UNITED STATES PATENT OFFICE.

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WORKING PROCESS FOR INTERNAL-COMBUSTION ENGINES.

1,039,823. Specification of Letters Patent. Patented Oct. 1, 1912.

No Drawing. Application filed February 3, 1910. Serial No. 541,841.

To all whom it may concern:

Be it known that I, GEORG SCHIMMING, a subject of the German Emperor, and residing at Friedrichshain 7, Berlin, Germany, have invented a certain new and useful Improved Working Process for Internal-Combustion Engines, of which the following is a specification.

This invention relates to internal combustion engines in which the exhaust gases are compressed in the cylinder, the firing mixture being then led into these compressed gases and ignited. If in such engines, the process is adopted that, at the end of the expansion stroke the exhaust valve is opened, and the pressure in excess of that of the atmosphere thereby removed, and then the exhaust valve immediately after closed again, too high a temperature in the case of a small compression space, such as must be used in order to attain economical results, is reached on the end of the compression, which high temperature is especially deleterious for the preservation of the working surfaces of the cylinder. In order to avoid the above mentioned disadvantage, the exhaust valve is not closed immediately after the excess pressure has been exhausted, but is kept open during part of the exhaust stroke, the result being that only part of the exhaust gases remain in the cylinder, and the compression is only effected to that point, which corresponds to the required firing temperature. This however in the case of the above mentioned small compression spaces has the great disadvantage, that the compression pressure of the exhaust gases no longer attains the initial expansion pressure namely the pressure at which the fuel was injected into the cylinder. It is therefore necessary, as in the case of a steam engine in which the compression at the end of the stroke is not carried up to the point where the pressure of the entering steam commences, for the fuel to rush in, thereby filling the small space, the result being an economical disadvantage. There is a further disadvantage of far greater importance than that above mentioned, in that the inrushing fuel (which may consist of a mixture of a gaseous or fluid fuel in the nature of a fine spray) may suddenly flare up or explode in the space at the lower pressure and since the admission valve must be sufficiently far open to admit the mixture, there is in consequence of the sudden combustion an increase of pressure over the pressure of the entering fuel, and thus it happens that in such internal combustion engines there is a back firing of the flame into the compressed fuel space. Even if the described increase of pressure only rises so far that the speed of admission of the fuel mixture become less than the firing speed, the result will be a back firing of the flame from the working cylinder into the space containing the mixture of impressed fuel and air.

In order to avoid the disadvantages above described it is necessary that, at the end of the compression stroke, there should be attained in the working cylinder not only the firing temperature but also approximately the pressure of admission. Such a working process is the object of the present invention and is carried into effect in the manner hereinafter described.

At the end of the expansion stroke, the exhaust valve opens in the usual manner, and permits such a quantity of gas to escape that the excess pressure in the cylinder is reduced, thereupon, during the course of the following compression stroke, fresh air is added to the exhaust gases which are being compressed. If the engine be of the four cycle type the air is added by suction and if of the two cycle type then by pressure, the air being added in such quantities that at the end of the compression stroke there are attained—firstly the temperature necessary for igniting the inrushing fuel and secondly, the pressure mentioned above as being necessary, the air being added in either one of the following ways. (*a*) That at, or after the outer dead center is passed, part of the exhaust gases are displaced by cold air. (*b*) By forcing compressed air into the exhaust gases the compression of which has commenced. The addition of this air gives also the following special advantage namely that in engines wherein the exhaust gases are compressed a cooling of the cylinder is obtained, while usually in these engines even with the compression of only a part of the exhaust gases, the lowest temperature of the gases contained in the cylinder, is exactly the same as the temperature of the exhaust gases.

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

1. The method of operating internal com-

bustion engines consisting in reducing the excess pressure in the cylinder at the end of the expansion stroke and admitting fresh air to the exhaust gases that are being compressed during the following compression stroke, said air being admitted in such quantity as to attain the ignition temperature for the in-rushing fuel and for creating the pressure necessary in the compression chamber during the compression of the mixture of exhaust gases and air.

2. The method of regulating the compression temperature in internal combustion engines in which waste gases are compressed consisting in introducing air to the waste gases in such quantity that the ignition temperature is safely attained and at the same time creating such pressure by compression that same is as nearly equal as possible to the admission pressure.

3. The method of regulating the ignition temperature in internal combustion engines and creating at the same time a pressure by compression as nearly equal to the admission pressure as possible consisting in admitting fresh air to the exhaust gases of reduced pressure in the cylinder during the compression stroke in such quantity as to attain safely the ignition temperature for the in-rushing fuel and creating at the same time a pressure in the compression chamber during the compression of the mixture of exhaust gases and air which is nearly equal to the admission pressure.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GEORG SCHIMMING.

Witnesses:
HENRY HASPER,
WOLDEMAR HAUPT.