E. S. CAMERON.

VALVE STRUCTURE FOR EXPLOSIVE ENGINES.

APPLICATION FILED MAR. 4, 1912.

1,090,599.

Patented Mar. 17, 1914.

2 SHEETS—SHEET 1.

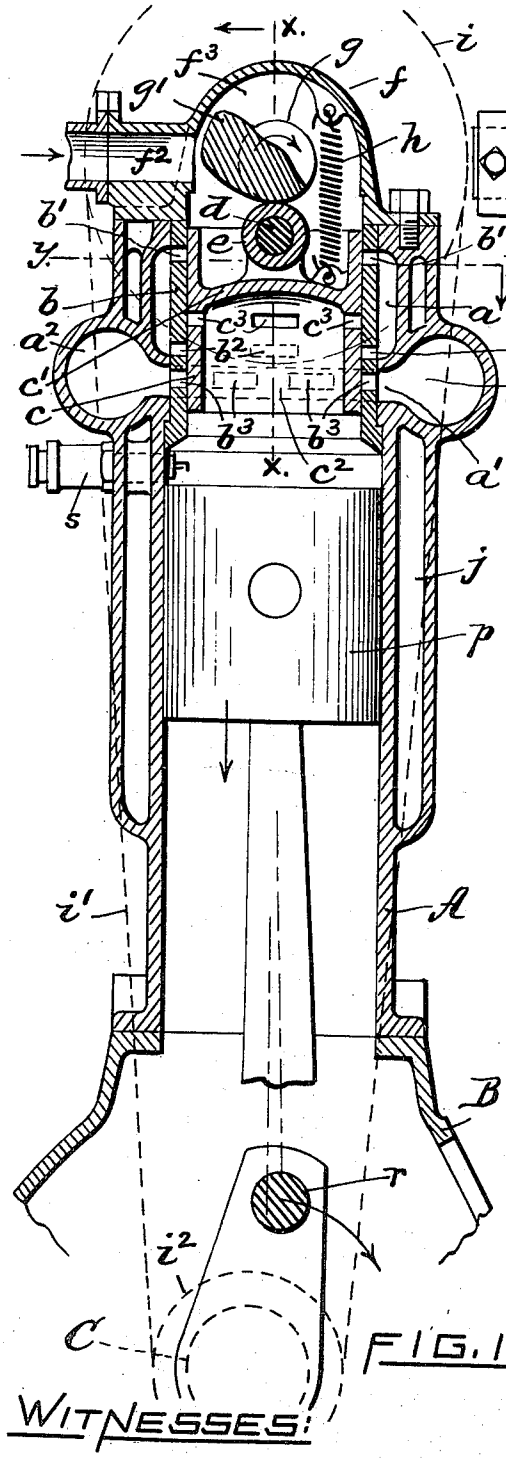

FIG. 1.

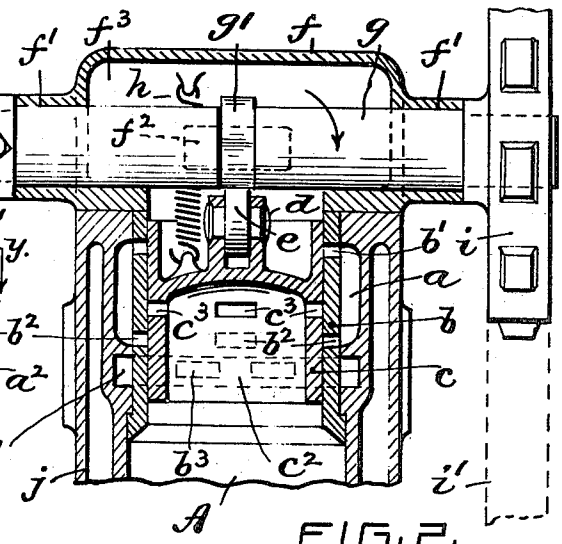

FIG. 2.

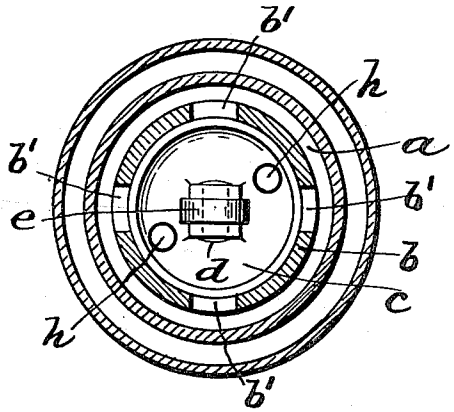

FIG. 3.

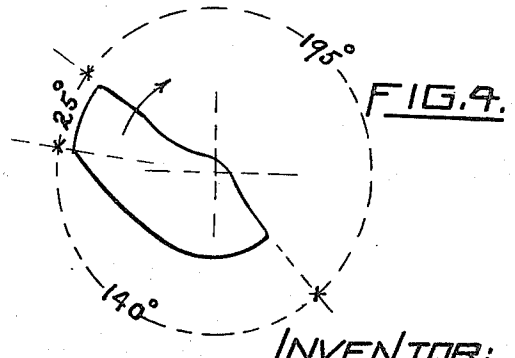

FIG. 4.

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2 SHEETS—SHEET 2.

FIG. 5.

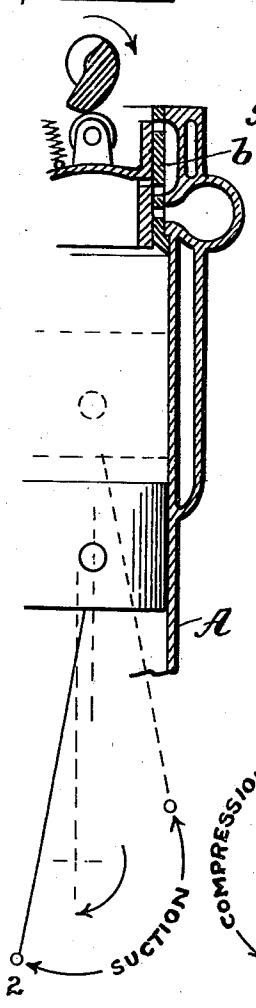


FIG. 6.

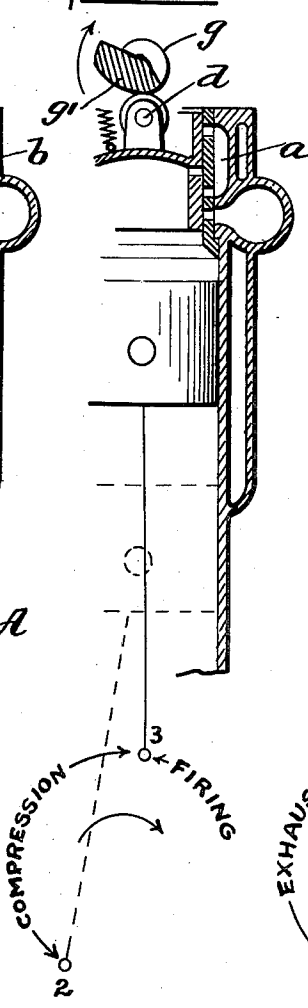


FIG. 7.

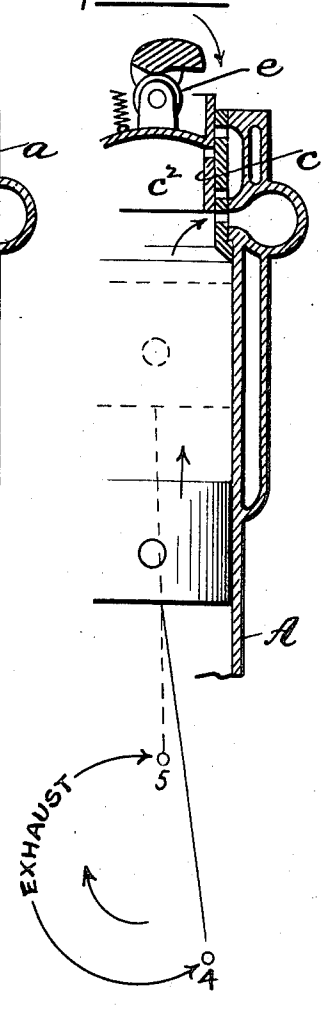
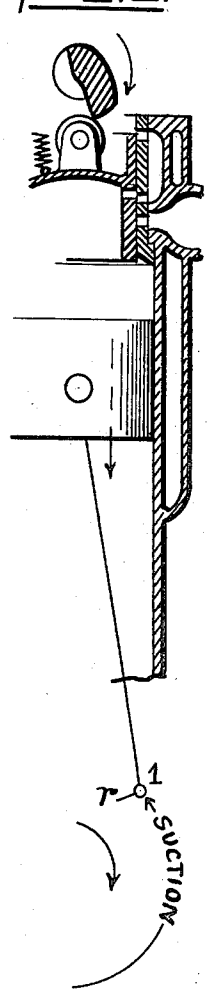


FIG. 8.



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UNITED STATES PATENT OFFICE.

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VALVE STRUCTURE FOR EXPLOSIVE-ENGINES.

1,090,599. Specification of Letters Patent. Patented Mar. 17, 1914.

Application filed March 4, 1912. Serial No. 681,362.

To all whom it may concern:

Be it known that I, EVERETT S. CAMERON, a citizen of the United States, residing at Beverly, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Valve Structures for Explosive-Engines, of which the following is a specification.

The objects of my invention are to provide a dome shaped piston valve having a series of ports through its annular wall, to uncover a series of intakes and a series of exhausts and to register with a series of inlets, respectively formed around the engine-cylinder, and means to impart a reciprocating motion to the valve to permit a very free gas supply with a short travel of said valve.

A further object of my invention is to provide means to permit the inrushing supply to sweep over the valve-head and keep the chamber between the dome of said valve and said cylinder always filled with fresh gas and thereby to obtain a more perfect combustion at the time of ignition.

With these objects in view the invention consists in the novel construction and combination of parts hereinafter described and claimed, and illustrated in the accompanying drawings, consisting of two sheets, showing the preferred form of my invention, in which—

Figure 1 is a central vertical section of an explosive engine cylinder, showing the parts embodying my improved valve structure, as at firing position. Fig. 2 is a section taken on line *x.—x.* of Fig. 1. Fig. 3 is a plan section on line *y.—y.* of Fig. 1. Fig. 4 is a side view of the cam for actuating my improved piston valve, and showing, in diagrammatic form, the movements in degrees throughout a revolution of said cam, to regulate said valve in governing the admission and the exhaust. Figs. 5 to 8 inclusive, represent fragmentary views showing the relative position of working parts in making a cycle of the engine: Fig. 5, shows the end of the suction stroke; Fig. 6, the beginning of the firing stroke; Fig. 7, the beginning of the exhaust stroke, and Fig. 8, beginning of the suction stroke.

Like reference characters refer to like parts in the several figures.

A— represents the engine-cylinder; B— the crank-case, and C— the engine-shaft.

A gas chamber surrounds the cylinder A, at its upper part, as at —*a*—, and this chamber is inclosed by a tubular ported bushing —*b*—, which is made fast in the bore of said cylinder and extends from the top thereof.

—*c*— represents my improved piston valve, which is slidable in the bushing —*b*— and has a transverse head —c^1— formed near its upper part so as to provide a chamber in said valve, as —c^2—, in open communication with the engine-cylinder, and the top of said head —c^1— has bifurcated portions to receive a pin —*d*— to act as a pivot center for a roller —*e*—.

The top of the cylinder A is closed by an inverted U-shaped cap —*f*—, having a journal bearing at each end, as at —f^1, f^1—, to receive a horizontal rotary shaft —*g*— whose axial center is in alinement with the center of the valve-roller —*e*— and axis of the engine-piston —*p*—. A cam —g^1— is formed on the shaft —*g*— and is provided with a peculiar working face designed for the valve roller —*e*— to move upon in limiting the degree of travel of the valve —*c*—.

Pull springs —*h*, *h*— are interposed between the valve —*c*— and cylinder-cap —*f*—, to keep the valve roller —*e*— in firm contact upon the working face of the cam —g^1—.

A gas supply chamber —f^3— is located above the valve —*c*—. The bushing —*b*— is provided with a series of intakes —b^1— arranged in a horizontal plane at its upper part, and also provided with a series of exhausts —b^3— arranged in a horizontal plane at its lower part. The exhausts —b^3— communicate with exhaust chambers —a^2— formed in the engine-cylinder.

When the valve —*c*— uncovers the intakes —b^1— the supply passes from the chamber —f^3—, through said intakes and into the gas chamber —*a*—.

The valve —*c*— is provided with a series of ports —c^3— arranged in a horizontal plane through its annular wall, to register with a series of inlets —b^2— formed at the lower part of the gas chamber —*a*—.

On the cam-shaft —*g*— is made fast a sprocket wheel —*i*—, which has a chain connection with a pinion —i^2— fast on the en-

gine-shaft C, in the manner as indicated by dotted lines in Fig. 1.

The engine-cylinder is formed with a water jacket, as —*j*—, extending from its top to about two thirds its length, to aid in connection with the gas supply in keeping the explosive portion of the engine cool.

The gas supply enters an opening —f^2— formed in the cap —*f*— and fills the chamber —f^3— above the valve —*c*—.

In operation: At beginning of the suction stroke (Fig. 8,) the highest part of the cam —g^1— comes into contact with and forces the roller —*e*— downward a movement sufficient to allow the valve to uncover the intakes —b^1— and close the exhaust ports —b^3—, and also permit the valve-ports —c^3— to register with the inlets —b^2—, when the crank-pin —*r*— will then be at the point —1— in said figure. The supply now passes from the chamber —f^3—, through the intakes —b^1—, of the bushing —*b*—, through the chamber —*a*—, through the inlets —b^2— of said bushing, through the valve-ports —c^3— and into the chamber —c^2—, between valve —*c*— and engine-piston —*p*—, this amount of travel of said valve being governed by the degree of movement had by the highest part of the cam, 25° as shown in Fig. 4, while the crank-pin will have moved 165°, to the point 2 in Fig. 5, in making this suction stroke. Just before the crank-pin reaches the end of suction stroke, at point 2 in Fig. 6, the cam —g^1— disposes its next lower working face to the roller —*e*—, to permit upward travel of the valve in closing the intakes —b^1— and inlets —b^2—, this amount of travel of said valve being governed by the degree of movement had by this portion of said cam, 140° as shown in Fig. 4, while the crank-pin will have moved 160°, to the point 3 in Fig. 6, in making this compression stroke. The firing now takes place, by means of the spark plug —*s*—, and as the explosion stroke terminates at the point 4 in Fig. 7, the cam will have disposed its lowest rise, governed by the degree of movement, 195° as shown in Fig. 4, to permit a further upward movement of the valve to uncover the exhaust ports —b^3—, when the crank-pin will then have traveled 230°, to the point 5 in Fig. 7, to force out the exhaust, after which the cam actuates the valve to the point of suction stroke, as shown in Fig. 8, and thereby completing the cycle of the engine.

The cam —g^1— revolves at a lesser speed than the engine-crank —*r*— and in the same direction, as indicated by the arrows on said parts in Fig. 1.

The employment of a bushing, as —*b*—, facilitates cheapness and accurateness in machining to provide the different series of intakes —b^1—, inlets —b^2—, and exhausts —b^3—, but I do not wish to limit myself to the use of such bushing as the said intakes, inlets, and exhausts may be formed in the cylinder casting, to lead direct from the cylinder-bore to the supply chamber —*a*— and to the exhaust chamber —a^2—.

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

1. In combination with the cylinder, of a closure member for the end of said cylinder having a gas supply chamber; an auxiliary gas chamber surrounding the cylinder-bore, near the outer part thereof, and also an exhaust chamber leading from the bore; a tubular bushing fixed in the cylinder-bore, said bushing having a series of intakes communicating with the outer part of the auxiliary chamber, a series of inlets leading from the inner part of the latter, and a series of exhaust ports communicating with the exhaust chamber; a dome-shaped piston valve slidable in the bushing, said valve having a series of ports to register with the inlets of the latter; a cam adapted to impart an inward movement to said valve to admit the supply through the intakes, through the auxiliary chamber, through the inlets, and through the ports of said valve, during the period of suction stroke, and means to return said valve to uncover the exhaust ports, substantially as set forth.

2. In combination with the cylinder, of a closure member for the end of said cylinder having a gas supply chamber; an auxiliary gas chamber surrounding the cylinder-bore, near the outer part thereof said chamber having a series of intakes and a series of inlets leading from the bore; an exhaust chamber surrounding the cylinder-bore, said chamber having a series of outlets leading from the bore; a dome-shaped piston valve slidable in the cylinder-bore, said valve having a series of ports to register with the series of inlets from the auxiliary chamber; a rotary cam to impart an inward movement to said valve to uncover and admit the supply through the intakes, through the auxiliary chamber, through the inlets, and through the ports of said valve, during the period of suction stroke, and means to return said valve to uncover the outlets leading to the exhaust chamber, substantially as set forth.

3. In combination with the cylinder, of a closure member for the end of said cylinder having a gas supply chamber; an auxiliary gas chamber formed in the cylinder-bore, near the outer part thereof, and also an exhaust chamber leading from the bore; a tubular bushing fixed in the cylinder-bore, said bushing having three transversely-arranged series of ports, one series to form intakes communicating with the outer part of the auxiliary chamber, an intermediate series to form inlets leading from the inner part of the last said chamber, and a series of exhausts to form outlets communicating with the exhaust chamber; a dome-shaped

piston valve slidable in the bushing, said valve having a series of ports to register with the series of inlets from the auxiliary chamber; a roller carried upon the dome of said valve; a rotary shaft having an integral cam for said roller to move upon, said cam designed to impart an inward movement to said valve to uncover and admit the supply through the intakes, through the auxiliary chamber, through the inlets, and through the ports of said valve, during the period of suction stroke, and means to return said valve to uncover the outlets during the period of exhaust stroke, substantially as set forth.

4. In combination with the cylinder, of a gas supply chamber above said cylinder; an auxiliary gas chamber formed in the cylinder-bore, near the outer part thereof, and also an exhaust chamber leading from the bore; a tubular bushing fixed in the cylinder-bore and having three series of ports arranged transverse of and in a horizontal plane through its wall, one series to form intakes communicating with the outer part of the auxiliary chamber, an intermediate series to form inlets leading from the inner part of the auxiliary chamber, and an inner series to form outlets communicating with the exhaust chamber; a dome-shaped piston valve slidable in said bushing and provided with an explosive chamber, said valve having a series of ports to register with the series of inlets from the auxiliary chamber; a roller carried by said valve; a shaft; a cam carried by said shaft and having an irregular flat working face for said roller to move upon, said cam designed to impart an inward movement to said valve to uncover and admit the supply through the intakes, through the auxiliary chamber, through the inlets and into the explosive chamber, during the period of suction stroke; means to respectively keep the said roller in contact with the cam face and to return said valve to uncover the outlets to the exhaust chamber, and means to rotate said shaft in one direction, substantially as set forth.

5. In combination with the cylinder having the auxiliary gas chamber —a— and exhaust chamber —a^2—; the closure member —f— having a main gas supply chamber; the fixed bushing —b— having the intakes —b^1—, intermediate inlets —b^2—, and outlets —b^3—; the valve —c— having ports —c^3— to register with the inlet; the roller —d— carried by said valve; the shaft —g— having integral cam —g^1— and the said cam designed to impart an inward movement to said valve to uncover the intakes and the inlets, during the period of suction stroke; the pull-springs —h— to keep the roller in contact with the cam face and to return the valve to uncover the outlets to the exhaust chamber, and driving arrangement consisting of the sprocket wheel —i—, pinion —i^2—, and chain connection —i^1—, substantially as set forth.

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

EVERETT S. CAMERON.

Witnesses:
M. P. CAMERON,
L. L. PRATT.