C. T. WADE.

GAS ENGINE.

APPLICATION FILED OCT. 23, 1906.

931,531. Patented Aug. 17, 1909.

Fig. 1.

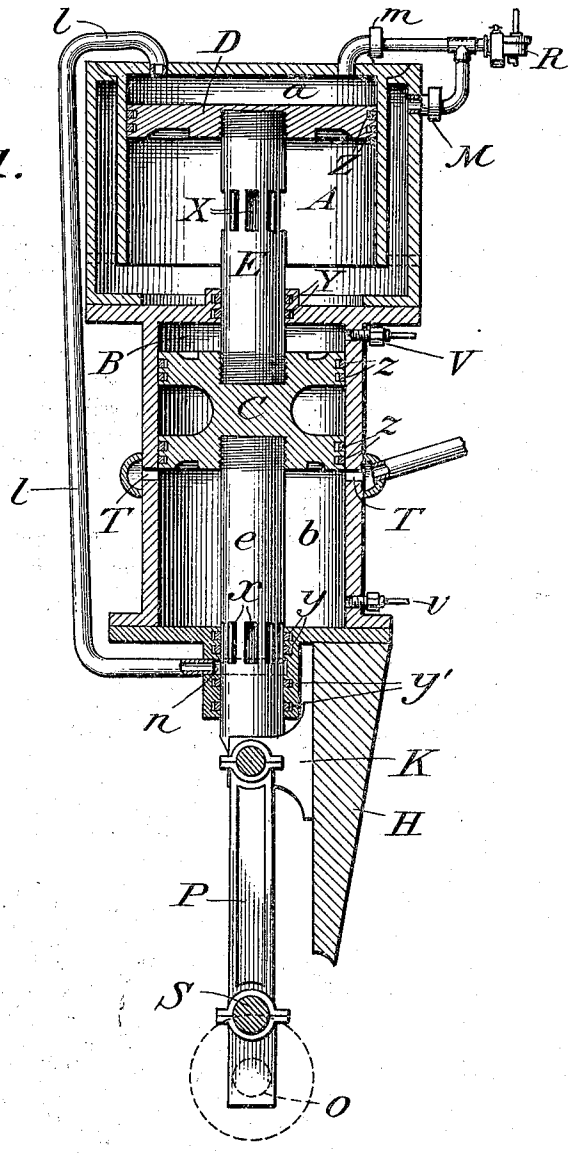
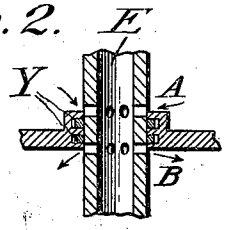


Fig. 2.



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CHARLES T. WADE, OF THE UNITED STATES NAVY.

GAS-ENGINE.

No. 931,531. Specification of Letters Patent. Patented Aug. 17, 1909.

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To all whom it may concern:

Be it known that I, CHARLES T. WADE, a citizen of the United States, and a lieutenant in the United States Navy, have invented new and useful Improvements in Gas-Engines, of which the following is a specification.

My invention relates to improvements in gas engines and the object of my invention is to provide a simple device of this type in which the explosion cylinder and a larger compression cylinder are placed end to end, a common piston rod connects the two pistons, a second piston rod or the first prolonged connects the piston in the explosion cylinder with a crosshead, the use of all valves between the cylinders is dispensed with, and in which all the burned gases in the explosion chamber are driven out and replaced with fresh carbureted air at the end of the stroke.

With this object in view, my invention consists in the construction and combinations of parts as hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a vertical section of my improved gas engine. Fig. 2 is a vertical section of a modified means for delivering the compressed carbureted air from the compression cylinder into the explosion cylinder.

A *a* represent a compression cylinder, larger than, and placed on the end of, the explosion cylinder B *b;* a common piston rod E connects the two pistons C and D, and a second piston rod *e* connects the piston C with the crosshead K, working on the crosshead guide H, the crosshead being connected to the crank-pin S of the crank-shaft O, by means of the connecting rod P.

The explosion cylinder is provided with exhaust ports T extending at intervals all the way around the cylinder, these ports leading to the open air or to a muffler of some suitable design.

The inlet to the compression cylinder is through a carbureter at R of some approved design, then through pipes and non-return valves at M and *m* to the two ends of the compression cylinder.

Cylinder and piston rod bearing surfaces are kept tight by means of piston rings Z and *z*, and by packing rings Y and *y* and *y'*, made of any suitable material; and rubbing surfaces of the crosshead, connecting rod and crank shaft are made of white metal, or other suitable material.

Connection is made from the upper end of the compression cylinder *a* to a chamber *n* between the packing rings *y* and *y'*, by means of a pipe *l l*.

A number of slots X and *x* are cut in the circumferences of the piston rods E and *e* in such a place that, near the end of the stroke, after exhaust has taken place, the slots X will extend in both the chambers A and B_2 connecting them; and near the end of the return stroke, the slots *x* will extend in both the chambers *b* and *n*, thus connecting *b* and *a* (through *l* and *n*). Thus the use of valves between the compression and the explosion cylinder, is entirely obviated.

The packing rings *y'* are placed apart so that the carbureted gas under compression may not escape to the open air when the slots are part way through this bearing.

The ignition is by any suitable means,—that shown in the drawing being by electric spark plug.

The cylinders may be air or water cooled, may be any size or shape, and the lubrication may be by any suitable method.

The explosive mixture of gas which has so far been called carbureted air, may be produced by drawing gasolene, oil or alcohol vapor, in combination with air, from a carbureter of some approved design; or may be produced by admitting a quantity of gasolene, oil or alcohol in a liquid state, into the cylinder filled with air.

Fig. 2 shows a modified form to replace the slots in the piston rods. The piston rod is here shown hollow, and at the places corresponding to the two ends of the slots, are sunk holes to the inside of the rod. At the end of the stroke, the course of the carbureted air would be from the compression cylinder A, through the upper holes to the inside of the rod, which is tight at both ends, then through the lower holes into the explosion cylinder B.

The operation is as follows:—Supposing the piston to be as in the drawing, with a charge of fresh carbureted air under compression in B. This charge being ignited by spark plug V forces piston C downward until exhaust ports T are uncovered. At the same time the piston D is forced downward, lightly compressing fresh carbureted air in

chamber A until the slots X extend through the partition between the chambers A and B, and thus open A to B; this occurring just after the exhaust ports T have been uncovered. The compressed charge in chamber A then drives out all the remaining burned charge in chamber B, and completely fills B with fresh carbureted air. Then on the return stroke, a partial vacuum is produced in A, to fill which fresh carbureted air rushes in through the carbureter at R, the pipe and non-return valve at M; the charge in B is compressed, the spark is applied at V and the operation continued, indefinitely. Similarly, in the position shown in the drawing, the exhaust has taken place in the explosion cylinder *b*, the slots *x* in the piston rod *e* have admitted fresh carbureted air under pressure, from compression cylinder *a* pipe *l* and chamber *n* to the explosion cylinder *b*, thus filling *b* with fresh carbureted air. On the return stroke a partial vacuum is created in compression cylinder *a*, causing fresh carbureted air to rush in through carboureter at R, pipe and non-return valve at *m;* the charge of fresh carbureted air in the explosion cylinder *b* being placed under compression. When the spark is applied at *v* the up stroke is again produced, compressing the charge in the compression cylinder *a*, until exhaust and the opening of the compression cylinder *a* to the explosion cylinder *b* again takes place, the operation then being continued, indefinitely.

I claim—

1. In a gas engine, the combination of a compression cylinder and an explosion cylinder arranged in line with each other, the head of one of said cylinders forming a partition between them, a cross head, a piston in each of said cylinders, slotted piston rods connecting said pistons together and connecting one of said pistons to said cross head, a crank shaft connected to said cross head and means, including said slotted piston rods, whereby the compressed charges of carbureted air may be delivered from the compression cylinder into each end of the explosion cylinder alternately, substantially as described.

2. In a gas engine the combination of an explosion cylinder and a compression cylinder arranged in line with each other, the head of one of said cylinders forming a partition between them, said compression cylinder being of greater diameter than said explosion cylinder, a piston in each of said cylinders, a slotted piston rod connecting said pistons, a cross head, a slotted piston rod connecting said cross head with one of said pistons, a connecting rod, a crank shaft connected thereto, and means, including said slotted piston rods, whereby the charge of carbureted air may be delivered from the compression cylinder into each end of the explosion cylinder alternately, substantially as described.

3. In a gas engine, the combination of an explosion cylinder and a compression cylinder arranged in line with each other, the head of one of said cylinders forming a partition between them, said compression cylinder being of greater diameter than the explosion cylinder, a piston in each of said cylinders, a peripherally slotted piston rod connecting said pistons, a cross head, a peripherally slotted piston rod connecting one of said pistons with said cross head, a crank shaft, a rod connecting said cross head and said crank shaft, and a connecting tube leading from one end of said compression cylinder to one end of said explosion cylinder, whereby compressed charges may be delivered to the opposite ends of the explosion cylinder alternately, substantially as described.

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Witnesses:
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