S. LOGAN.

INTERNAL COMBUSTION MOTOR.

APPLICATION FILED MAY 25, 1911.

1,135,942.

Patented Apr. 13, 1915.

3 SHEETS—SHEET 1.

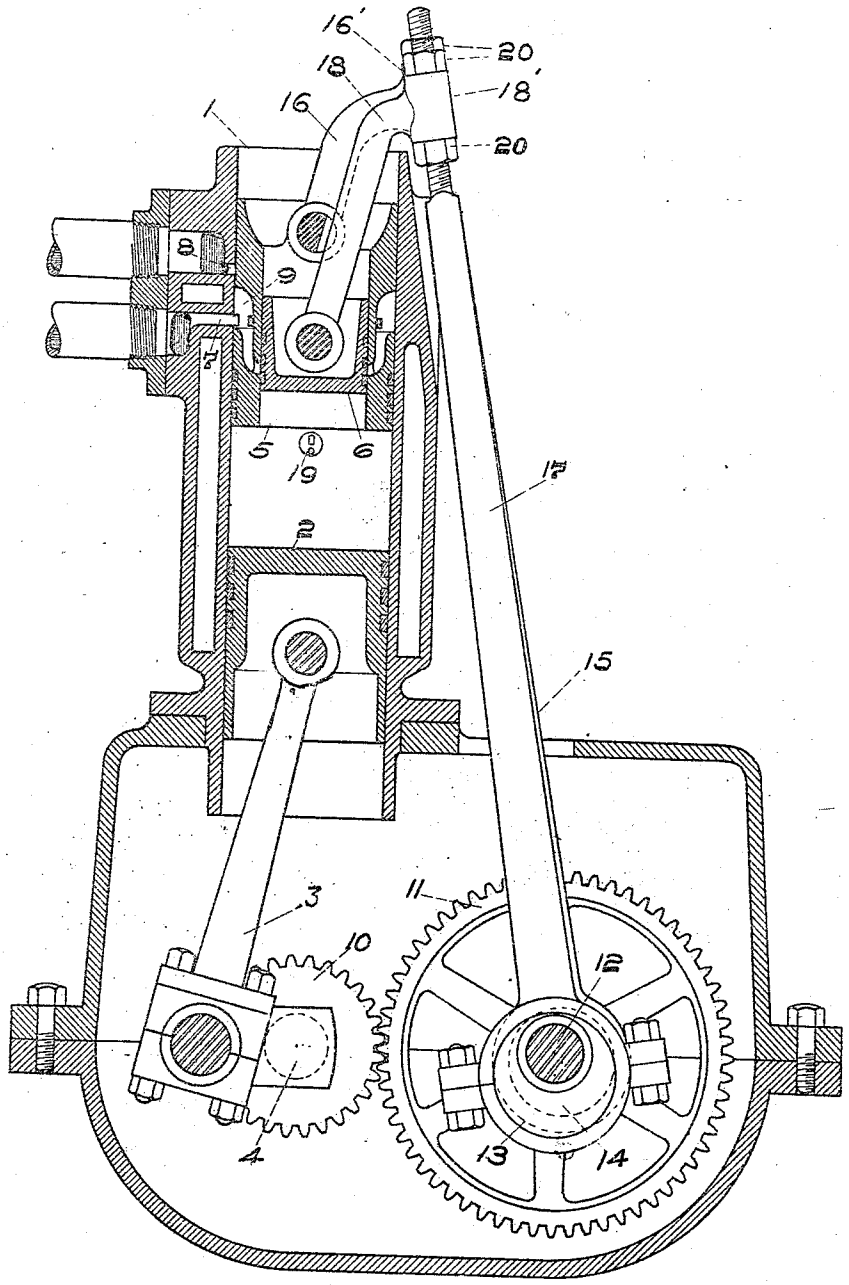


FIG. 1.

Inventor

SYLVESTER LOGAN

Witnesses

Fred F. Clarke

Laura S. Inman

By Edward R. Inman

Attorney

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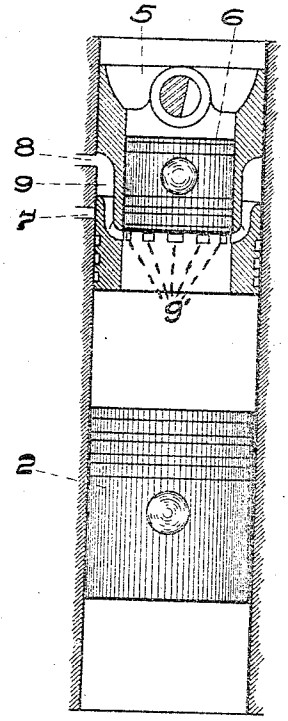


FIG. 2.

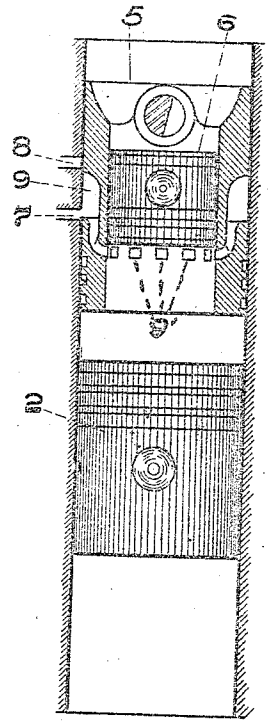


FIG. 3.

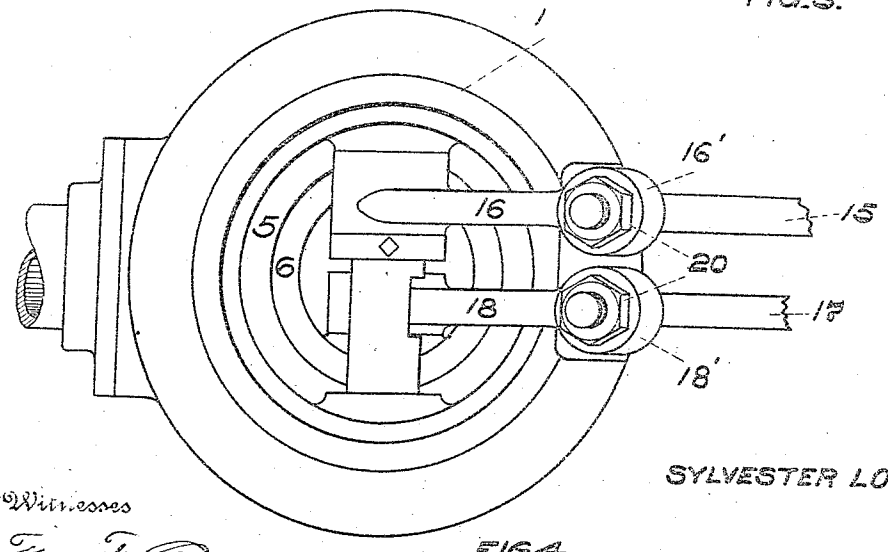


FIG. 4.

Witnesses

Theo. F. Clarke

Laura S. Inman

Inventor

SYLVESTER LOGAN

By Edward R. Inman

Attorney

S. LOGAN.

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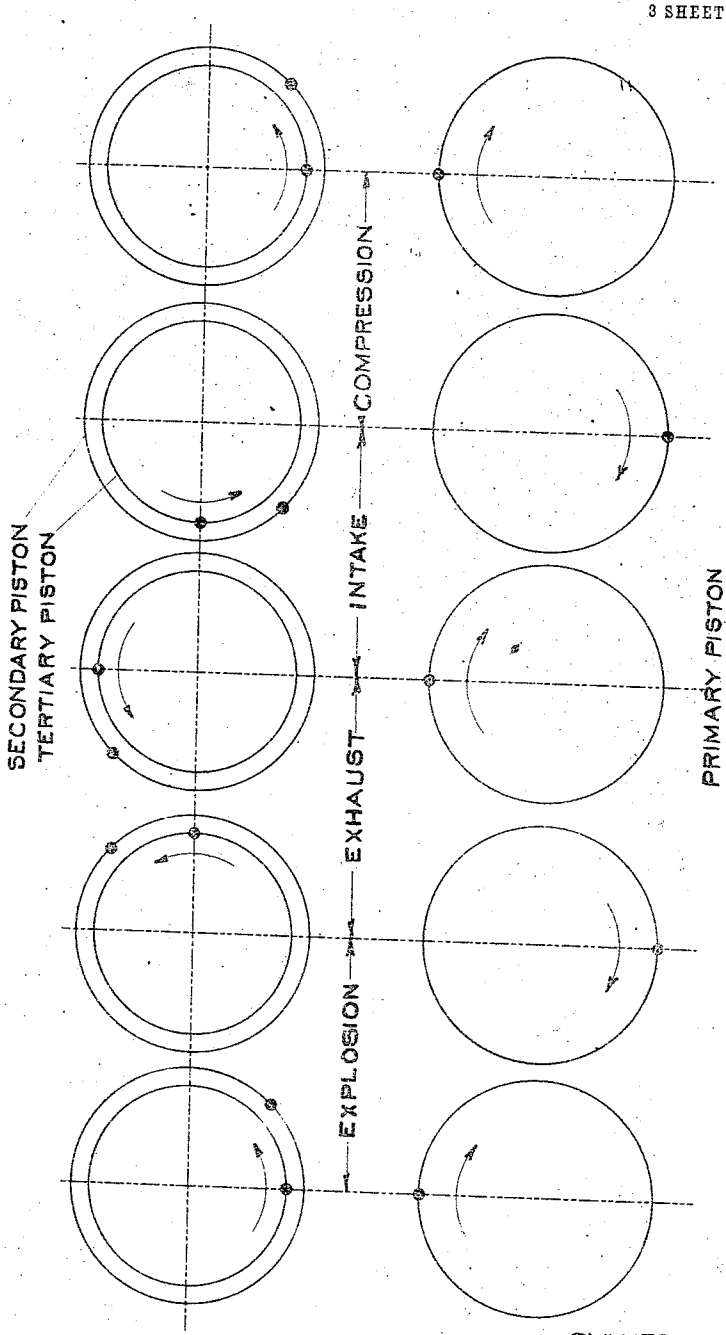


FIG. 5

Witnesses

C. W. Rippey

H. E. Bready.

Inventor

SYLVESTER LOGAN

By Edward R. Gross

UNITED STATES PATENT OFFICE.

SYLVESTER LOGAN, OF FRANKLIN, PENNSYLVANIA, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, OF ONE-HALF TO LOWE E. SIMPSON AND ONE-HALF TO ORVILLE SIMPSON, BOTH OF CINCINNATI, OHIO.

INTERNAL-COMBUSTION MOTOR.

1,135,942. Specification of Letters Patent. Patented Apr. 13, 1915.

Application filed May 25, 1911. Serial No. 629,490.

To all whom it may concern:

Be it known that I, SYLVESTER LOGAN, citizen of the United States, residing at Franklin, in the county of Venango and State of Pennsylvania, have invented certain new and useful Improvements in Internal-Combustion Motors, of which the following is a specification.

The construction and operation of my improved motor are herein set forth with sufficient clearness to enable those skilled in the art to which it appertains, to make and use the same.

In the drawings I have shown a certain construction by means of which my inventive idea may be mechanically embodied, but said drawings are, to a certain extent illustrative merely, and details of construction could, in some respects, be considerably modified without departing from the spirit and scope of my invention.

The various figures in the drawings are as follows:—

Figure 1 is a central, vertical section of my motor. Fig. 2 is a side view of the pistons, partly in section and a certain portion of the cylinder walls showing said pistons in a position which they occupy during a portion of the fuel-intake stroke. Fig. 3 is substantially the same view shown in Fig. 2 except that it shows the pistons in the position which they occupy during a portion of the exhaust stroke. Fig. 4 is a plan view of the cylinder. Fig. 5 is a diagram illustrating the relative position of the three pistons throughout the various functions of a cycle.

The object of the invention here set forth is to provide an internal combustion motor, of the four-stroke cycle type, wherein valves of the usual construction are dispensed with, and pistons of novel construction and arrangement, are caused to perform the functions usually performed by valves. Said construction adds considerably to the efficiency of the engine for the reason that, when valves are employed a certain amount of power is required to operate the same which is lost, while on the other hand, and with the construction here shown, the pistons which perform the valve functions, are adapted to aid in the conversion of the pressure developed in the cylinder into available power, and thus to add to the actual power efficiency of the motor.

The construction, as illustrated in the drawings, by which I attain said object, is substantially as follows:—

I employ a cylinder 1, which is somewhat longer than that employed in the usual construction. Occupying the lower end of said cylinder is a primary piston 2, which is attached by means of a connecting rod 3 to the main crank-shaft 4 of the motor. In the upper end of said cylinder, two pistons are employed, a secondary, cylindrical piston 5, which is of the same diameter as piston 2, and a tertiary piston 6, which is positioned and operates within piston 5. An exhaust port 7 is formed in the wall of cylinder 1 for the escape of gases of combustion. An inlet port 8 is also formed in the cylinder wall for the intake of fuel. A passage 9 is formed through the walls of the secondary piston 5, which passage comprises at its inner end or portion the series of ports 9′, the outer end of which passage is arranged to register or communicate with ports 7 and 8 at the proper intervals, whereby the fuel intake and combustion exhaust of the motor are properly effected. The tertiary piston 6 is arranged to travel over said ports 9′ and to uncover the same when the outer end of said passage 9 is in communication with ports 7 and 8.

My motor, as here shown, is arranged, as aforesaid, to operate upon the four-stroke cycle.

Attached to the crank-shaft 4, is a pinion 10 which meshes with a gear 11 upon the eccentric or secondary shaft 12 upon which two eccentrics 13 and 14 are mounted. The ratio between said gear and pinion is two to one. Eccentric 13 has about one half the throw or travel given to eccentric 14. Piston 5 is connected by means of a rod 15 and an arm 16 to eccentric 13, and piston 6 is connected by means of a rod 17 and arm 18 to eccentric 14, which causes said pistons 5 and 6 to travel or reciprocate one half as

fast as piston 2, and this construction causes the tertiary piston 6 to cover the ports 9′ during two strokes of piston 2, which are the compression and power strokes, and to uncover said ports during approximately two other strokes of said piston 2, which are the exhaust and fuel inlet strokes. The pressure due to the explosion and expansion of the fuel charge, is not only exerted upon the primary piston 2, but also upon the secondary and tertiary pistons, and the pressure thus exerted upon said pistons 5 and 6 is transmitted and converted into power by means of the connections 15 and 16, 17 and 18 and the eccentrics 13 and 14 to shaft 12, and from thence through the gear and pinion to the main crank-shaft 4. From an inspection of Fig. 5, it will be seen that the secondary piston is arranged at a position approximately 45° in advance of the tertiary piston, and at the instant of explosion, said secondary piston has traveled a one-quarter part of its stroke upward or away from the primary piston and that said primary piston and the tertiary piston are at the point of their nearest approach to each other—that is, the primary piston is at the highest point of its stroke, and the tertiary piston is at the lowest point of its stroke; also that during the explosion or power stroke, all of the pistons are being actuated by the pressure in the cylinder and are traveling in response to said pressure, and are, therefore, each contributing to, and all cooperating in the conversion of said pressure into available power. So far as the relative travel and motions of the pistons are concerned, this action and coöperation during the power stroke is the material point, and during the remainder of the cycle the only material point is the opening of the ports, as shown in Figs. 2 and 3, at the proper point and during the proper period.

It will be readily understood that various modifications of mechanism could be substituted for the connections 15, 16, 17 and 18, as shown in the drawings, without departing from the scope of my invention.

Any suitable type of ignition could be employed with my improved motor, but I have here shown an electric spark-plug 19 of a well-known type.

As previously stated, the drawings are illustrative merely, and I do not intend to be understood as confining myself to the exact form of construction there shown. The essential feature of my invention, regardless of the precise mechanical embodiment thereof, is the employment of three pistons within a motor cylinder, all of which are arranged to be acted upon by the pressure generated by the combustion of fuel within said cylinder, and to coöperate in the conversion of said pressure into available power by the employment of additional or supplementary mechanism well known in the art, such as a crank-shaft, connecting rods, reducing gear, igniter, etc.; two of said pistons being arranged to perform the function of controlling-ports for the admission of fuel to the cylinder and the discharge of the products of combustion therefrom.

In the construction shown, it being necessary to provide means for accomplishing the relative vertical adjustment of the secondary and tertiary pistons, I provide the arm 16 with a sleeve 16′ which receives and is arranged to be longitudinally adjustable upon the upper, screw-threaded end of rod 15: I also provide arm 18 with a sleeve 18′ which receives and is arranged to be longitudinally adjustable upon the upper screw-threaded end of rod 18, and by means of the nuts 20 upon said rods, which are arranged to bear upon either end of said sleeves, I am enabled to effect such adjustment, which is for the purpose of securing the proper register of the inlet and exhaust passage 9 in piston 5, with ports 7 and 8 in the cylinder, and also the proper position of the lower end of piston 6 relative to ports 9′ in piston 5.

What I claim and desire to secure by Letters Patent, is:—

1. In an internal combustion motor, the combination with a cylinder and means for converting pressure therein into available power, of three pistons operable within said cylinder, and arranged to form the primary elements of said converting means, two of said pistons being arranged as coöperative unsupplemented or direct controlling means for the fuel-inlet ports and the exhaust-outlet ports in said cylinder.

2. In an internal combustion motor, in combination, a cylinder for such motor having inlet ports and exhaust ports through the walls thereof, and means for converting the pressure within said cylinder into available power, said converting means comprising among the elements thereof, a main piston operative within said cylinder, a secondary cylindrical piston also operative within said cylinder, said secondary piston having ports passing through its walls and arranged to communicate directly with both the inlet ports and the exhaust ports in the wall of said cylinder, a tertiary piston operable within said secondary piston and arranged to directly control the inner or adjacent ends of the openings of the ports within said secondary piston, for the purpose set forth.

3. In an internal combustion motor having a single cylinder, in combination, means for converting the pressure generated within said cylinder into available power, the primary elements of said converting means consisting of three pistons, a primary piston, and a secondary piston operative within said

cylinder, and a tertiary piston operative within said secondary piston, there being inlet ports and exhaust ports through the wall of said cylinder, also ports through the wall of said secondary piston adapted to communicate directly with said cylinder ports respectively at different and proper intervals in harmony with a four-stroke cycle, said tertiary piston being arranged to directly control the adjacent ends of the ports in said secondary piston in like manner, for the purpose set forth.

4. In an internal combustion motor, a cylinder, a primary piston operative in said cylinder at one end thereof, a secondary cylindrical piston operative in the other end of said cylinder, a tertiary piston operative in said secondary piston, inlet ports in said cylinder, exhaust ports in said cylinder, said secondary and tertiary pistons being arranged for the coöperative, unsupplemented or direct control of said ports for the inlet of fuel to and the outlet of the products of combustion from said cylinder; all three of said pistons being adapted to co-act in the communication of the explosive force within the cylinder to the crank-shaft of the motor.

5. In an internal combustion motor, a cylinder, there being inlet ports and exhaust ports in the walls of said cylinder, a primary piston operative in one end of said cylinder, a crankshaft, a pinion upon said shaft, a connecting rod connecting said piston to said shaft, a secondary, cylindrical piston operative in the other end of said cylinder and within the same chamber in which said primary piston is located, there being ports through the walls of said secondary piston arranged to communicate directly with the ports in said cylinder, a tertiary piston operative within said secondary piston and arranged to directly control the ports in said secondary piston, a secondary shaft, a gear upon said secondary shaft arranged to mesh with said pinion, said gear and said pinion being of the relative ratio of two to one, two eccentrics upon said secondary shaft and adjustable means connecting said secondary and said tertiary pistons to said eccentrics respectively.

6. In an internal combustion motor, in combination, a cylinder for such motor having a series of inlet ports and another series of exhaust ports through the wall thereof, means for converting the pressure within said cylinder into available power, said converting means comprising among the elements thereof, a main piston operative within one end of said cylinder, a secondary piston operative within the other end of said cylinder, said secondary piston being of cylindrical form and having one series of ports extending through its wall arranged to communicate with both series of ports in said cylinder, a tertiary piston operable within said secondary piston and arranged to control the inner or adjacent ends of the ports within said secondary piston, for the purpose set forth.

7. In an internal combustion motor, in combination, a cylinder for such motor having a series of inlet ports, and another parallel series of exhaust ports through the wall thereof, a main piston operative within said cylinder at one end thereof, a secondary cylindrical piston operative in the other end of said cylinder, said secondary piston having one series of ports extending through the wall thereof and arranged to have communication with both series of ports in said cylinder at different intervals and in consonance with a four-stroke cycle, a tertiary piston operable within said secondary piston and arranged to control the inner or adjacent openings of the ports within said secondary piston, also in consonance with a four-stroke cycle, all three of said pistons being adapted to co-act in the communication of the explosive force within the cylinder to the crank-shaft of the engine.

8. A four-cycle engine comprising a valve casing having one end constantly in communication with the combustion chamber of the engine, and provided with a fuel-inlet port and an exhaust port nearer to said combustion chamber, two valve members working in said casing and adapted to cooperate directly with said ports, whereby the inlet of fuel to, and the exhaust of the gases of combustion from said combustion chamber are effected, and valve-moving mechanism actuated by the engine and adapted to move the two valve members differentially and to give the two valve members one impulse for each two impulses of the engine.

9. A four-cycle gas engine comprising a cylindrical valve-casing having one end constantly in communication with the combustion chamber of the engine, and provided with a fuel-inlet port, and provided with an exhaust port nearer to said combustion chamber, a first cylindrical valve member working in said casing and provided with an annular passage adapted to coöperate with said ports, a cylindrical second valve member adapted to coöperate directly with the passage in the first valve member, and valve moving mechanism actuated by the engine and adapted to move the two valve-members differentially and to give to said two valve members one impulse for each two impulses of the engine.

10. A four-cycle gas engine comprising a cylindrical valve-casing having one end constantly in communication with the combustion chamber of the engine, and provided with a fuel-inlet port, and provided

with an exhaust port nearer to said combustion chamber, a first, cylindrical valve member working in said casing and provided with an annular passage adapted to coöperate with said casing ports at different intervals, a second cylindrical valve chamber adapted to coöperate with the passage in the first valve member, and valve-moving mechanism actuated by the engine adapted to move said two valve members differentially and to give to said two valve members one impulse for each two impulses of the engine, both of said valves being arranged and adapted to coact with the motor piston in the communication of the explosive force within the cylinder, to the crank shaft of the motor.

11. In a motor, the combination with a chamber adapted to contain an expansive fluid, of two cylinders having direct communication with said chamber, a piston operative in one of said cylinders, two pistons operative in the other of said cylinders, said two pistons being arranged as controlling means for the inlet port and for the exhaust port which extend through the wall of said last mentioned cylinder, all three of said pistons being adapted to be actuated by the expansive force of the fluid within said chamber, and means for converting said actuation into available power.

12. In a gas engine, the combination of a combustion chamber, a main cylinder and a valve cylinder communicating with said combustion chamber at one end, the valve cylinder being provided with a supply and an exhaust port entering it directly through one of its walls, a main piston in the main cylinder, a valve sleeve in the valve cylinder directly coöperating with the walls thereof and with said ports, a valve piston within said valve sleeve and directly coöperating with the sleeve walls, the valve sleeve being provided with a port through one of its walls directly coöperating with said valve piston and said inlet and exhaust ports, a crank shaft and connections between the same and said main piston, valve sleeve and valve piston to cause said sleeve and valve piston to move differentially and to regulate the intake and exhaust in relation to the main piston.

13. In a gas engine, the combination of a combustion chamber, a working cylinder communicating therewith, a working piston in said cylinder, a valve cylinder communicating at one end with the combustion chamber and having in its wall a series of intake ports circumferentially arranged and also a series of exhaust ports similarly arranged, a piston sleeve in said valve cylinder having an annular port chamber passing through its wall, said chamber being adapted to coöperate with the ports in said valve cylinder, a valve piston working within the valve sleeve and coöperating with said port chamber, a crank shaft connected with the main piston, a countershaft connected with the crank shaft to move at half speed and connections between the countershaft and said valve piston to cause the latter to move differentially to regulate the intake and exhaust in accordance with the movement of the main piston.

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

SYLVESTER LOGAN.

Witnesses:
P. W. HANLON,
ED. E. LUCH.