C. ROBINSON.

GAS ENGINE.

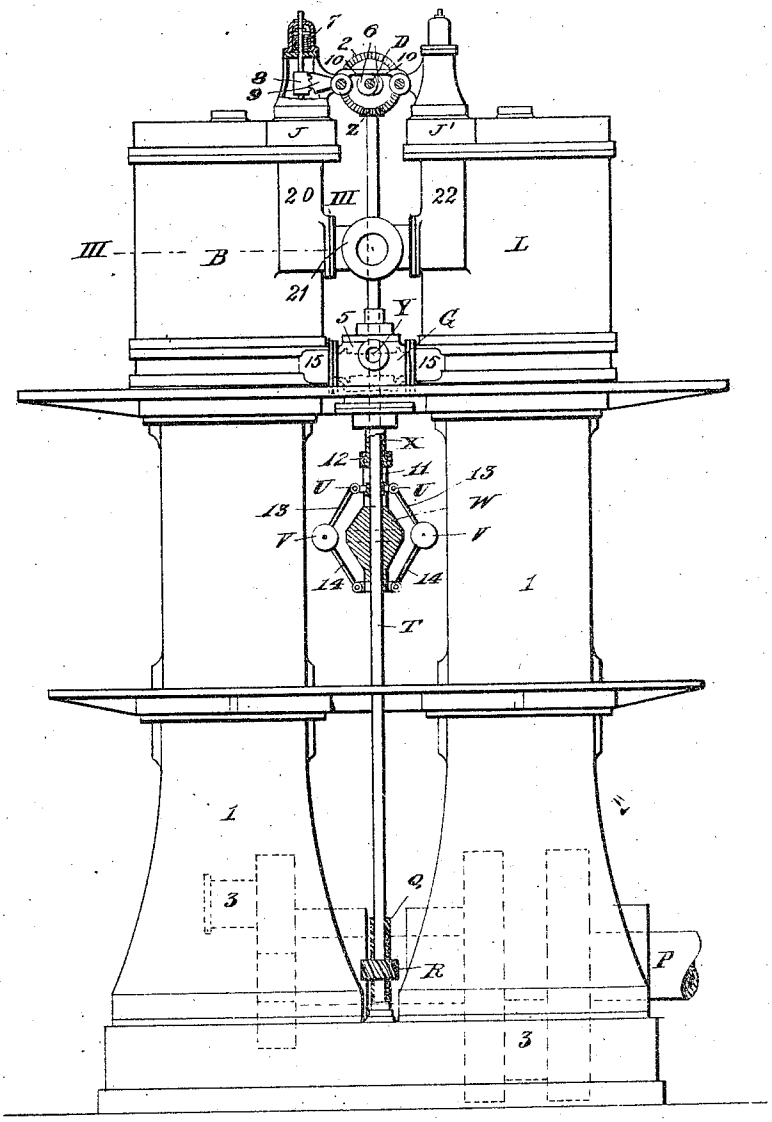
APPLICATION FILED MAR. 13, 1900.

1,028,492.

Patented June 4, 1912.

2 SHEETS—SHEET 1.

Fig. 1



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2 SHEETS—SHEET 2.

Fig. 2.

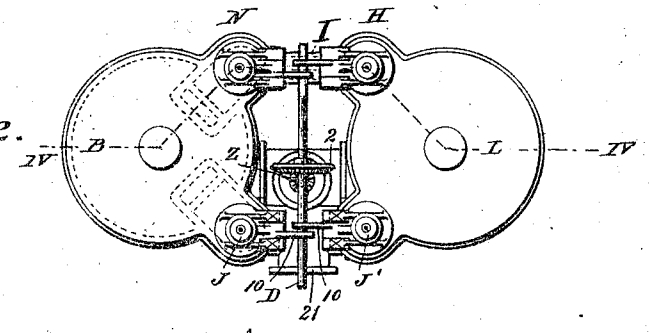


Fig. 4.

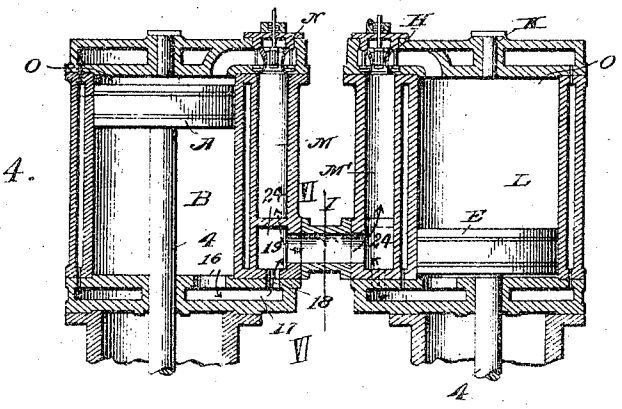


Fig. 5.

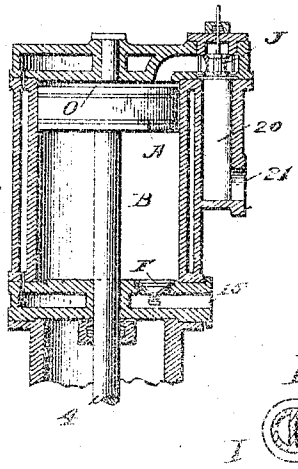


Fig. 3.

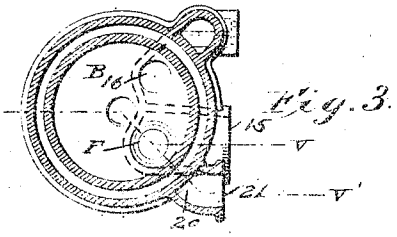
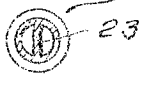


Fig. C.



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UNITED STATES PATENT OFFICE.

CYRUS ROBINSON, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE MACHINE COMPANY, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

GAS-ENGINE.

1,028,492. Specification of Letters Patent. Patented June 4, 1912.

Application filed March 13, 1900. Serial No. 8,526.

To all whom it may concern:

Be it known that I, CYRUS ROBINSON, a subject of the Queen of Great Britain, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification, reference being had therein to the accompanying drawing.

Figure 1 is a front elevation, partly in section, of a gas engine embodying my invention. Fig. 2 is a plan of the two cylinders and a portion of the valve operating mechanism. Fig. 3 is a horizontal section through one cylinder on the line III—III, Fig. 1. Fig. 4 is a vertical section of the two cylinders, on line IV—IV, Fig. 2, showing the arrangement of ports and gas mixture admission valves. Fig. 5 is a vertical section of one cylinder through the cylinder exhaust valve and inlet check valve, the lower part on line V—V, and the upper part on line V—V′, Fig. 3. Fig. 6 is a cross sectional view through the supply connection between the cylinders along the line VI, VI of Fig. 4.

Referring to the drawings, B and L indicate two connected cylinders fitted with pistons A and E. The spaces above the pistons constitute the combustion chambers, while in the spaces below the pistons, and by the downward movement of the latter, the gas mixture for each cylinder is compressed by the piston of the other cylinder. Said cylinders are mounted on a suitable frame or base 1, preferably columnar in form and hollow. The main shaft is shown at P, mounted in the lower portion of the base, and has its crank or wrist pins 3, 3 set opposite one another at an angle apart at 180 degrees so that the pistons move alternately. With these cranks the piston rods 4, 4 are connected by any well known or preferred means.

The gas mixture from any suitable source enters the engine by a pipe or coupling Y which joins or is a part of the casing 5 of the throttle valve G, which latter has a stem X that is tubular and passes vertically through the valve casing. Through this stem passes loosely the vertical valve operating shaft T, driven from the engine shaft P by a spiral gear and pinion Q R. The valve gear lay shaft D is suitably mounted between the cylinders at the upper end of the engine and has fixed thereon a bevel gear 2 which is driven by a bevel pinion Z on said shaft T. The parts of this gearing are of such ratio or proportions as to give the shaft D the same speed as that of the main engine shaft P. The shaft D is provided with eccentrics or cams 6 arranged at proper angles to actuate the two cylinder admission valves N, H and two exhaust valves J, J′. The stems of these valves are severally pressed upward to close the valves by springs 7, and have racks 8 engaged by gear segment levers 9 by which the valves are periodically depressed and opened. The levers are severally operated for this purpose by the cams 6 which engage the lever arms 10.

The governing means which I prefer, but on the particular construction of which the other features of my invention are not necessarily dependent, comprises a balance weight W adapted to slide on and rotate with the shaft T and connected by arms 11 and a rotary joint 12 with the throttle stem X.

U, U, are governor arms fixed on the shaft T, and serving to suspend the balls V, V by links 13. The balls are also connected with the weight W by links 14. As the balls move outward by the acceleration of the engine and centrifugal force, the parts W, 11, X and G are raised and the mixture supply through the connection Y and casing 5 cut off or decreased.

From the casing 5 the explosive mixture passes into the lower end of the cylinders alternately by pipes, inlets or connections, 15 and check valves F, being drawn in by the upward movements of the pistons.

The lower end of each cylinder is connected by suitable ports and passages with the admission valve of the other cylinder. Thus, the cylinder B has at its lower end a port 16, passage 17 and port 18, preferably formed in the double cylinder head. The port 18 communicates with an outlet 19 and thence, by the connection I, with the space M′ of the cylinder L. The cylinder L, it will be understood, communicates in a similar manner with the space M of the cylinder B. By these means the gaseous or explosive volume drawn into the lower ends of the cylinders alternately, is compressed into the passages and spaces described and

principally (and alternately) into the spaces M and M'.

The cylinder admission valves are shown respectively at N and H in, or at the upper ends of, the spaces M and M', controlling the admission of the mixture to the upper ends of the cylinders in the usual or any preferred manner.

A charge of the mixture having been compressed, for instance by the piston A into the space M', the admission valve (in the instance supposed the valve H) is opened by the operation of the shaft D above described, and said mixture or the principal or a sufficient part thereof is admitted into the clearance space O of the cylinder which is left above the piston at this time. The ignition of such mixture (the valve H having closed) now takes place by any well known or suitable means, as by the igniter K. Thereupon the piston E will be forced downward, imparting movement to the engine shaft and compressing a charge for the cylinder B into the space M. At the same time the exhaust valve J is opened by the operation of the shaft D and the products of combustion allowed to escape from the cylinder B through the passage 20 and the exhaust outlet 21. The latter outlet also communicates by a passage 22 with the exhaust valve J' of the cylinder L.

It will be understood that the above described cycle is repeated indefinitely in and by the cylinders B, L and pistons A, E, and coöperating passages and valves.

23 is a vertical partition in the connection, duct or pipe I in line and joining similar partitions 24 cast in the lower cylinder heads, whereby are formed through said connection two separate and independent ducts, through which respectively (and in the directions shown by the full and dotted arrows in Fig. 4) are compressed and driven the explosive charges for the storage spaces or chambers M', M, as already described.

What I claim is:—

1. In an explosive gas engine, the combination of two cylinders arranged side by side, pistons within said cylinders dividing them into explosion and compression chambers, each cylinder having at its compression end a head provided with a duct for the outward passage of the compressed mixture and a duct for the inward passage of the uncompressed mixture, an external chamber for the mixed gases connected to the said ducts for the uncompressed mixture, a throttle valve for governing the gas supply for the said external chamber, and each cylinder having at its explosion end a head provided with an inlet duct for the compressed mixture and an exhaust duct, valves in the said inlet and exhaust ducts, a shaft parallel to and between the cylinders, valve operating devices between the said shaft and the two inlet and the two exhaust valves, and a governor actuated by the said shaft and connected to the said throttle valve, substantially as set forth.

2. In an explosive gas engine, the combination of two cylinders arranged side by side, oppositely moving pistons therein and dividing the cylinders into compression and explosion chambers, two ducts one leading from the compression end of one cylinder to the explosion end of the other, and the other leading from the compression end of the second cylinder to the explosion end of the first, two independently movable admission valves arranged opposite each other at the explosion ends of the cylinders, exhaust valves arranged opposite to each other at the said ends, a transverse valve shaft between the said admission and exhaust valves adapted to actuate the same, a throttle valve connected to the compression ends of both of said cylinders to control the intake of explosive mixture thereto, a governor connected to said valve and an operating shaft connected to the said governor and the said transverse valve shaft, substantially as set forth.

3. In a gas engine, the combination of two parallel cylinders arranged side by side, pistons in the cylinders, a crank shaft, connections between the pistons and the crank shaft, a gas valve located between the cylinders, ducts leading from the valve to the cylinders at their inner ends, a continuously rotating shaft parallel to the cylinders and located between them, a governor on the shaft, connections between the governor and valve whereby the action of the latter is controlled by the former, an intake valve and an exhaust valve located near the outer end of one cylinder, a similar intake valve and a similar exhaust valve located near the outer end of the other cylinder, a cross shaft located between the two cylinders and having connections with the aforesaid shaft to be continuously rotated thereby, and operative connections between the said cross shaft and the said valves whereby all of the valves are operated by the shaft in proper timed relation, substantially as set forth.

4. In a gas engine, the combination of two parallel cylinders located side by side, pistons in the cylinders, a crank shaft, connections between the pistons and the crank shaft, a valve for mixed gases between the cylinders, a shaft parallel to the cylinders and located between them, a governor controlled by the shaft, connections between the governor and the valve whereby the former controls the latter, ducts leading from the valve to the cylinders, inlet and exhaust valves for one cylinder, similar intake and exhaust valves for the other cylinder, a cross shaft, gearing between the cross shaft and the parallel shaft whereby the former is controlled

by the latter, and devices controlled by the cross shaft whereby the said inlet and exhaust valves of the two cylinders are operated in proper timed relation, substantially as set forth.

5. In a gas engine, the combination of two parallel cylinders, pistons one in each cylinder dividing it into explosion and compression chambers, a crank shaft, connections between the crank shaft and the pistons, each of the said cylinders having a gas intake duct connected with its compression chamber, an outlet duct for compressed gas connected with the compression chamber, and an inlet duct for compressed gas connected with the explosion chamber, the ends of said inlet and outlet ducts for compressed gas being immediately adjacent each other, and a single unitary connection between the two cylinders, the said connection having separate passages, one registering with the said outlet duct of one cylinder and the inlet duct of the other, and the other passage registering with the outlet duct of the second cylinder and inlet duct of the first, substantially as set forth.

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

CYRUS ROBINSON.

Witnesses:
H. HORNE,
M. L. ROWE.