PATENT SPECIFICATION

Application Date : Nov. 4, 1926. No. 27,737/26. **276,528**

Complete Accepted : Sept. 1, 1927.

COMPLETE SPECIFICATION.

Improvements in or relating to Internal-combustion Engines.

I, FRITZ GOCKERELL, a German citizen, of Feilitzschstrasse 2A, München, Germany, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to a two-stroke or four-stroke internal-combustion engine with automatic ignition.

The invention comprises a simplified construction and a reliable working engine which, owing to its light weight, is eminently suitable for motor vehicles and enables an engine speed of 3000 to 4000 revolutions per minute to be obtained. All the hitherto known constructions of high speed Diesel engines which are built without compressor or provided with a mixing chamber separated from the interior of the cylinders, fail to give the power ensured by the invention, and also to fulfil the conditions with which a motor vehicle engine has to comply.

In the first place, these engines cannot attain the high number of revolutions which, in the case of motor vehicle engines, is just as essential as rapid acceleration, and in addition, their great weight as well as the high cost due to the complicated manufacture, render them unsuitable for motor vehicle engines.

The invention eliminates these drawbacks and provides not only a high speed, but also an astonishingly simple automatic ignition engine which works in a reliable manner and with the greatest economy with any liquid fuel.

The invention is characterised by the main piston being provided with a fuel-chamber of variable capacity and operated so that it opens at the beginning of the upward stroke of the piston for the purpose of receiving and conveying fuel, and closes at the upper dead centre of the piston after being placed in communication with the cylinder combustion chamber.

Several constructions of the new engine are illustrated by way of example in the accompanying drawing, applied to a two-stroke engine.

Figures 1 and 2 show in longitudinal section an engine with the piston in the uppermost and near lowermost dead centre positions, respectively.

Figures 3 and 4 show in longitudinal section two constructions of a poppet valve engine in which however the inner distribution by the piston takes place in a different manner.

In the construction shown in Figures 1 and 2, 1 is the crank-case on which is mounted the cylinder 2 which is provided in the well-known manner with the exhaust port 3, the air inlet port 4 and the passage conduit 5 through which latter the charging air drawn in through the inlet ports 4 and compressed in the crank case by the descending pistons, passes into the cylinder interior in front of the piston. In addition to these inlets and conduits, at the circumference of the cylinder is further provided another fuel inlet port 6 which is fed by a carburettor 15 and arranged at the bottom stroke end of the piston, whilst in the head of the cylinder 2 is provided at least one small passage conduit 7.

The engine piston in the cylinder 2 has, as will be more clearly seen in Figure 2, an annular groove 16 which extends around its circumference and is formed by a temporary movement apart between the two piston portions or sections. This groove forms a fuel chamber which is fed with fuel at the lower dead centre of the piston, through the slot or port 6.

During the ascent of the piston this

[*Price* 1/-]

fuel is transferred into the upper portion of the cylinder 2, constituting the combustion chamber, and through the passage conduit 7 comes in contact with the highly compressed and heated charging air contained above the piston, so that the said air suddenly expands and rushes into the fuel chamber of the piston owing to which combustion takes place, which drives the piston downwards. The piston is constituted by two sleeve like parts 8, 9 which are adjustable in and relatively to each other and supplement each other. The two piston portions are closed together by a pressure spring 14 so that the gap between them is closed. In the inner piston portion 8 is mounted the gudgeon pin 11 with which engages a connecting rod 10 which is connected to the crank-pin of the disc 12. Owing to the spring 14 pressing the two piston portions 8, 9 against each other, the divided piston is driven by the connecting rod. The latter has at the upper pin boss a projecting cam or finger which projects through a slot of the piston sleeve 8 into the second piston sleeve 9.

The cam finger overcomes the action of the pressure spring 14 and moves the two piston sleeves apart when the piston reaches the bottom dead centre and starts on its ascent. Owing to this, the joint is opened and an annular groove 16 constituting the fuel chamber (Figure 2) is produced in the piston. Owing to the movement apart of the piston portions, there is of course produced in the annular groove 16 a suction which has a favourable effect in drawing in the fuel. A set screw 13 in the piston sleeve 9 enables the movement part of the piston to be accurately adjusted.

In Figures 3 and 4 is shown an engine construction which works with outlet and inlet valves 3^1, 5^1 in place of the valve gear ports. Here also, the piston is constituted by the two portions 8, 9 which are mounted movably one within the other. The upper sleeve portion 8 in Figure 3 is connected by means of the gudgeon pin 11 to the connecting rod 10, whilst the lower piston sleeve 9 is controlled by a separate advance rod 10^1 engaging with its central pin 11^1, the movement of the rod 10^1 for the purpose of distribution is produced by the crank-pin by means of an eccentric sheave, in such a manner that at the bottom dead centre of the piston, the piston joint is opened and forms a fuel chamber which is then filled with fuel through the inlet port 6.

In Figure 4, in place of the eccentric advance rod, a simple connecting rod 10 is used for controlling the divided piston; this connecting rod has a control cam or finger and engages with the driver pin 11^1 of the lower piston sleeve 9. The upper piston sleeve 8 has on its pin 11 a guide roller on which acts the connecting rod control cam, and in this manner in opposition to the traction spring 14^1, produces the opening of the piston joint and its conversion into a fuel chamber as soon as the piston reaches the lower dead centre.

In a four-stroke engine the construction and operation are the same, with the exception that a mechanically operated valve, which opens at every two revolutions, is disposed between the fuel-admission groove 6 and the carburettor 15.

The working is as follows:

When the piston in the cylinder has reached its lower dead centre, its portions are automatically moved apart at the joint so that a fuel chamber is formed which comes opposite the fuel inlet 6 and draws the charge therefrom. During the next upstroke, the piston carries the fuel to the upper end of the cylinder until the passage conduit 7 becomes operative, and the fuel is placed in communication with the combustion chamber situated above the piston.

When the upper edge of the combustion chamber in the piston is level with the lower edge of the conduit 7 the highly compressed and heated charge of air which is above the piston suddenly expands with extreme rapidity so that the fuel in the fuel chamber is wholly atomised by the said air rushing in at a pressure of about 35 to 39 atmospheres. The fuel thus mingles with this air and is ignited. The piston reaches the upper dead centre only after the charge is fired, whereafter the fuel chamber in the said piston closes, so that the combustion gases fully co-operate and the fuel chamber is free for the next charge. After the fuel chamber 16 is closed by the movement of the two piston sections towards one another, the said sections act bodily as a solid piston.

Owing to the engine piston acting as a fuel delivery member, the air is supplied to the fuel, in a manner contrary to the Diesel engine principle, but this is done in the simplest manner and in the most efficacious way, since the free cross-sectional area available for this process, is about 400 times greater than that of a fuel nozzle corresponding to the Diesel injection engine.

If the engine according to the invention is to be used for aviation purposes, the arrangement of a decompressor and the provision of an artificial ignition device which is of course used merely for

starting are indispensable as the engine must be started by hand.

The new engine is very advantageous when it is desired to use a compressor, as the simplicity is not affected thereby, for the compressor need deliver to the cylinders only pure air, contrary to the case of the explosion engines in which the compressor is in communication with the carburettor.

Owing to the small and constant "filling" volume of the fuel chamber, the fuel mixture is preferably adjusted to rich, and there is the advantage that the fuel consumption is small and in exactly dosed quantities, and that the quantity of fuel can be sensitively regulated by means of a throttle, as in a carburettor engine.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A high-speed internal-combustion engine with self-ignition, characterised by the main piston being provided with a fuel-chamber (such as 16) of variable capacity and operated so that it opens at the beginning of the upward stroke of the piston for the purpose of receiving and conveying fuel, and closes at the upper dead centre of the piston after being placed in communication with the cylinder combustion-chamber.

2. An internal-combustion engine with automatic ignition according to Claim 1, characterised by the engine piston being constituted by two sleeve-like portions movable relatively to each other, the space between the two positions (such as 8, 9) of which is widened in a mechanically positive and periodical manner for the formation of the groove-shaped fuel-chamber (such as 16).

3. An internal-combustion engine according to Claim 1, with divided sleeve piston according to Claim 2, characterised by the movement apart of the two piston portions (such as 8, 9) required for the formation of the groove-shaped fuel-chamber being controlled by the connecting rod (such as 10) of the piston, and by means of a cam finger mounted on the same or by means of a second advance rod controlled, through an eccentric sheave, from the crank-pin.

4. An internal-combustion engine according to Claims 1 to 3, characterised by the cylinder-head having in its inner wall at least one passage conduit (such as 7) which establishes communication between the fuel groove and the combustion chamber in the cylinder, situated above the piston, so that the fuel and highly heated charging air are brought together for the purpose of mixing and ignition.

5. An internal-combustion engine according to Claims 1 to 4, characterised by the two piston portions (such as 8, 9) which can move relatively to each other, being so controlled that the space between them forming the fuel chamber (such as 16), is closed at the upper dead centre of the piston after the initiation of the combustion.

6. The internal-combustion engines substantially as described or substantially as illustrated in the accompanying drawings.

Dated this 4th day of November, 1926.

FRITZ GOCKERELL,
Per Boult, Wade & Tennant,
111/112, Hatton Garden London, E.C. 1,
Chartered Patent Agents.

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[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1.

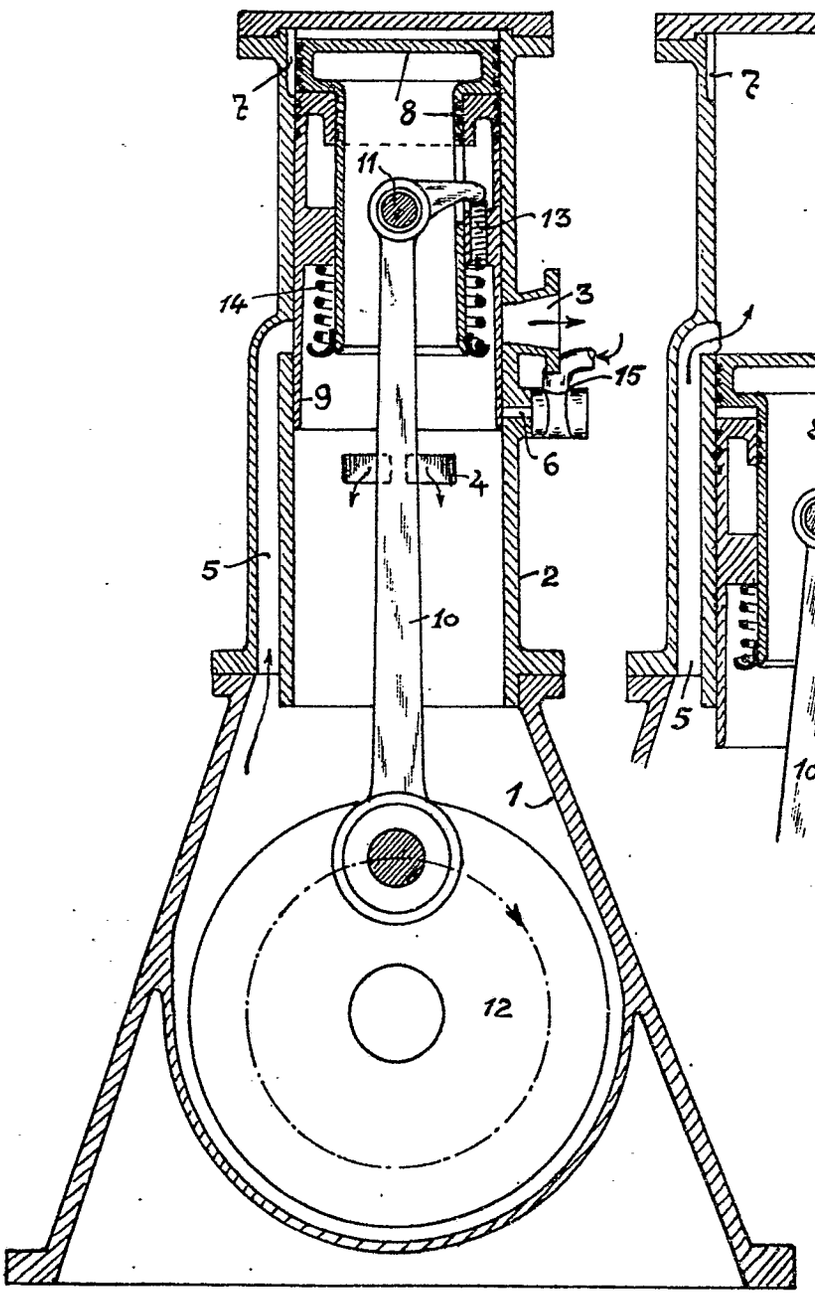
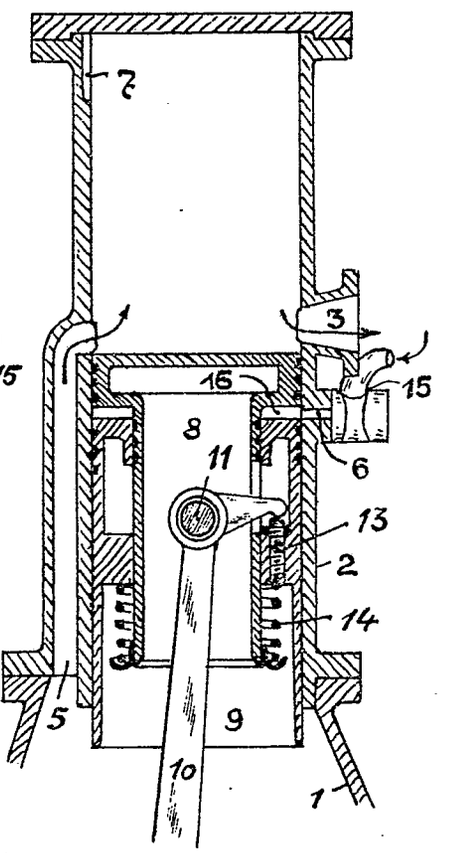


Fig. 2.



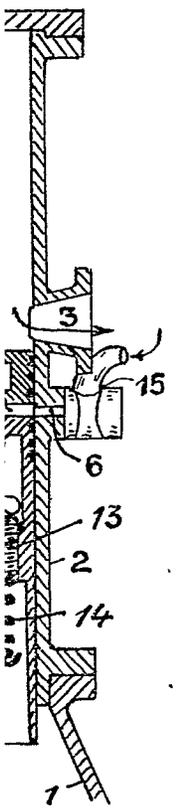


Fig. 3.

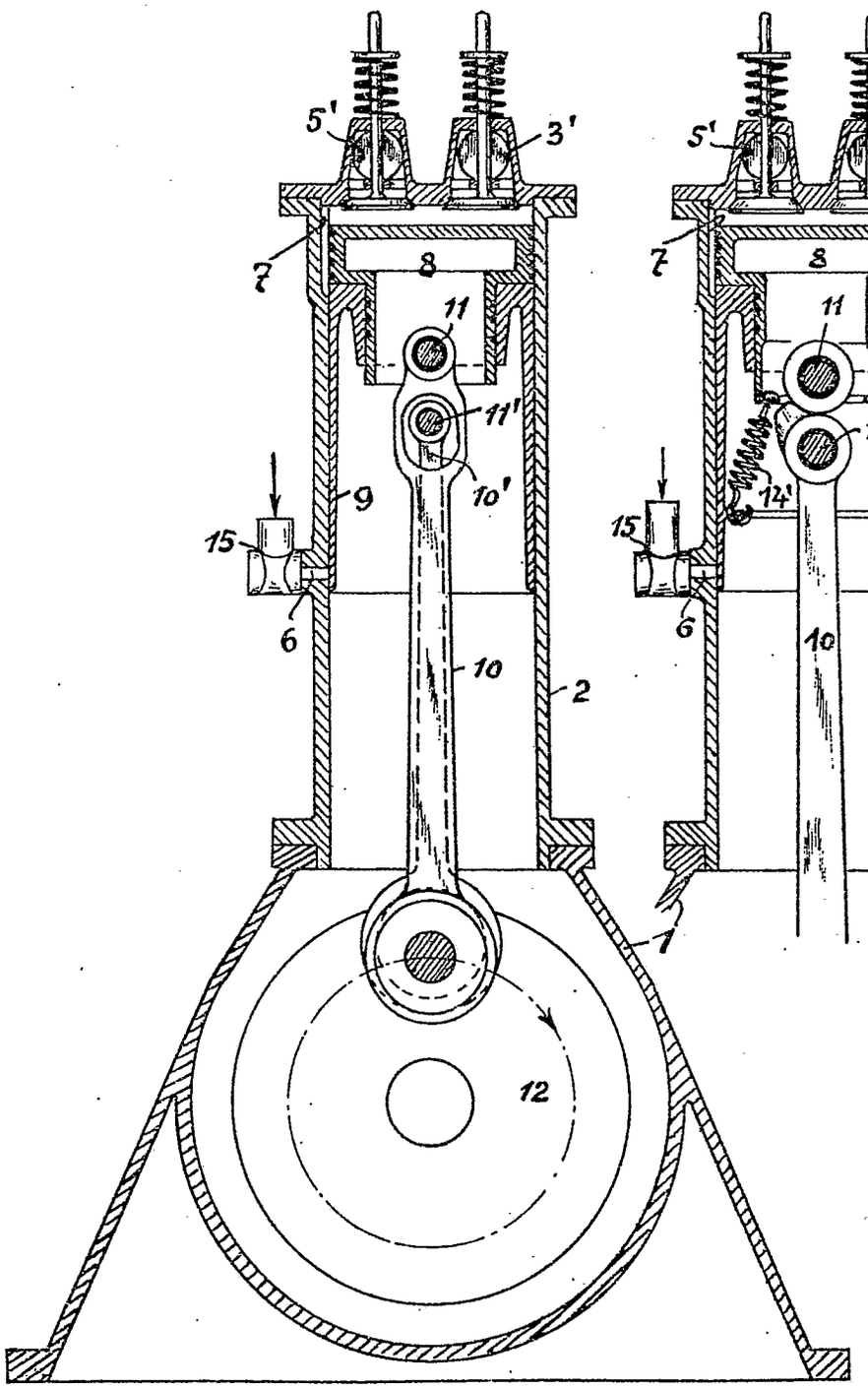


Fig. 4.

Charles & Read Ltd. Photo Litho.

276,528 COMPLETE SPECIFICATION

SHEET 1

2 SHE
SHEE

[This Drawing is a reproduction of the Original on a reduced scale]

Fig. 1.

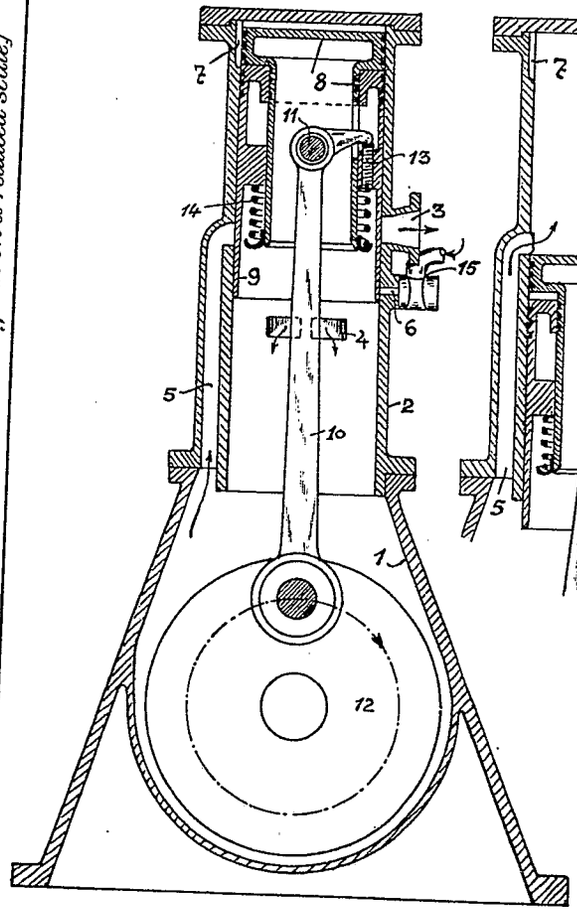


Fig. 2.

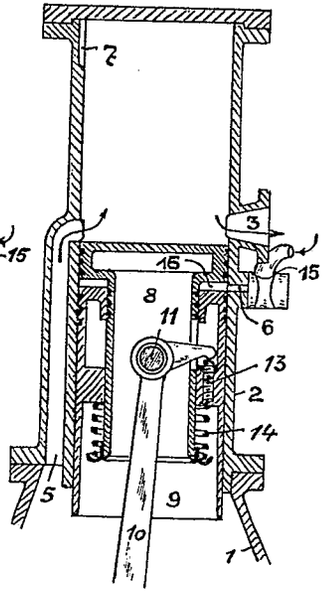


Fig. 3.

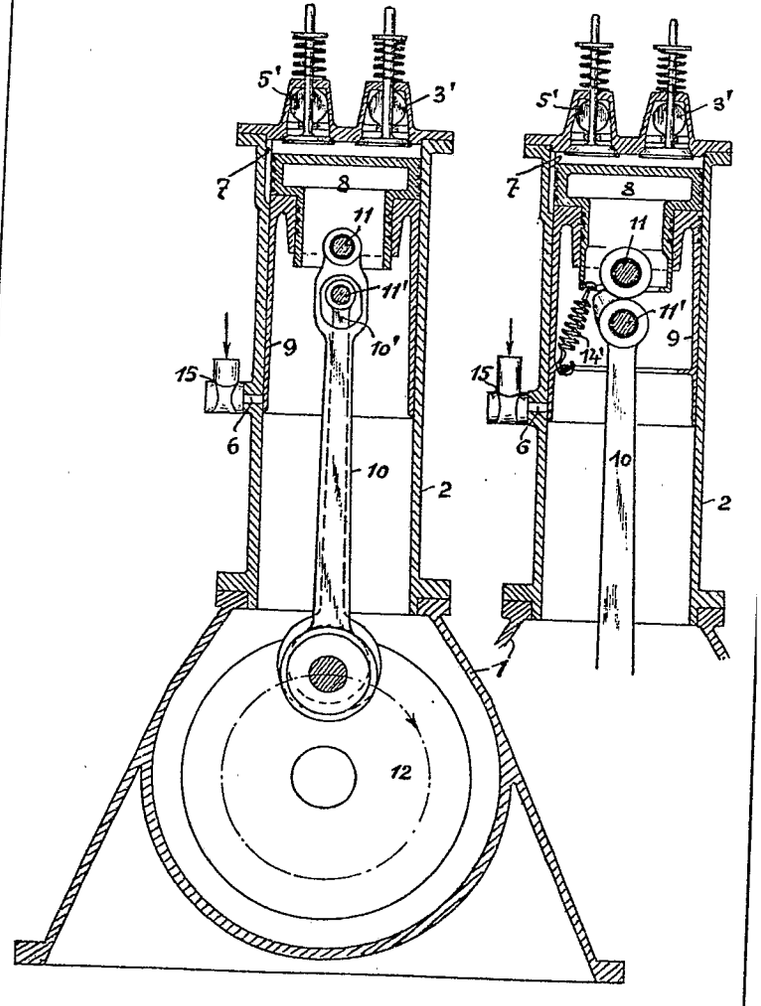


Fig. 4.

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