K. FABEL.

INTERNAL COMBUSTION MOTOR.

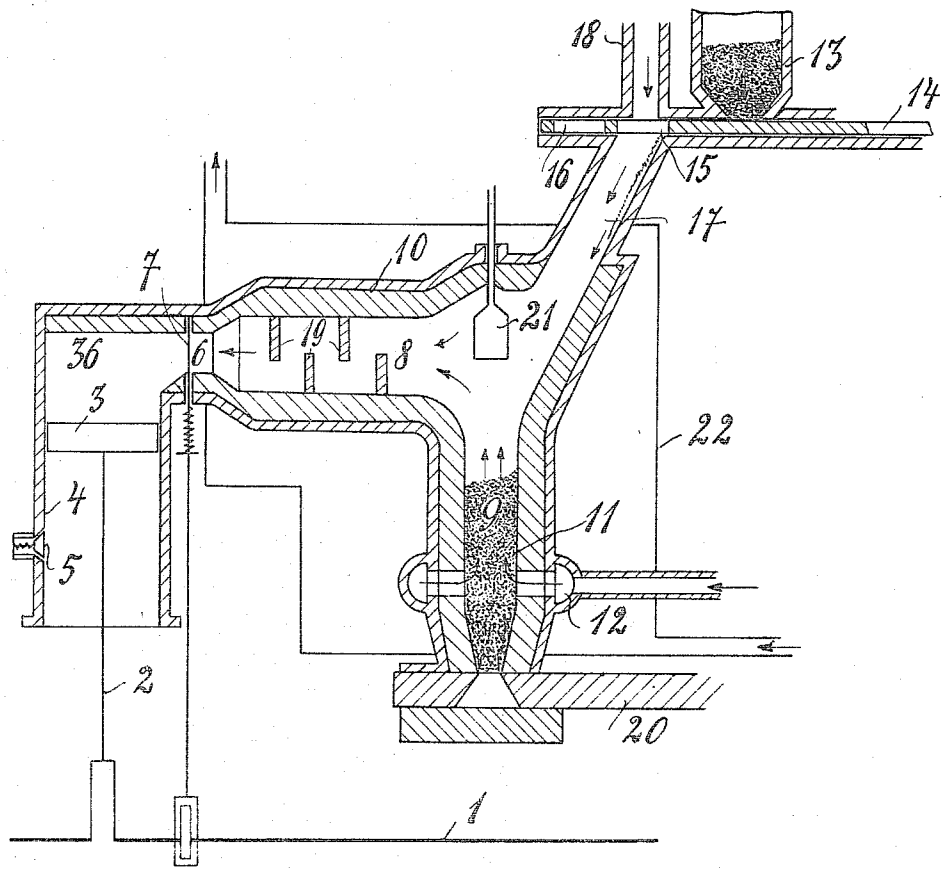
APPLICATION FILED MAR. 7, 1910.

985,793.

Patented Mar. 7, 1911.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses:
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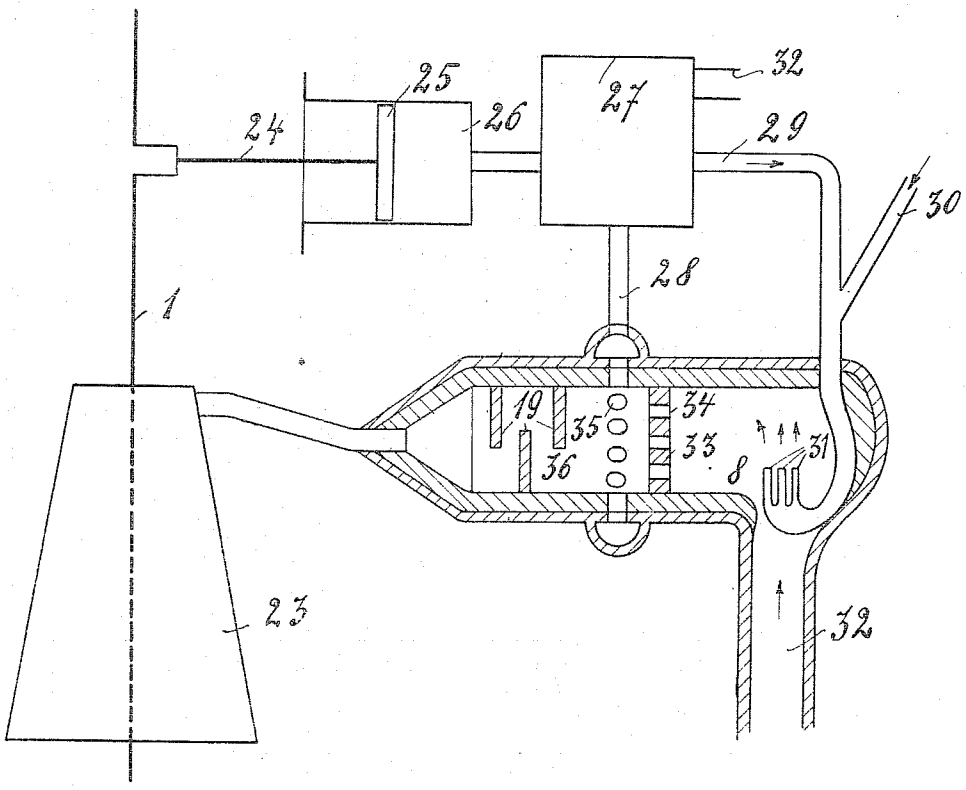
2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

KARL FABEL, OF HAMBURG, GERMANY.

INTERNAL-COMBUSTION MOTOR.

985,793. Specification of Letters Patent. Patented Mar. 7, 1911.

Application filed March 7, 1910. Serial No. 547,770.

To all whom it may concern:

Be it known that I, KARL FABEL, of 135 Hasselbrookstrasse, Hamburg 23, Germany, a subject of the German Emperor, residing at Hamburg, in the State of Hamburg, German Empire, have invented new and useful Improvements in Internal-Combustion Motors.

This invention relates to internal combustion motors having a separate combustion chamber and air pump, and the present improvements have for their object to provide an internal combustion motor of this type which while being capable of being worked with all kinds of fuel, shall be especially adapted to be worked with solid fuel.

In the internal combustion motors proposed hitherto having a separate combustion chamber, the air for combustion has usually been admitted together with the air for forming the combustible mixture into the working cylinder. In such cases where combustion is in any way approximately complete the gaseous mixture enters the cylinder in a very highly heated state so that special means are required to reduce the temperature to a suitable degree. Even when the admission of the air takes place in proximity to the working cylinder this increase of temperature cannot be avoided in such motors. Further with the method of supplying air, only gaseous or readily gasified fuel can be used, and it is not possible to use solid fuel.

According to this invention these drawbacks are obviated and the motor is enabled to be worked with all kinds of fuel by admitting only that quantity of air separately into the combustion chamber, which is necessary for complete combustion, while only all air which is mixed with the products of combustion for cooling the mixture before its expansion in the working chamber of the engine, is admitted into a chamber hereinafter called the mixing chamber and separated from the combustion chamber. By this arrangement which can be carried out in many different ways, a very advantageous reduction of the temperature in the working cylinder is effected, and solid fuel can be used without the occurrence of the previous drawbacks, such as the production of a high temperature.

Two ways of carrying out this invention are illustrated by way of example in the accompanying diagrammatic drawings in which:—

Figure 1 is a vertical section of a piston motor worked with solid fuel, and Fig. 2 is a similar view of a turbine worked with solid fuel.

Referring first to Fig. 1 the designating numeral 1 is the motor shaft connected by means of the piston rod 2 with the working piston 3 which moves in the working cylinder 4. 5 is an exhaust valve operated from the motor shaft by means not shown. 36 is the mixing chamber formed in the head of the working cylinder; it communicates through a passage 6 with the combined combustion fuel chamber 8, 9 which is lined with a non-heat-conducting material 10. The passage 6 is opened and closed by means of a slide 7 that is operated from the motor shaft 1. The fuel 11 is contained in the fuel compartment 9 of the combustion chamber and the air for combustion is supplied to it through duct openings 12 formed in the lower part of said fuel chamber. The fuel is drawn from a vessel 13 that is situated above the chamber 9 and has a funnel-shaped lower part. Below the opening in the lower part of the vessel 13 there is arranged a slide 14 which is provided with two apertures 15 and 16. When the slide aperture 15 comes into coincidence with the opening in the lower part of the vessel 13, fuel will fall into the said slide aperture and will be carried along by the forward movement of the slide until the aperture of the slide comes over the chute 17 that leads into the chamber 9. 18 is an air-supply duct arranged above the chute 17. When the slide aperture 15 connects the pasages 17 and 18 together, compressed air passes out of the duct 18 and carries along with it into the chute 17 the fuel which is contained in the slide aperture 15 so that this fuel falls into the combustion chamber. The air entering through the duct 18 serves together with the air that is admitted through the duct openings 12, as air for combustion for the purpose of effecting the complete combustion of the gases issuing from the fuel chamber 9. When the slide 14 is situated at the opposite end of its travel, air will enter the chute 17 also through the second aperture 16 in the said slide. 19 are baffles of refractory material arranged within the chamber 8; their function is to effect an intimate mixing to-

gether of the combustion gases issuing from the chamber 9 and the air entering from the duct 18. A slide 20 is provided below the chamber 9 for the purpose of removing the ashes from that chamber. A slide-bar 21 is provided above the chamber 9 for the purpose of enabling the fuel contained in the chamber 9 to be stirred and thus caused to sink and enable the ashes to be removed. The combustion chamber is surrounded with a cooling jacket 22 to which water is supplied continuously.

The operation of the improved motor working on the two-stroke cycle is as follows:—The motor is started by turning the shaft 1 by means of any suitable mechanical appliances, whereby the air for combustion is first compressed in a compressing pump (not shown), and the air for forming the combustible mixture is compressed in the working cylinder. During this operation the exhaust valve 5 of the cylinder is and remains open until the piston has moved through part of its stroke. The slide 7 is closed. When now on further rotation of the shaft 1 the valve 7 is opened, the pressure in the chambers 8 and 9 will cause the hot gases of combustion to pass into the mixing chamber 36 in the head of the cylinder wherein they mix with the colder air contained therein. Expansion then begins and the valve 7 closes again. When the working piston has reached the end of the cylinder, the exhaust valve 5 opens, and a part of the gaseous mixture passes out during the compression period that now begins again.

It is advisable to inject water into the working cylinder and the compressing pump before and during the compression period for the purpose of economizing power in the compressing operation.

The motor may be made double-acting, instead of single-acting as shown.

In the construction shown in Fig. 2, the shaft 1 is driven by a turbine 23, instead of by means of a piston. The shaft is connected by means of a piston rod 24 to the piston 25 of an air pump 26 which forces air into a receiver 27. This receiver 27 is connected by a pipe 28 with the mixing chamber 36, and by two ducts 29 and 32 with the combustion chamber 8. A pipe 30 for the supply of the liquid fuel is connected to the air supply duct 29, so that the liquid fuel is carried along by the air flowing through this duct, and issues in a vaporized condition from the orfices 31 inside the chamber 8. An additional quantity of air for combustion is suppled through the duct 32. This air flows around the pipes 31, mixes with the combustible vapors issuing therefrom and effects their combustion. The combustion chamber 8 is combined with the mixing chamber 36 to form one body. Both chambers are separated from each other by a partition 33 of non-heat-conducting material which is provided with openings 34 for the passage of the gases therethrough. Air is supplied from the duct 28 through the orifices 35 to the mixing chamber 36 where it meets with the hot gases of combustion entering through the orifices 34. Here also baffles 19 are provided for the purpose of promoting an intimate mingling of the gases so as to produce a homogeneous mixture.

The piston motor and the turbine may be worked with any kind of fuel. When gas is used for this purpose it is compressed by a separate pump. The ignition of the combustible mixture may be effected by any suitable means.

The control of the motor is effected by varying the supply of fuel and air for combustion; this being readily done by regulating the pumps or the stroke of the fuel slide.

I claim:

1. An internal combustion motor comprising a working cylinder, a combustion chamber exteriorly of the working cylinder, means whereby air for combustion is admitted into the combustion chamber partly below and directly to the fuel and partly to the combustion gases above the fuel, a mixing chamber for the reception of the products of combustion and communicating with said working cylinder and said combustion chamber, and means whereby after the complete combustion of the fuel air is solely admitted to the mixing chamber for cooling the products of combustion prior to their expansion in the working cylinder.

2. An internal combustion motor comprising a working cylinder, a combustion chamber exteriorly of the working cylinder, means whereby air for combustion is admitted into the combustion chamber partly below and directly to the fuel and partly to the combustion gases above the fuel, a mixing chamber for the reception of the products of combustion and communicating with said working cylinder and said combustion chamber, means whereby after the complete combustion of the fuel air is solely admitted to the mixing chamber for cooling the products of combustion prior to their expansion in the working cylinder, and means whereby the air supplied to the combustion chamber assists in the feeding of the fuel thereto.

3. A device of the class described comprising a working cylinder having a mixing chamber, a separate combustion chamber provided with a fuel compartment, a contracted passage between said combustion chamber and the mixing chamber, and a movable slide positioned therebetween.

4. A device of the class described comprising a working cylinder having a mixing chamber, a separate combustion chamber provided with a fuel compartment, a contracted passage between said combustion

chamber and the mixing chamber, a movable slide positioned therebetween, said fuel compartment provided with air ducts leading thereto and adapted to communicate through the combustion chamber with the mixing chamber, an air duct oppositely arranged with respect to the said fuel compartment and adapted to feed compressed air through said combustion chamber and into said mixing chamber.

5. A device of the class described comprising a working cylinder having a mixing chamber, a separate combustion chamber provided with a fuel compartment, a contracted passage between said combustion chamber and the mixing chamber, a movable slide positioned therebetween, said fuel compartment provided with air ducts leading thereto and adapted to communicate through the combustion chamber with the mixing chamber, an air duct oppositely arranged with respect to the said fuel compartment and adapted to feed compressed air through said combustion chamber and into said mixing chamber, a fuel compartment positioned adjacent to said last-named air duct, means for feeding fuel from said compartment in line with said air duct whereby the passage of air therefrom assists the passage of the fuel to the fuel compartment, and a slidable ash remover beneath said compartment.

Dated this 10th day of February 1910.

In testimony whereof I affix my signature.

KARL FABEL.

In the presence of—

OTTO W. HELLMRICH,

IDA CHR. HAFERMANN.