke it will have forced part of the charge of gasolene through the opening or port d^* into the lower cylinder C. The electric sparker is then operated, and the port d^* being open the explosion of the gasolene in the cylinders C C′ is simultaneous, and thereby a balanced or equal pressure is exerted on each of the pistons and the force of said explosion drives the pistons away from each other or toward the open ends of the cylinders. Immediately after the explosion the valve e closes by gravity, and the valve d is closed by the end of arm d'' releasing its pressure thereon, and the gas which remains in the cylinder C forces the piston P downward. Then the rod g'' is moved downward by means of the eccentric on the lower end thereof mounted on shaft B, which causes the end of arm g' to press the valve g upward off its seat and permits the said gas in the cylinder C to exhaust through the port g^*, after which the said port is closed again by the valve g. The small residue of gas left in the cylinder C′ after the explosion burns out and creates a vacuum therein which, in connection with the suction of the upper piston, raises the valve e again from its seat and draws in a new charge of gasolene into the cylinder C′ through the port d'''' and opening c'. Then as the pistons P and P′ return the same operation is repeated. The valve controlling the admission of gasolene to the engine is opened more or less frequently, accordingly as the speed of the fly or balance wheel is increased or diminished, until when the engine is working at full power and the fly-wheel is making the greatest number of revolutions it is opened with every revolution of the fly-wheel. The balance-wheel governor f'''' consists of two arms f^5 f^5, pivotally secured near their centers in elongated slots f^* in two opposite spokes of the balance-wheel, said arms f^5 f^5 having weights f^6 f^6 on their outer ends and their inner ends bent toward the crank-shaft B and moving in an annular groove f^7 in a sleeve f^8, which slides on the crank-shaft B. Said sleeve f^8 is furnished with a projecting point f^9, which as the governor f'''' moves the sleeve f^8 strikes the pulley f^{10}, regulated by the spring f^{12} and secured by the nut f^{13} on the rod f'''.

No claims have been made in this application for the speed regulator or governor, as it has been reserved for a separate application.

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

1. In a gas-engine, two coacting cylinders placed in alinement one above the other, pistons in said cylinders, a channel connecting said cylinders, a valve in said channel adapted to open the same to admit the combustible charge supplied to the upper cylinder into the lower cylinder and keep said channel open until the explosion of said combustible charge, and to close said channel immediately after said explosion, and means of igniting the combustible charge in said upper cylinder, substantially as shown and described.

2. In a gas-engine, two coacting cylinders placed in alinement one above the other, pistons working in said cylinders and connected with the crank-shaft of said engine, a valve operated by the suction of the piston in said upper cylinder on its forward stroke, said valve admitting the combustible charge to said upper cylinder, said piston in said upper cylinder opening said valve and drawing said combustible charge into said upper cylinder by suction; a channel connecting said cylinders, a valve adapted to open said channel and admit the combustible charge into the lower cylinder and to leave said channel open until said combustible charge is exploded, and to close said channel immediately after said explosion; and means for igniting said combustible charge in said upper cylinder, substantially as shown and described.

3. In a gas-engine, two coacting cylinders one above the other provided with a partition between them, pistons working in said cylinders from opposite directions, the upper piston connected with the driving-shaft by a cross-head and connecting-rods, and the lower piston by a piston-rod, a port adapted to establish communication between the interiors of said cylinders, a spring-controlled valve seated in said port adapted to be opened as

the pistons approach the partition, a suction-valve operated by the upper piston and adapted to admit gas to the upper cylinder, a spring-controlled valve adapted to admit the gasolene into the supply-reservoir, a governor to operate the same, a spring-controlled exhaust-valve adapted to be opened as the pistons start on their forward stroke, and means for igniting the combustible charge, substantially as shown and described.

4. A gasolene-engine provided with upper and lower cylinders in alinement with each other, each provided with a piston, a gasolene-receiving chamber, a spring-valve for controlling the feed of gasolene thereto, and means for operating said valve once at every revolution of the engine, an air and gasolene mixing chamber connected to said receiving-chamber and provided with a gravity-valve, and means for operating said piston and raising said gravity-valve by suction and thereby admitting gasolene to the upper cylinder, a valve for establishing communication between said cylinders, and a valve for exhausting the products of combustion from the lower cylinder, substantially as shown and described.

5. In a gas-engine provided with two cylinders one above the other, a partition separating the same, provided with a valve for establishing communication between said cylinders, pistons working from opposite ends of the cylinders toward said partition, a cross-head connected with the upper piston, and connecting-rods connecting said cross-heads with cranks on the driving-shaft, substantially as shown and described.

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

SCHUYLER W. ZENT.

Witnesses:
CLAY WHITE,
L. REBER.

Corrections in Letters Patent No. 682,583.

It is hereby certified that in Letters Patent No. 682,583, granted September 10, 1901, upon the application of Schuyler W. Zent, of Marion, Ohio, for an improvement in "Multiple-Cylinder Explosive-Engines," errors appears in the printed specification requiring correction, as follows: Page 1, line 87, the reference letter "*f'''* " should read *f''*, and page 3, line 35, the compound word "cross-heads" should read *cross-head;* and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 24th day of September, A. D., 1901.

[SEAL.]

F. L. CAMPBELL,
Assistant Secretary of the Interior.

Countersigned:
F. I. ALLEN,
Commissioner of Patents.

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