April 28, 1931. F. LANG 1,803,262

SELF IGNITING OIL MOTOR

Filed March 11, 1926

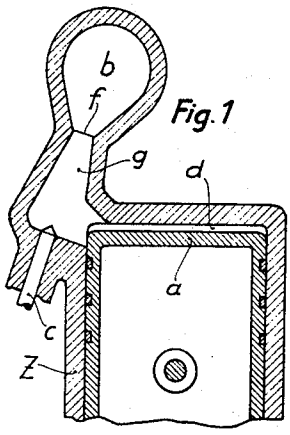


Fig. 1

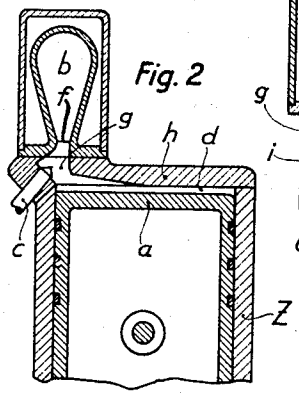


Fig. 2

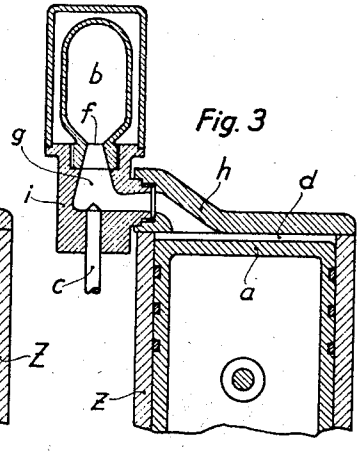


Fig. 3

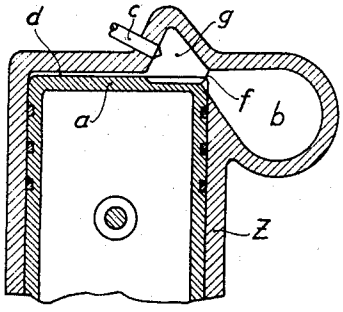


Fig. 4

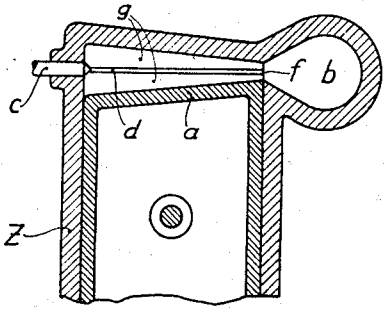


Fig. 5

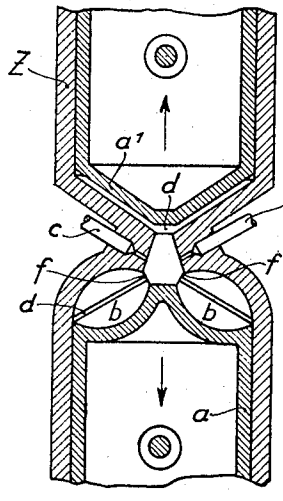


Fig. 6

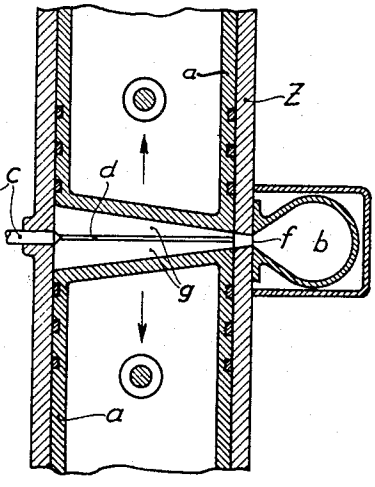


Fig. 7

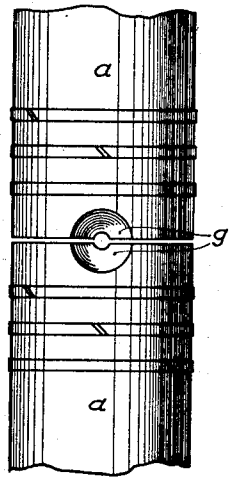


Fig. 8

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UNITED STATES PATENT OFFICE

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SELF-IGNITING OIL MOTOR

Application filed March 11, 1926, Serial No. 94,069, and in Germany February 14, 1926.

This invention relates to self-igniting motors in which the chamber wherein the air is compressed by the piston on its compression-stroke is subdivided into at least two chambers which communicate by at least one aperture having a throttling cross-sectional area. One of the chambers at least is arranged to be reduced in size or volume as the compression proceeds so as to force a flow of compressed air into the other chamber or chambers through a throttling constriction of the aperture or communication. According to the invention the parts are so arranged and constructed that fuel injected into the chamber before the end of the compression-stroke in a direction toward, or practically toward, the constriction meets such air-flow in a funnel-shaped space tapering toward and arranged in advance of the constriction. More specifically, under this invention at least a portion of the walls of the compartment with fixed volume is arranged in a fixed relation to the cylinder of the motor and the compression is increased to such a degree, that the charge of mixed fuel and air, even at the normal starting of the cold engine, is ignited without requiring any auxiliary igniting device.

In the accompanying drawings, in which seven forms of construction of the subject matter of the invention are illustrated in a diagrammatical manner,

Figs. 1 to 7 each show the respective forms of construction in vertical longitudinal section through the upper parts of cylinder and piston in the position of highest compression and

Fig. 8 is a detail view of the pistons employed in the modification according to Fig. 7.

The parts which are not necessary for the understanding of the invention have been omitted in the drawing.

In all seven modifications the cylinder is indicated by the reference character Z, the piston by a or a' respectively, the two compartments of the compression chamber by b and d and the fuel nozzle arranged on the cylinder by c. The two compartments b and d are connected with each other at least during the last part of the compression stroke by a throttling constriction f, which preferably is formed as short as possible.

As shown, the fuel-nozzle c is arranged outside of and separate from the compartment b, which compartment is entirely imperforate, access thereto being only through the constriction f.

The transit from the chamber d to the throttling constriction f is formed by a funnel-shaped mixing passage g, which latter materially assists in the ignition and combustion, as experience has shown. This funnel-shaped passage or mixing chamber, as shown, lies between the fuel-injector-nozzle c and the throttling constriction f and tapers from the nozzle c to the constriction f, the nozzle being at the widest portion of the funnel-shaped passage or chamber.

The operation of the engine according to Fig. 1 is as follows: The air entering into the cylinder during the suction stroke is compressed during the next stroke, whereby a brisk flow of air through the throttling constriction f into the supplemental compartment b arranged on the cylinder is produced. The fuel nozzle c has the same longitudinal axis as said constriction, so that at least a portion of the fuel is injected into the core of the air current. This fuel injected through the nozzle towards the end of the compression stroke contacts already in the mixing funnel g, that means before the constriction f, with the air flowing into the compartment b and being heated and ignited on account of the compression, the compressed air stored in said compartment b flowing through the constriction into contact with the mixture to support and maintain the combustion as the piston recedes.

The second modification according to Fig. 2 is differentiated from the first one only in constructional regard, while the operation, especially the flow of the air and mixture currents are the same. In the engine according to Fig. 2 a removable cylinder cover h is provided, on which as well the receptacle containing the supplemental compartment as also the injection nozzle c are arranged. This constructional feature is especially

adapted for the reconstruction of existing engines into motors according to the invention, as in such cases only the cylinder cover must be changed.

The third modification too, illustrated in Fig. 3, is differentiated only in constructional regard from the first form of construction. In the same manner, as in Fig. 2, here also a removable cylinder cover *h* is provided, but this modification has a further advantage as compared with the second modification. In the modification of Fig. 2 the receptacle containing the compartment *b* and the nozzle must be secured each singly to the cylinder cover, while in the modification according to Fig. 3 both parts are united in one piece *i*. The latter contains said two parts, which in accordance with the changing conditions of operation must be replaced the most frequently, and it is more simple and suitable for this purpose to loosen only one connection with the cylinder cover than two such connections as in Fig. 2.

In the modification according to Fig. 4 the supplemental compartment is arranged on the cylinder as lateral crop-like structure. In this construction the bottom of the piston, when approaching the illustrated dead center position, assists in forming the throttling constriction *f* and the mixing funnel *g*. The flow of the air and fuel current before the ignition proceeds quite similar to the previous modifications and can be understood forthwith. When the piston again descends after the ignition, it automatically increases the cross sectional area of the throttling connection between the compartments *b* and *d*, so that in this construction the charge, present in the space *b*, can relax without great throttling losses and accordingly more easily, than in the previously described constructions.

In the modification according to Fig. 5 also the supplemental compartment is arranged quite similarly as in the just described construction. Again the correspondingly recessed bottom of the piston assists in forming the mixing funnel *g*, the remaining part of which lies in a groove of the cylinder cover. Especially notable in this modification is the long mixing path, offered to the fuel and to the air.

The modification according to Fig. 7 refers to an engine with two pistons reciprocating in opposite directions in one cylinder, but otherwise differentiates only slightly from the previously described modification. The recesses of the bottoms of the two pistons, forming the mixing funnel *g*, are shown in side-view in Fig. 8.

In the modification according to Fig. 6 again an engine with oppositely reciprocating pistons is illustrated. In contradistinction to all other modifications in this form of construction two compartments *b* and two nozzles *c* are provided. Furthermore and also in contradistinction to the previously described forms of construction the bottom of the piston *a* assists towards the end of the compression stroke in forming the two compartments *b* and also the required throttling place *f* and the common mixing space *g*.

The nozzles *c* and accordingly also the two compartments *b* suitably are arranged in such a manner, that the jets ejected from the nozzles pass each other, without contacting. The divided arrangement of the additional combustion space in the piston and in the cylinder can be employed, of course, also in engines with a single piston.

The shape of the compartment *b*, the walls of which are at least partially in a fixed relation to the cylinder walls, and the arrangement of said compartment are not restricted, of course, to the forms illustrated in the drawing. The compartment *b* can be subdivided in any desirable manner, without deviating from the basic idea of the invention, if such a procedure appears to be necessary and advantageous.

It is not necessary, that the throttling constriction consists, as shown in the drawing, of one single narrow aperture, but it may be composed also of several narrow apertures or slots of any suitable shape.

In the drawing only engines with airless fuel injection are illustrated, but the invention can be applied also to such self igniting oil motors, in which the fuel is injected with air.

The invention relates in an equal manner to four-cycle and two-cycle engines.

It is clear, that a motor constructed according to the invention and being provided with a starting device, by which the motor is started under normal conditions, can also be started by hand in case said starting device should fail to act, however in such an abnormal case it can not be expected that the engine starts without being fed with heat from the outside.

I claim:

1. In an oil-motor for self-ignition comprising a cylinder and a piston cooperating to form a compartment arranged to be reduced in volume by the piston, said cylinder being provided with a second compartment of fixed dimensions communicating with the first compartment by a passage tapering from the first compartment toward the second compartment and a throttling constriction between the tapering passage and the second compartment, in combination with a fuel-injector arranged in advance of the tapering passage to inject fuel into and toward the same substantially at the end of the compression-stroke of the piston, said piston being arranged to compress the air in said compartments so highly as to ignite by the heat of

compression fuel injected into said highly compressed air.

2. In an oil-motor for self-ignition comprising a cylinder and a piston cooperating to form a compartment arranged to be reduced in volume by the piston, said cylinder being provided with a second compartment of fixed dimensions communicating with the first compartment by a passage tapering from the first compartment toward the second compartment and a throttling constriction between the tapering passage and the second compartment, in combination with a fuel-injector whose axis coincides with the axis of the tapering passage in which is arranged in advance of the tapering passage to inject fuel into and toward the same substantially at the end of the compression-stroke of the piston, said piston being arranged to compress the air in said compartments so highly as to ignite by the heat of compression fuel injected into said highly compressed air.

3. In an oil-motor for self-ignition comprising a cylinder and a piston cooperating to form a compartment arranged to be reduced in volume by the piston, a second compartment of fixed volume opening into the first compartment and a fuel-injector arranged to inject fuel toward the end of the compression stroke, in combination with a passage tapering toward the second compartment and between the same and the fuel-injector and communicating with the second compartment by a throttling constriction, said piston being arranged to compress the air in said compartments so highly as to ignite by the heat of compression fuel injected into said highly compressed air.

4. In an oil-motor for self-ignition comprising a cylinder and a piston cooperating to form a compartment arranged to be reduced in volume by the piston, a second compartment of fixed volume opening into the first compartment and a fuel-injector arranged to inject fuel toward the end of the compression stroke, in combination with a passage tapering toward the second compartment and between the same and the fuel-injector and communicating with the second compartment by a throttling constriction, the second compartment being imperforate and unobstructed in its interior, said piston being arranged to compress the air in said compartments so highly as to ignite by the heat of compression fuel injected into said highly compressed air.

5. In an oil-motor for self-ignition comprising a cylinder and a piston cooperating to form a compartment arranged to be reduced in volume by the piston, a second compartment of fixed volume opening into the first compartment and a fuel-injector arranged to inject fuel toward the end of the compression stroke, in combination with a passage coinciding axially with the fuel-injector and tapering toward the second compartment and between the same and the fuel-injector and communicating with the second compartment by a throttling constriction, said piston being arranged to compress the air in said compartments so highly as to ignite by the heat of compression fuel injected into said highly compressed air.

6. In an oil motor for self-ignition comprising a cylinder and a piston working therein cooperating to for ma chamber arranged to be reduced in volume by the piston, said cylinder being provided with a chamber of fixed volume connected with the first chamber by a throttling restriction, a fuel injector, a funnel-shaped mixing chamber tapering from the injector toward the throttling restriction and forming part of the first chamber arranged between the fuel injector and the throttling restriction, said piston arranged to compress the air in said chambers so highly as to ignite by the heat of compression fuel injected into said highly compressed air, said fuel injector arranged to inject fuel substantially at the end of the compression stroke into the highly compressed air in the mixing chamber, the nozzle of said fuel injector lying outside of and separate from the fixed volume chamber.

In testimony whereof I have hereunto affixed my signature.

FRANZ LANG.