June 3, 1930. W. RIEHM 1,761,844

HEATING DEVICE FOR THE SUCTION AIR OF COMBUSTION ENGINES

Filed April 11, 1925

Fig. 1.

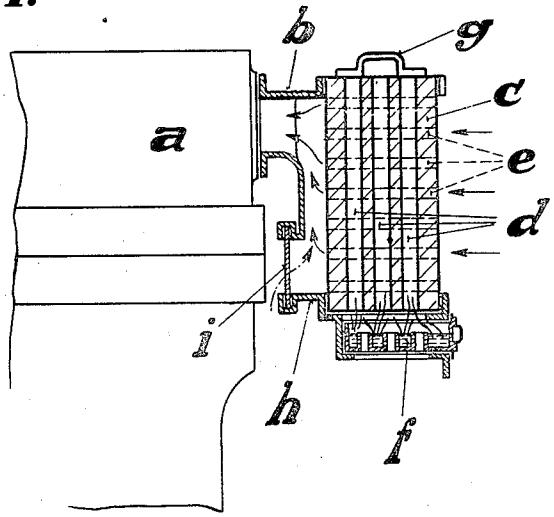


Fig. 2.

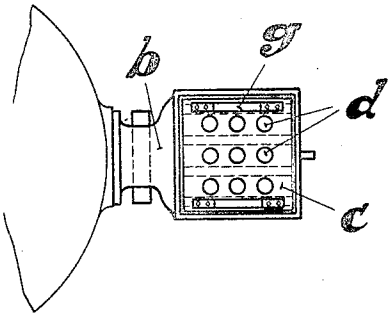


Fig. 3.

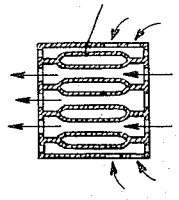
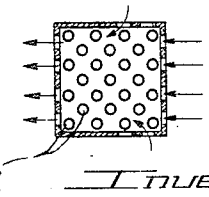


Fig. 4.



Inventor

Wilhelm Riehm

By

Marcellus and Fehr

Attorneys

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UNITED STATES PATENT OFFICE

WILHELM RIEHM, OF AUGSBURG, GERMANY, ASSIGNOR TO THE FIRM: MASCHINENFABRIK AUGSBURG-NUERNBERG, AKTIENGESELLSCHAFT, OF AUGSBURG, GERMANY, A CORPORATION OF GERMANY

HEATING DEVICE FOR THE SUCTION AIR OF COMBUSTION ENGINES

Application filed April 11, 1925, Serial No. 22,331, and in Germany February 14, 1925.

In order to start self-igniting combustion engines of the Diesel or constant-pressure-cycle type it is proposed to heat the suction air for the purpose of quickly and safely starting the engine. Reference is directed to the copending application of Wilhelm Riehm, Serial No. 22,327, filed April 11, 1925, wherein this feature is disclosed. According to this invention a device is provided serving for this purpose, said device consisting of a metal block with a set of longitudinal and a set of tranverse passages which are adjacent to each other and which may be arranged above a heating flame in such a manner that the heating gases will pass through one set of passages thereby heating said block, while the sucked in air is passing through the set of passages perpendicularly to the former, thereby being heated without coming in contact with the combustion gases. Instead of the metal block there may also be used a properly constructed body with tubes, through which the heating gases discharge, while the sucked in air will surround the same on the outside.

It is further essential for the invention, that this heating body is loosely mounted within a casing in such a way that it may be easily taken out and again inserted. This is of importance for such cases where the combustion machine is installed in rooms, in which for the purposes of safety it is not permissible to employ an open flame. By reason of the heating body being easily exchangeable the latter may be taken out of the casing and previously heated outside of the engine-room, for instance in a special heating stove or in a steam or hot water bath and again be inserted into the casing for starting the engine.

In the drawing in which like characters of reference designate like parts throughout the several views thereof:

Fig. 1 is a side elevation with certain parts in section of an internal combustion engine constructed in accordance with this invention;

Fig. 2 is a plan view of the engine shown in Fig. 1;

Fig. 3 is a horizontal sectional view through a modified form of heater adapted for use with the engine of this invention; and

Fig. 4 is a horizontal sectional view through still another form of heater.

Referring to Figs. 1 and 2 of the drawing the cylinder cover *a* of the combustion engine is provided with a casing *b*, into which a metal body or block *c* is inserted in a manner to be easily exchangeable. The metal block is provided with handles *g* which furnish convenient means for its removal from or insertion into the casing. The metal block is traversed in vertical direction by a set of passages *d* and in horizontal direction by a set of passages *e* in such a manner that the passages will not intersect each other. Below the metal block *b* a tray *f* is inserted into the casing *b* so that it may be easily withdrawn therefrom, said tray being filled preferably with the fuel used by the engine. This fuel is ignited before starting the engine. The combustion gases will discharge through the vertical passages *d* and will thereby heat the metal block *c*. The sucked in air passes through the horizontal passages *e* thereby taking up the heat imparted to the metal block by the heating gases, without thereby coming in contact with the combustion gases. In this manner the sucked in combustion air is pre-heated to such an extent, that only a relatively low pressure will be necessary for the compression, in order to bring about the self-ignition of fuel injected therein. The starting may therefore also be easily and safely accomplished when the engine is cold.

Instead of the metal block or body with the passages *d* and *e* a built-up metal body consisting of tubes may be inserted into the casing, said body having for instance a form as represented in Figs. 3 or 4. The combustion gases issuing from the heating flame will discharge through the interior of the tubes *k* or *l*, while the sucked in air will flow around the tubes on their outside and thereby be heated.

If the combustion engine be installed in a room, in which for the purposes of safety it is desirable not to use or impossible to use an open flame for the heating of the body *c*, the latter is simply withdrawn in upward

direction from the casing by means of the handles *g*, heated up outside of the engine room in any suitable manner and thereupon again inserted into the casing. The heating device will in this manner be able to serve for the same purpose as above described. An essential feature of the heating device according to this invention is therefore its ability of being easily exchanged.

On the rear side of the casing *b* behind the heating body *c* there is further provided an extension *h* forming a by-pass for the suction air, which during starting of the engine is closed by the slide *i*. As soon as the engine has come to its normal operation, this slide may be removed, so that the greatest part of the combustion air will enter into the engine through the by-pass. By this arrangement the resistance against the sucking in of the air, which is caused by the narrow passages of the heating body, is properly decreased.

I claim:

1. In a high-compression self-igniting internal combustion engine of the constant-pressure-cycle-type adapted to operate upon fuel injection, a cylinder, a combustion air inlet for said cylinder, means associated with said inlet for heating the combustion air admitted to said engine on starting, to provide a sufficiently high compression temperature within said cylinder upon starting of the engine to secure self-ignition of fuel injected therein and means for by-passing unheated combustion air to the engine.

2. In a high-compression internal combustion engine of the constant-pressure-cycle type adapted to operate with fuel injection and self-ignition, a combustion air inlet, a heating device for said combustion air inlet including a metal body, said body having one set of passages for a heating medium, and a second set of passages separated from the first-mentioned set and disposed in heat-conducting relation thereto for the combustion air, and an external source of heat associated with said metal body and adapted to supply a heating medium to said first named set of passages.

3. In a high-compression internal combustion engine of the constant-pressure-cycle type operating with fuel injection and self-ignition, a casing mounted on said engine, said casing providing an inlet for the combustion air fed to said engine, a metal body carried by said casing, said body having two sets of adjacent passages disposed in heat-conducting relation and adapted to receive a heating medium and the combustion air respectively, a by-pass for combustion air around said metal body, and a valve controlling said by-pass, whereby all or a portion of said combustion air may be fed to the engine through the metal body in accordance with the positioning of said valve.

4. In a high-compression internal combustion engine of the constant-pressure-cycle type adapted to operate with fuel injection and self-ignition, a cylinder, a combustion air inlet for said cylinder, a casing mounted on said cylinder, said casing providing an air passage communicating with said combustion air inlet, and a portable air heater removably carried by said casing for heating said combustion air on starting to provide a sufficiently high compression temperature within said cylinder upon starting of the engine to secure self-ignition of fuel injected therein.

5. In an internal combustion engine of the Diesel type operating with fuel injection and self-ignition, a cylinder, a combustion air intake for said cylinder drawing in air from atmosphere, a heater having an external source of heat independent of engine operation for heating said combustion air during engine starting to provide a compression temperature within said cylinder during engine starting sufficient to cause self-ignition of fuel injected therein, and means for supplying unheated air to said cylinder after said engine has been started.

In testimony whereof I have affixed my signature.

DR. WILHELM RIEHM.