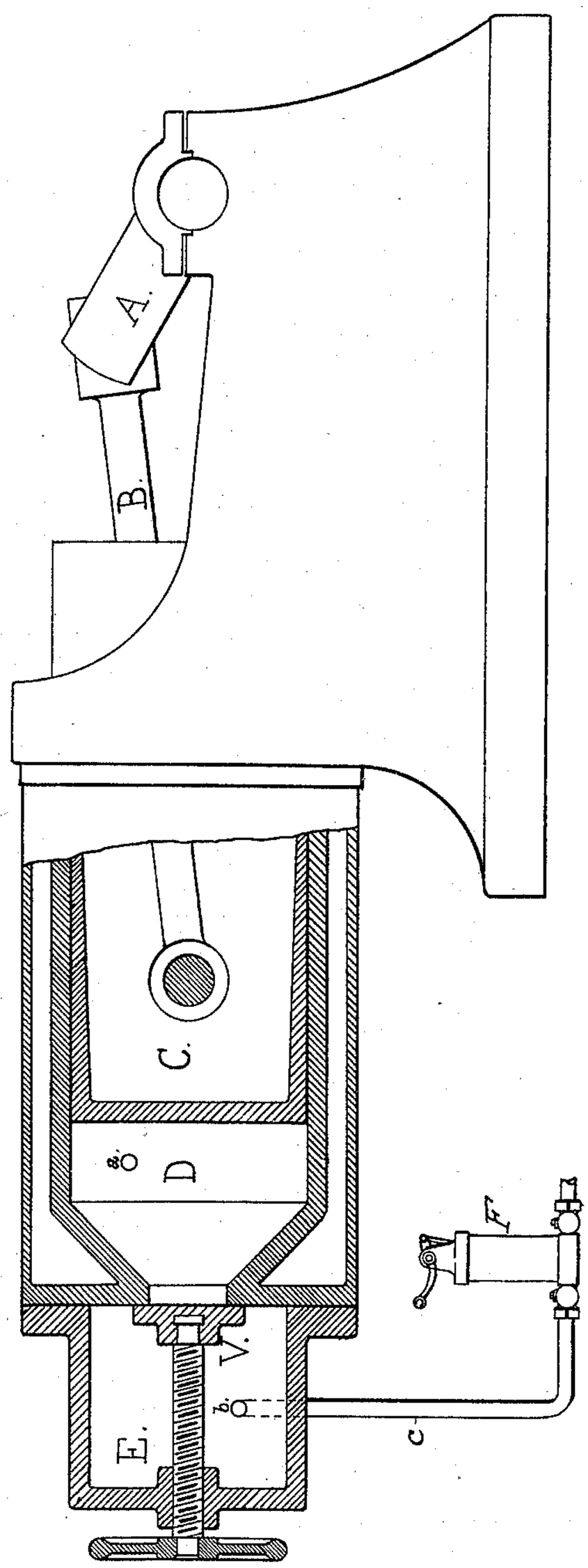
(No Model.)

P. A. N. WINAND.

METHOD OF STARTING GAS OR HYDROCARBON ENGINES.

No. 561,302. Patented June 2, 1896.



WITNESSES:

Chas. C. Collier.

Jno. S. Schuler

INVENTOR

Paul A. N. Winand,

BY

Chas. B. Collier,

ATTORNEY.

UNITED STATES PATENT OFFICE.

PAUL A. N. WINAND, OF PHILADELPHIA, PENNSYLVANIA.

METHOD OF STARTING GAS OR HYDROCARBON ENGINES.

SPECIFICATION forming part of Letters Patent No. 561,302, dated June 2, 1896.

Application filed February 25, 1893. Serial No. 463,675. (No model.)

To all whom it may concern:

Be it known that I, PAUL A. N. WINAND, a subject of the King of Belgium, residing in the city of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented an Improvement in Gas or Hydrocarbon Engines, of which the following is a specification.

My invention relates to that class of gas or hydrocarbon engines in which the movement of the piston is effected by the explosion of charges of mixed air and gas behind the piston in the cylinder of the engine; and it consists, briefly stated, in providing the engine with a supplementary storage chamber or vessel connected to the cylinder and having a valve opening therefrom into the cylinder, into which chamber I admit, under pressure, an explosive mixture and introduce the same at the proper times into the working cylinder of the engine where the same is ignited in the ordinary way.

In the accompanying drawing, A is the crank of the engine; B, the connecting-rod; C, the piston; D, an extension of the cylinder into which the explosive mixture is introduced; E, the supplementary chamber above referred to; *a*, a valved opening from the cylinder of the engine into the atmosphere for the exhaust, in the first instance, of the air contained in said space into the external atmosphere upon the introduction of the explosive mixture.

b is a valved inlet into the chamber E for the introduction of the explosive mixture into the latter, and V is the valve opening from the chamber E into the cylinder D.

Any ordinary pump or appliance F may be employed for forcing an explosive mixture of air and gaseous or vaporized fuel through a pipe *c* and inlet *b* into the chamber or vessel E.

In the starting of the engine—that is to say, prior to the introduction into the cylinder of the explosive mixture—it is desirable that the piston C be set at or near the beginning of its working stroke, so as to produce a considerable driving power on the crank A when pressure is produced in the cylinder D by the introduction of the explosive mixture. This being done, communication is established between the interior of the cylinder and the outer atmosphere, which may be either by means of the opening *a* controlled by a special cock or valve or by and through the inlet or exhaust valve of the engine. Next, the valve V between the chamber E and the cylinder D is opened, and the explosive mixture is forced from the pump or source of supply through the inlet *b* into the vessel E and through the valve V into the cylinder under a pressure slightly above atmospheric pressure, thus displacing the air contained in the cylinder, which escapes into the atmosphere. Next, the communication between the cylinder and the atmosphere is closed, as is also the valve V between the chamber E and the cylinder; but the introduction of the explosive mixture into the vessel E is continued until the desired pressure has been attained in said chamber E. When such desired pressure has been attained, the valve V is again opened, and the compressed mixture flows into the cylinder and acting upon the piston starts the engine.

The igniting device (not shown, but which may be any of the well-known devices employed for that purpose) now fires or ignites the mixture—that is to say, as soon as motion has been imparted to the piston by the pressure exerted upon it of the compressed explosive mixture that has been introduced into the cylinder.

It is very important in engines of the character herein referred to that the impulse of the first charge should be very powerful or sufficiently so to enable the engine to make several revolutions. According to my invention herein described a more powerful initial impulse can be applied or given to the engine than in any other manner known to me by reason of the increased volume of the explosive mixture employed as compared with the volume contained simply in the cylinder itself, which is the ordinary method; and, again, by reason of the fact that according to my method motion is imparted to the piston by the direct pressure of the introduced mixture prior to the explosion or ignition of the latter. A certain velocity of the piston has thus been attained immediately before the explosion of the mixture occurs, which is very desirable and a valuable feature, while in all other engines of this class known to me the piston is at rest when the first explosion is effected. In the latter cases a comparatively

long time is required for the piston to travel the first small fraction of its range of motion, during which time the temperature, and consequently the pressure, of the exploded charge will have been reduced considerably and the result in useful work accomplished is small. Again, it may be stated that, other things being equal, when starting an engine of this character from a given pressure, which it is not advisable to exceed, the larger the initial volume of the mixture is the better will there be sustained the pressure during the stroke and the more efficient will be the work performed. Another fact important to be stated in connection with my invention is this, to wit: In engines of the class under consideration when the resistance to the motion of the engine upon its being started is considerable it is impracticable to give or secure such initial impulse to the piston as to effect the compression, upon the inward stroke of the piston, of the succeeding charge of mixture introduced into the cylinder according to the present methods employed, and even when the external resistance to the engine is not excessive, if one or two charges of mixture first introduced into the cylinder are not adapted for explosion, as is frequently the case, the energy of the first impulse would be overcome in effecting the compression of the mixture in the cylinder upon the return or inward strokes of the piston after a few revolutions. Such being the case it is usual in present constructions to employ means to greatly reduce, if not entirely remove, the pressure of the mixture in the rear of the piston at the outset, which is done by discharging upon the inward strokes a large portion of the mixture into the atmosphere or into the exhaust-pipe. All of this portion of the mixture is of course wasted.

According to my present method the compression to be effected by the piston on its inward stroke and the consequent resistance opposed to it is reduced without the necessity of allowing any portion of the charge to escape or be wasted. This result is attained simply by allowing the valve between the supplementary chamber E and the cylinder D to remain open until the engine has acquired sufficient speed to enable it to effect the full compression of the mixture within the cylinder itself upon the inward stroke of the piston, the increased space afforded by the supplementary chamber resulting in correspondingly-reduced resistance to the piston upon its inward stroke. When the engine shall have attained sufficient speed to effect easily the compression of the mixture within the cylinder D, the valve V is closed and the engine is operated in the usual way—that is to say, the mixture is introduced from any suitable source of supply directly into the cylinder—and as this method is well known I do not deem it necessary to describe the same or the valve mechanism connected therewith.

It is hardly necessary to say that the mixture for the displacement of the air in the cylinder in the first instance may be introduced as well from the ordinary source of supply as from the supplementary chamber E without departing from my invention.

It is evident that when the engine is to be stopped after having performed its work it can be made to store compressed explosive mixture in the chamber E ready for use in starting the engine again by opening the valve V and at the same time cutting off the igniting device and again closing the valve V when the charge shall have been compressed in the chamber E.

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

1. The method of starting a gas or hydrocarbon engine, which consists in first displacing the atmospheric air or gases contained in the working cylinder of the engine by the introduction to the cylinder of a charge of combustible under a pressure only sufficient to effect such displacement and then introducing to said cylinder combustible mixture under a higher pressure, substantially as described.

2. The method of facilitating the starting of a gas or hydrocarbon engine which consists in providing means, extraneous to the cylinder for the reception, without exhaust into the atmosphere, of the volume of the combustible mixture, upon the inward stroke of the piston, substantially as described.

3. In a gas or hydrocarbon engine, the combination, with a piston and piston-cylinder, of a chamber for containing combustible material communicating with the cylinder, a valve for opening and closing the passage between said chamber and cylinder, said chamber and cylinder being provided with openings for the admission, respectively, of combustible material and the admission and exit of air, valves for covering said openings, and a pump connected with the opening in the chamber for forcing the explosive mixture into the same, all substantially as and for the purposes set forth.

In testimony whereof I have hereunto subscribed my name, in the presence of two witnesses, on this 14th day of February, A. D. 1893.

PAUL A. N. WINAND.

Witnesses:
CHAS. C. COLLIER,
GEO. W. REED.