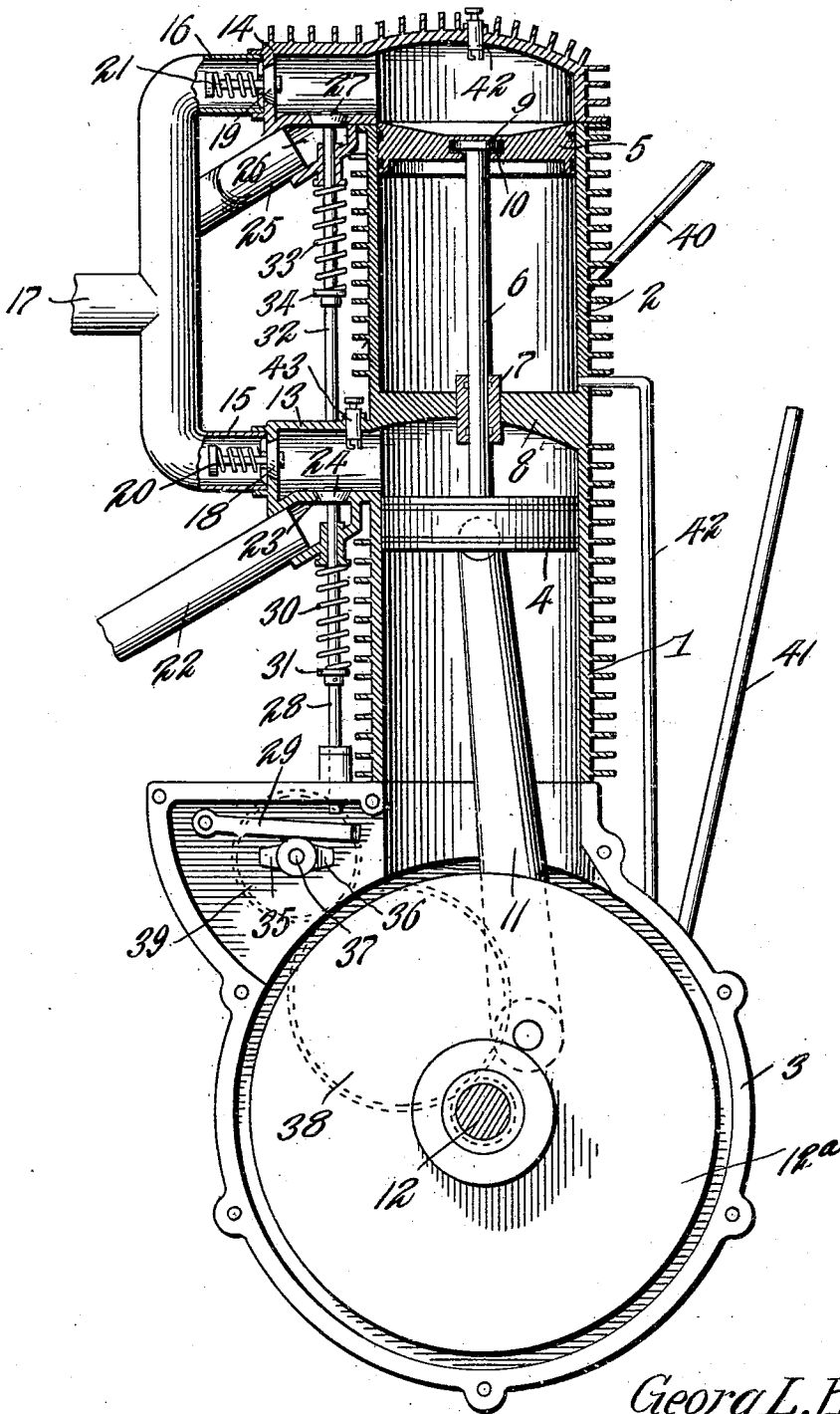


G. L. BORDEN.
ENGINE.

APPLICATION FILED APR. 24, 1909.

958,583.

Patented May 17, 1910.



Witnesses
E. R. Ruppert.
J. F. Byrne.

Inventor
Georg L. Borden.
By Victor J. Evans
Attorney

UNITED STATES PATENT OFFICE.

GEORGE L. BORDEN, OF CAMPBELL, NEW YORK.

ENGINE.

958,583.

Specification of Letters Patent.

Patented May 17, 1910.

Application filed April 24, 1909. Serial No. 491,978.

To all whom it may concern:

Be it known that I, GEORGE L. BORDEN, a citizen of the United States, residing at Campbell, in the county of Steuben and State of New York, have invented new and useful Improvements in Engines, of which the following is a specification.

My invention relates to improvements in internal combustion engines of the four cycle type.

The primary object of my invention is the provision of an engine of this character wherein a power impulse shall be delivered for every revolution of the fly wheel, the invention comprehending a multiple cylinder engine wherein the cylinders are arranged one above the other.

The invention also comprehends an engine which shall be simple, durable and efficient of construction, and which may be manufactured and sold at a comparatively low cost.

A further object of the invention is the provision of an internal combustion engine of the above stated character wherein the piston of one cylinder may move independently of the piston of the other cylinder in a plane parallel thereto, whereby to compensate for any irregularity in alinement of the vertical walls of the cylinders.

With the above and other objects in view, the invention consists in the construction, combination and arrangement of parts hereinafter fully described and claimed, and illustrated in the accompanying drawing, wherein the figure is a vertical sectional view of an internal combustion engine constructed in accordance with my invention.

Referring to the drawing by reference numerals, 1 designates the lower and 2 the upper cylinder of my improved internal combustion engine. The lower cylinder 1, its head, and the upper cylinder 2 are formed integrally. The head of the upper cylinder 2 is made separately and secured in applied position in any suitable manner. The lower cylinder 1 is fully open at its lower end and is secured to a two piece crank case 3. Pistons 4 and 5 are respectively located in the lower cylinder 1 and upper cylinder 2 and are connected together by a piston rod 6 which works in a stuffing box 7 secured in the head 8 of the lower cylinder. The piston rod 6 is rigidly secured to the piston 4 and loosely connected with the piston 5, the connection between the piston 5 and the

piston rod 6 being established through the medium of a head 9 secured to the piston rod and located in a recess 10 formed in the piston. The recess 10 is larger than the head 9 to permit the piston 5 to move independently of the piston 4 in a plane parallel thereto, such movement of the piston 5 permitting the pistons to compensate for any irregularities in alinement of the vertical walls of the cylinders. A connecting rod 11 is pivotally secured at its upper end to the piston 4 and suitably connected at its lower end to the crank shaft 12, a fly wheel 12^a being mounted on the crank shaft. The heads of the cylinders 1 and 2 are provided with valve chambers 13 and 14, respectively.

The branches 15 and 16 of a fuel supply pipe 17, respectively communicate with the valve chambers 13 and 14. Valves 18 and 19 are respectively located in the valve chambers 13 and 14 to normally cut off communication between the valve chambers and the supply pipe 17, the valves being normally retained seated by springs 20 and 21, respectively. The valve chamber 13 communicates with an exhaust pipe 22 through the medium of a port 23 which is normally closed by a valve 24, and the valve chamber 14 communicates with an exhaust pipe 25 through a port 26 which is normally closed by a valve 27. The exhaust valve 24 is carried by a rod 28 which has its lower end disposed for engagement by a lever 29. A coiled expansion spring 30, which encircles the rod 28 and which is interposed between the valve chamber 13 and a collar 31 secured to the rod, normally retains the exhaust valve 24 seated. The exhaust valve 27 is carried by a rod 32 which also has its lower end disposed for engagement by a lever, not shown. A coiled expansion spring 33, which is mounted on the rod 32 and which is interposed between the valve chamber 4 and a collar 34 secured to the rod, normally retains the valve 27 seated.

The lever 29, and the lever adapted for engagement with the lower end of the rod 32, are adapted to be operated by cams 35 and 36, respectively, the said levers having one of their ends movably attached to the casing of the engine and their free ends adapted to be brought into contact with the lower ends of the rods 32 and 28 for the purpose hereinafter described. The cams 35 and 36 are secured to a shaft 37 which is

rotated by the crank shaft 12 through the medium of gears 38 and 39. The operation of the rods 28 and 32 through the medium of the levers unseats the valves 24 and 27 and permits the cylinders to exhaust. Lubricant is supplied to the upper cylinder 2 through a pipe 40 and to the crank case 3 through a pipe 41. A relief pipe 42 communicates at one end with the lower end of the upper cylinder 2. A spark plug 42 is secured to the head of the upper cylinder 2, and a spark plug 43 is secured to the valve chamber 13 of the lower cylinder 1.

The operation of my improved internal combustion engine may be stated to be as follows: With the parts of the engine in the position shown in the drawing, the lower piston has just reached the limit of its scavenging stroke, the upper piston has just reached the limit of its compression stroke, and the spark plug of the upper cylinder has just been operated. An explosion in the upper cylinder will cause the upper piston 5 to describe its power stroke and the lower piston to describe its inhaust stroke. The momentum developed in the fly wheel will cause the upper piston to describe its scavaging stroke and the lower piston to describe its compression stroke. At the completion of these strokes an explosion takes place in the lower cylinder, such explosion causing the lower piston to describe its power stroke and the upper piston to describe its inhaust stroke, and so on.

From the foregoing description, taken in connection with the accompanying drawing, it should be apparent that I provide an internal combustion engine of the four cycle type wherein a power impulse will be delivered for every revolution of the fly wheel.

While I have described the method of operation of the invention, together with the apparatus which I now consider to be the best embodiment thereof, I desire to

have it understood that the apparatus shown is merely illustrative, and that such changes may be made when desired as are within the scope of the claim.

Having thus described the invention, what I claim as new, is:—

An engine having two cylinders separated by a head, a crank casing in communication with the lower cylinder, a fly wheel mounted in said casing, pistons located in said cylinders, a connecting rod pivotally secured to the lower piston and eccentrically connected to the fly wheel, a piston rod passing through the head separating the cylinders, the lower end of which rod is fixed to the lower piston, a head forming the upper end of the latter and adapted to be freely received by a recess formed in the upper piston whereby the latter is free to move independently of said piston rod, in a downward direction, a fuel supply pipe, valve chambers in communication with said pipe and cylinders, valves located in said chambers, suitable exhaust pipes, spring-actuated rods, valves carried by the upper ends of the latter for controlling the exhaust from the cylinders, a shaft mounted in the lower portion of the casing of the engine, cams fixed upon the shaft, pivoted levers one end of which are movably secured within the casing the free ends of which are adapted to be forced into contact with the lower ends of the rods for actuating the latter in one direction and unseating the valves carried by the upper ends of said rods, and suitable gearing for connecting the crank shaft to the cam shaft, as and for the purpose described.

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

GEORGE L. BORDEN.

Witnesses:

JOHN E. FREDERICK,
L. M. McCABE.