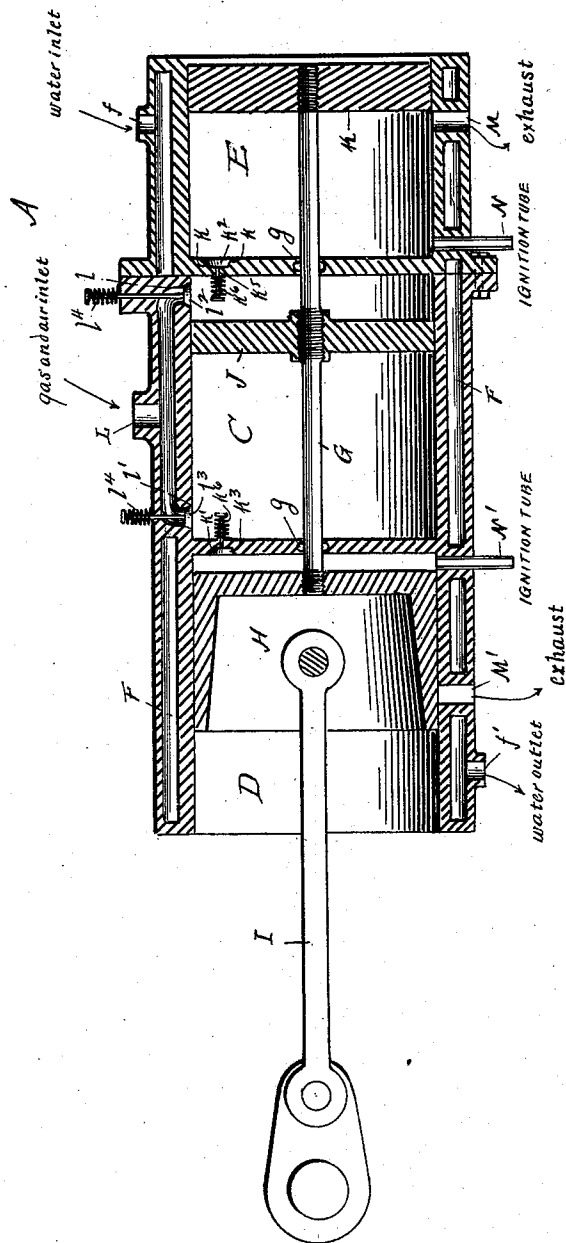


(No Model.)

G. H. WILLETTTS.
EXPLOSIVE ENGINE.

No. 567,530.

Patented Sept. 8, 1896.



Witnesses:

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Phillips.

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UNITED STATES PATENT OFFICE.

GEORGE HENRY WILLETTS, OF ZELIENOPLE, PENNSYLVANIA.

EXPLOSIVE-ENGINE.

SPECIFICATION forming part of Letters Patent No. 567,530, dated September 8, 1896.

Application filed November 30, 1895. Serial No. 570,619. (No model.)

To all whom it may concern:

Be it known that I, GEORGE HENRY WILLETTS, a citizen of the United States, and a resident of Zeliénople, in the county of Butler and State of Pennsylvania, have invented certain new and useful Improvements in Explosive-Engines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawing, and to letters of reference marked thereon, which forms a part of this specification.

The figure of the drawing is a representation of a central vertical longitudinal section of engine.

The object of this invention is to provide an explosive-gas engine of improved character; and the invention consists in the novel construction and combination of parts, all as hereinafter described, and pointed out in the appended claims.

Referring to the accompanying drawing, the letter A designates an elongated open-ended cylinder, having therein partition heads or walls B B', which divide its interior into a central charging-chamber C and end power-chambers D and E.

F designates a water-jacket which surrounds the inner wall or shell of the said cylinder.

f is the water-inlet, and *f'* the outlet thereof.

G designates a piston-rod which is common to the three cylinder-chambers and extends through the walls or heads B B'. *g g* are metallic packings for said rod where it passes through the said walls or heads.

H is a trunk-piston in chamber E, and to which one end of the piston-rod is connected. The use of this form of piston enables me to do away with slides, the connecting-rod I being connected directly thereto.

J designates a second piston, which works in the charging-chamber C, and K is a third piston, which works in the power-chamber D.

L designates the gas and air inlet, from which lead two ports or passages *l l'*, which communicate with the charging-chamber C near the respective ends thereof. *l² l³* are valves which control the said ports and which

are normally held to their seats by the action of springs *l⁴*.

k k' are ports in the respective partition walls or heads B B' and which connect, respectively, the chambers D and E with the chamber C. *k² k³* are valves which control said ports and which open toward the respective chambers D and E. *k⁵* are springs which are seated around the said stems *k⁵* for the purpose of reseating the valves.

M M' are the exhausts for the respective chambers D and E, and which communicate with the central portions thereof. N N' are the ignition or "hot" tubes for the said chambers.

The operation is as follows: Supposing the piston-rod and its pistons to be on the forward stroke, a vacuum is created in the chamber C behind the piston J which causes the valve *L³* to unseat and gas and air to be drawn into that end of said chamber. At the same time the valve *k²* is forced open by the compression of the air and gas upon the opposite side of the piston J, admitted upon the previous stroke, which air and gas then flow into the chamber E. This inflow of gas and air cleans out the chamber E, (the exhaust being open.) As soon as the pressure in chambers E and C becomes equalized, or nearly enough so to balance the valve *k²*, the latter is closed by its spring. The piston is now upon its return stroke, and the air and gas are compressed in the chamber E by the piston H until the explosion takes place, which occurs at the time the limit of the return stroke is reached. During this same stroke the valve *k³* is opened and the air and gas previously admitted to the chamber C behind the piston J are forced into the chamber D to be compressed by piston K upon the next forward stroke. At the same time a new charge of air and gas is being admitted behind the piston J. It will be noted that the piston-rod is always under tension.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an explosive-gas engine, the combination with the cylinder having a central charging-chamber and a power-chamber at each end thereof communicating with the charg-

ing-chamber by a valved port, said power-chambers having each an exhaust-port near its outer end, and the charging-chamber to valved gas and air inlet ports, of the centric
5 piston-rod common to all three of the chambers, and the three piston-heads carried by said rod, one for each chamber, substantially as specified.

2. In an explosive-gas engine, the combination with the open-ended, water-jacketed cylinder, having therein two power-chambers and an intermediate charging-chamber communicating with each of the power-chambers by a port through its end wall, spring-actuated valves for controlling said ports, an exhaust-port and an ignition-tube for each
15 power-chamber, and two valved air and gas inlet ports communicating with the respective end portions of the charging-chamber, of the piston-rod common to all of said chambers, and the three piston-heads carried by the
20 said rod, one for each of the said chambers, the forward of said pistons being of trunk form, substantially as specified.

25 3. In an explosive-gas engine, the combination with a cylinder having two power-chambers and an intermediate charging-chamber communicating with each of the power-chambers by a valved port through its end wall,

said chambers having suitable inlet and exhaust ports, of the piston-rod common to all three of the chambers, and the three pistons carried by said rod, one in each chamber, the forward piston being of trunk form, substantially as specified.

4. In an explosive-gas engine, the elongated cylinder having therein two diametric partitions, forming a central or charging chamber, and two end or power chambers each of which communicates with the central chamber through one of said partitions, a spring-actuated valve for controlling each of said
40 ports, and a centric piston-rod common to the three chambers, and carrying a piston-head in each, said central or charging chamber having a valved inlet-port communicating with each end portion thereof, and the end or power chambers having each an exhaust-port at its outer end portion and an
45 ignition device at its inner end portion, substantially as specified.

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

GEORGE HENRY WILLETTS.

Witnesses:

T. M. WARD,
GAWN WARD.