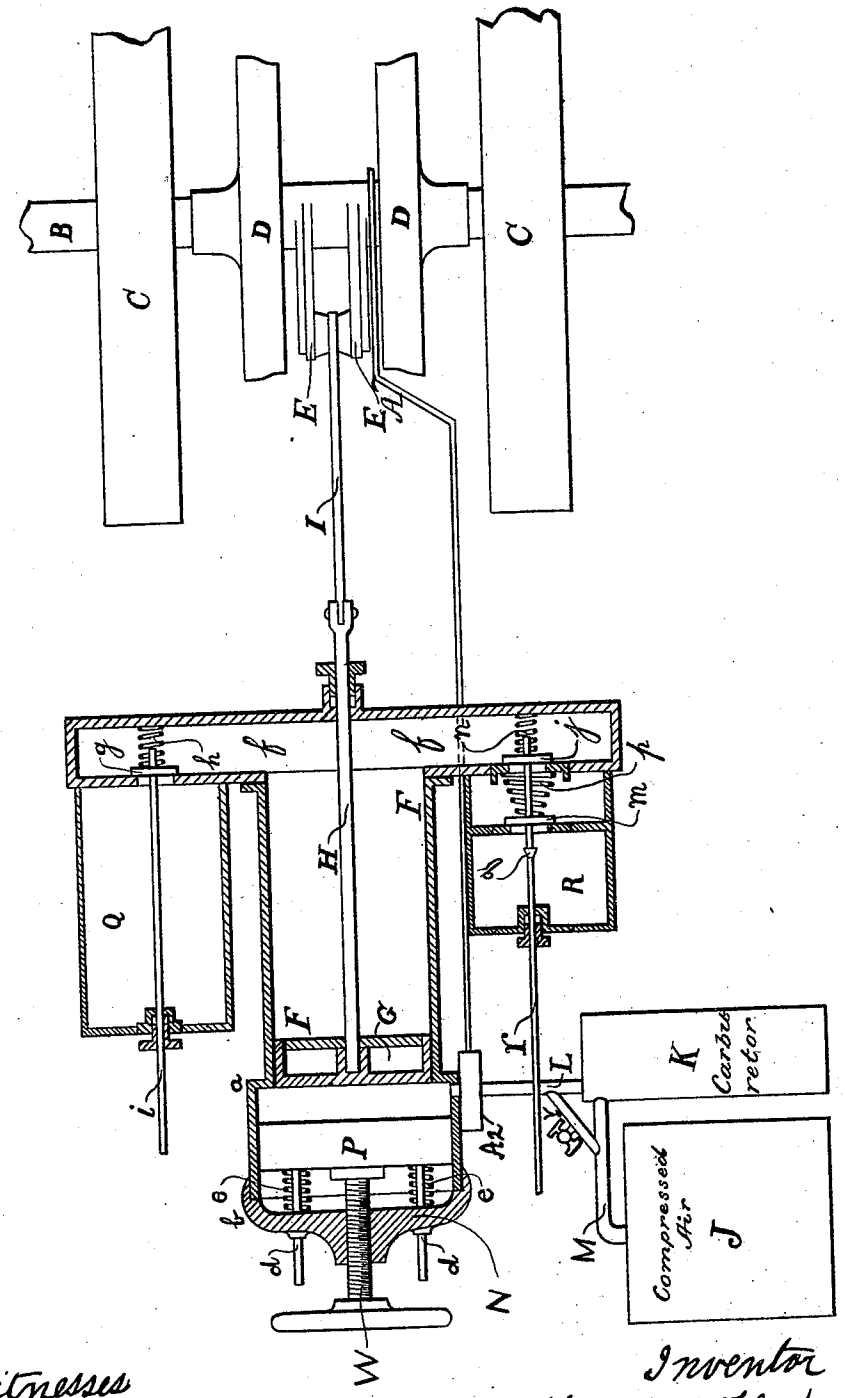
(No Model.)

H. C. HART.

GAS ENGINE.

No. 569,918. Patented Oct. 20, 1896.



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HENRY C. HART, OF DETROIT, MICHIGAN.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 569,918, dated October 20, 1896.

Application filed May 31, 1894. Serial No. 513,061. (No model.)

To all whom it may concern:

Be it known that I, HENRY C. HART, of Detroit, in the county of Wayne and State of Michigan, have invented a new and useful Improvement in Gas-Engines, of which the following is a specification.

My invention relates to gas-engines; and it consists in the improvements hereinafter described, and pointed out in the claims.

Referring to the accompanying drawing, the figure is a plan view, partly in section, of so much of a gas-engine as is necessary to illustrate my invention.

B is the main shaft, and C C are the fly-wheels, of the engine.

D D are drums keyed upon the shaft B.

E E are arms pivoted upon the shaft B between the drums D D. The arms E E are free to turn in a positive direction (looking from the lower side of the figure) independent of the shaft B and drums D D, but are prevented from turning in the other direction independent of said drums by a clutch.

F F is a cylinder which is closed to the outer air at both ends. The rear end of said cylinder from *a* to *b* is made larger than the remainder and is closed by a movable piston P.

G is a piston adapted to fit and reciprocate in the smaller portion of the cylinder F. H is a piston-rod attached to said piston and extending through a stuffing-box in the forward end of said cylinder.

I is a connecting-rod pivoted at one end to the outer end of the piston-rod H and at the other end to the free ends of the arms E E.

J is a reservoir of compressed air.

K is a carbureter.

L M Y are pipes connecting the carbureter K, reservoir J, and cylinder F.

A part of the compressed air from the reservoir J passes through the carbureter K and becomes impregnated with a combustible vapor. Another portion of said air passes through the pipe Y and mixes in the pipe L with the portion that has passed through the carbureter K to form an explosive mixture. The cock in the pipe Y is used to regulate the size of the passage through said pipe, and consequently the amount of air that passes to the pipe L, without passing through the carbureter K.

N is a yoke secured to the cylinder F and extending diametrically across the rear end of said cylinder.

P is a piston fitting and adapted to reciprocate in the larger portion of the cylinder F.

d d are guide-rods secured to the piston P and passing through apertures in the yoke N.

e e are coil-springs surrounding the guide-rods *d d*, pressing by their elasticity against the yoke N and against the piston P.

W is a hand-screw the shank of which passes through the yoke N, concentric with the cylinder F. The inner end of the shank of the hand-screw W is adapted to limit the backward travel of the piston P.

When the gas between the pistons P and G is at the tension of the atmosphere, the piston P is forced by the pressure of the springs *e e* to the inner end of the enlarged portion of the cylinder F, in which said piston reciprocates.

A is a valve-rod connected at one end to an eccentric on a sleeve around the shaft B, said sleeve being rigidly connected to the arms E E.

A^2 is a valve-case in which is a valve operated by the rod A to admit the charge at the proper moment and to exhaust the products of combustion as required.

I have not attempted to show and describe the valve mechanism and valves particularly, as they form no part of my present invention.

Q and R are cylindrical chambers, each of which is closed at one end and at the other end communicates by a passage *f* with the cylinder F.

g is a valve which may close the passage between the chambers Q and the cylinder F.

h is a spring adapted to force the valve *g*, passing through a stuffing-box in the end of the chamber Q.

j is a valve entirely similar to the valve *g*, adapted to close the passage between the chamber R and the cylinder F.

The chamber R is divided into two compartments by a diaphragm or partition.

m is a valve located about midway between

the ends of the chamber R and adapted to close all connections between the two portions of said chamber.

n is a spring acting to force the valve *j* against its seat.

p is a spring acting to hold the valve *m* against its seat.

r is a valve-stem secured to the valve *j* and passing through an aperture in the valve *m* and through a stuffing-box in the end of the chamber R.

q is a lug upon the valve-stem *r*, located a short distance from the valve *m* when the valve *j* is on its seat.

The operation of the above-described device is as follows: Air is compressed to a small tension and forced into the reservoir J by an auxiliary pump. (Not shown.) This air is carbureted and converted into an explosive mixture on its way to the cylinder F. When the piston G has reached the position shown, the inlet-valve is opened, permitting the explosive mixture to rush in between the pistons P and G, forcing the piston P back until it strikes the hand-screw W. At this point the inlet-valve is closed and the charge is ignited by an electric spark or otherwise. The force of the explosion drives the piston G forward, compressing the air before it. When the force of the explosion has spent itself, the piston G comes to rest, and the compressed air before it drives said piston back to its first position and imparts the energy stored up in said air to the main shaft B by means of the clutches upon the arms E E.

If the valves *g* and *j* are closed, the only air compressed by the piston G will be that in the cylinder F and passages *f f*, and by the stroke of said piston will be compressed to comparatively high tension. If the valve *j* is opened by pressing the stem *r* in a short distance, the piston G will compress the additional amount of air contained between valves *j* and *m*. The stroke of said piston will be somewhat longer and the tension of the air will be somewhat less than under the first-named conditions. If the valve-stem *r* is pressed still farther in, the lug *q* will strike against the valve *m* and force said valve away from its seat, so that all the air in chamber R will be compressed by the forward movement of the piston G.

The valve *g* may be opened in the same manner as the valve *j*, adding the amount of air in the chamber Q to that to be compressed by the forward movement of the piston G. In this way the stroke of the piston G and the tension of the air compressed before it may be varied between limits, and by screwing the hand-screw W in or out the amount of the charge may be varied to adapt the energy of explosion to the amount of resistance, so that the action of the engine may be adapted to the work required of it. An auxiliary spring may be used to bring the piston G back to the same place at the end of each stroke and to prevent the force of the explosive mixture from moving piston G.

As the cross-section of the cylinder F at that portion in which the piston P travels is considerably greater than that of the rest of the cylinder, only a short travel of said piston is required to admit the necessary quantity of explosive mixture, so that only a short time is lost in getting the charge into said cylinder. It will be noticed that the pistons P and G come nearly together at the end of each stroke, so that nearly all the products of combustion are expelled in the exhaust.

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

1. In a gas-engine in which the work of the explosion is stored in an air-cushion, the combination of a chamber for containing the air constituting said cushion, one or more auxiliary air-chambers, and one or more valves adapted to close the passage between said chambers, substantially as shown and described.

2. In a gas-engine in which the work of the explosion is stored up in an air-cushion, an auxiliary air-chamber R, communicating with the main chamber, the chamber R, being divided into two compartments, valves *j m* adapted to close the passages between said compartments and the main chamber a valve-stem *r*, secured to the valve *j*, said valve-stem passing through, and adapted to slide through an aperture in the valve *m*, and a lug *q*, upon said valve-stem, substantially as shown and for the purposes described.

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Witnesses:
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