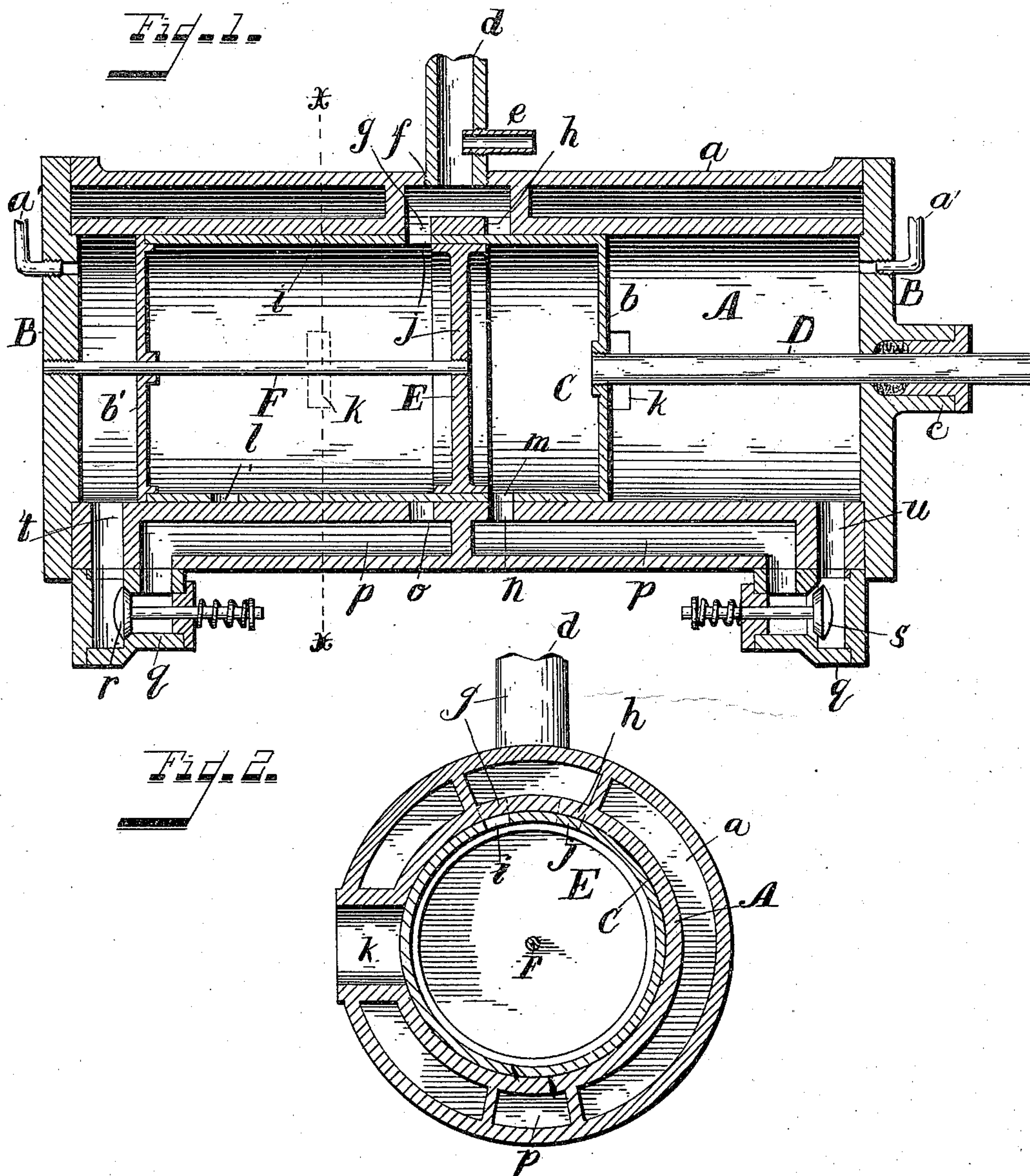


(No Model.)

L. F. BURGER.  
GAS ENGINE.

No. 598,496.

Patented Feb. 8, 1898.



Witnesses.

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# UNITED STATES PATENT OFFICE.

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## GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 598,496, dated February 8, 1898.

Application filed September 17, 1896. Serial No. 606,151. (No model.)

*To all whom it may concern:*

Be it known that I, LEOPOLD F. BURGER, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Gas-Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to double-acting gas or explosive engines of that class in which two impulses are given to the piston-rod for each revolution of the crank-shaft; and it has for its object the improved construction of such engines, whereby a single closed cylinder is employed and whereby the simplicity and efficiency of action of the engine are greatly increased.

The novelty of my invention will be hereinafter set forth, and specifically pointed out in the claims.

In the accompanying drawings, Figure 1 is central sectional side elevation of the cylinder and so much of the associated parts of a gas-engine as is necessary to illustrate my invention. Fig. 2 is a transverse sectional view on the dotted line *xx* of Fig. 1, looking to the right.

The same letters of reference are used to indicate identical parts in both the figures.

As the framework and ordinary details of the engine constitute no part of my invention I have not illustrated the same, and they may be of the usual or any suitable construction.

I provide a single cylinder A, closed at both ends by heads B and surrounded by a water-jacket *a*. Within the cylinder is fitted a hollow cylindrical piston C, turned true both on its exterior and interior surfaces and with closed ends or heads *b' b*. The length of this piston is a little more than one-half of the length of the cylinder, and to its head *b* is suitably secured a piston-rod D, which extends out through a stuffing-box *c* and is suitably connected by a pitman (not shown) to the crank-shaft of the engine. Within the piston is snugly fitted a partition-head E, located at the middle of the cylinder and held stationary by a rod F, secured thereto and extending through an aperture in the head

*b'*, and has its outer end suitably secured to the head B of the cylinder. The air is admitted to the cylinder through a passage *d*, into which the explosive material is also admitted through a small passage *e*, and both of these passages may be controlled by valves. (Not shown.) The passage *d* opens into a chamber *f*, having two ports *g h*, which, as seen in Fig. 2, are out of alinement with each other, but which are on each side of the dividing-head E. The piston is likewise provided with two ports *i j*, the latter of which registers with the port *g* when the head *b'* is adjacent to the head B at one end of the stroke of the piston, as seen in Fig. 1, and the former of which registers with the port *h* at the end of the opposite stroke of the piston when the head *b* is adjacent to the head B, carrying the stuffing-box. Exhaust-ports *k* are formed through the sides of the cylinder, as shown, so as to be uncovered by the piston just before the end of its stroke each way to permit the escape of the burned gases, and these ports, if desired, may enter a channel common to both. The piston has two other ports *l m* near its outer end, the latter of which registers with a port *n* through the cylinder when the ports *g* and *j* register, and the former of which registers with a port *o* when the ports *h* and *i* register. The ports *n o* open into passages *p*, which lead to valve-cases *q* at the ends of the cylinder, containing spring-closed valves *r s*, opening into ports *t u*, leading into the cylinder at each end. These valves may be of the usual or any suitable construction and may be opened by the action of the piston alone and closed by their springs, or they may be actuated by any suitable automatic governor mechanism connected with the engine.

Any suitable igniting mechanism may be used for exploding the compressed charge at each end of the cylinder, and I have only illustrated a well-known form of tube-igniter *a'* for that purpose.

The operation of the engine is as follows, assuming that a charge has just been drawn in through the ports *g j* into the piston and that a compressed charge is about to be exploded between the head *b'* of the piston and its adjacent head B of the cylinder, the posi-



tion of the parts being shown in Fig. 1: At this same moment the ports *m n* register, and the charge within the piston, between the head *b* and partition *E*, is forced through the open valve *s* and port *u* into the cylinder between the head *b* of the piston and the head *B* of the cylinder carrying the stuffing-box. The exhaust on this side is open, as shown, and just the moment the charge on the left is exploded the piston is propelled to the right, closing the exhaust on the right and the valve *s*, thereby compressing the charge at the right of the piston until the piston reaching the end of its travel the charge to the right is exploded and the piston again propelled to the left. At each stroke of the piston a fresh charge is drawn into the piston and then is expelled therefrom into the end of the cylinder just at or after the moment of exhaust, and an impulse is given to the piston at each end of its stroke, as will be readily understood.

Having thus fully described my invention, I claim—

1. In a double-acting gas-engine, the combination of a single cylinder with closed ends, a hollow piston with closed ends fitted therein, a piston-rod carried by said piston, a partition within said piston held by a stay-rod se-

cured to one of the heads of the cylinder, inlet-ports for the explosive charge registering alternately with ports in the piston at each end of its stroke on each side of the partition-head, outlet-ports from the piston registering alternately with other ports leading to the cylinder outside of the piston at each end and controlled by valves, and igniting mechanism, substantially as described.

2. In a double-acting gas-engine, the combination of a single cylinder with closed ends provided with inlet-ports *g, h* out of alignment, a hollow piston, *C*, within said cylinder and provided with ports, *i, j*, to register alternately with the ports, *g, h*, a fixed partition-head, *E*, within said piston and located between the ports, *g, h*, the ports, *l, m* in said piston to register alternately with ports, *o, n*, opening into the cylinder through ports, *t, u*, controlled by valves, exhaust-ports, *k*, and igniting mechanism, the whole constructed and arranged substantially in the manner and for the purpose specified.

LEOPOLD F. BURGER.

Witnesses:

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