

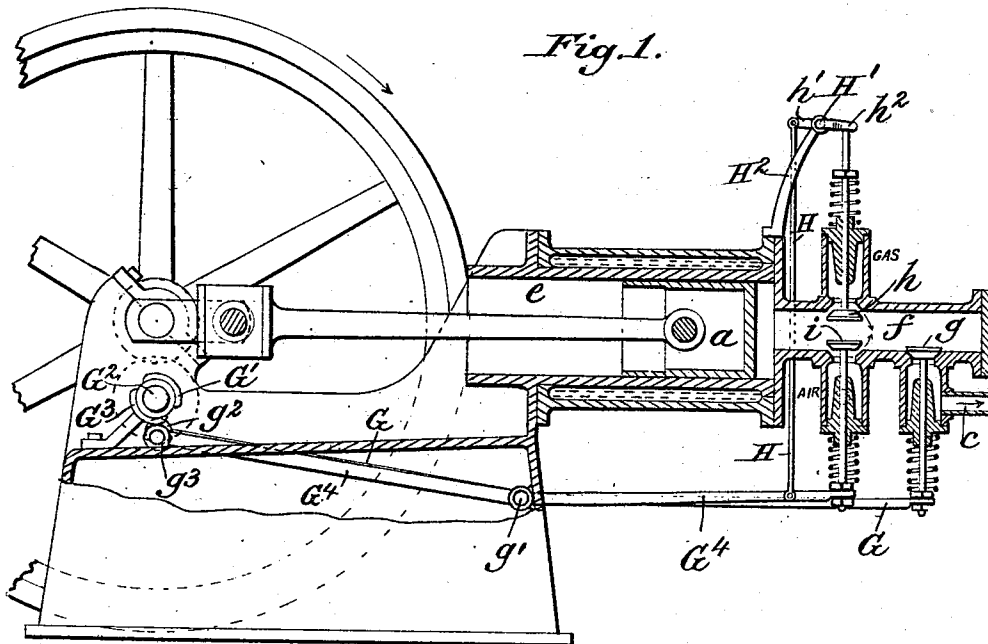
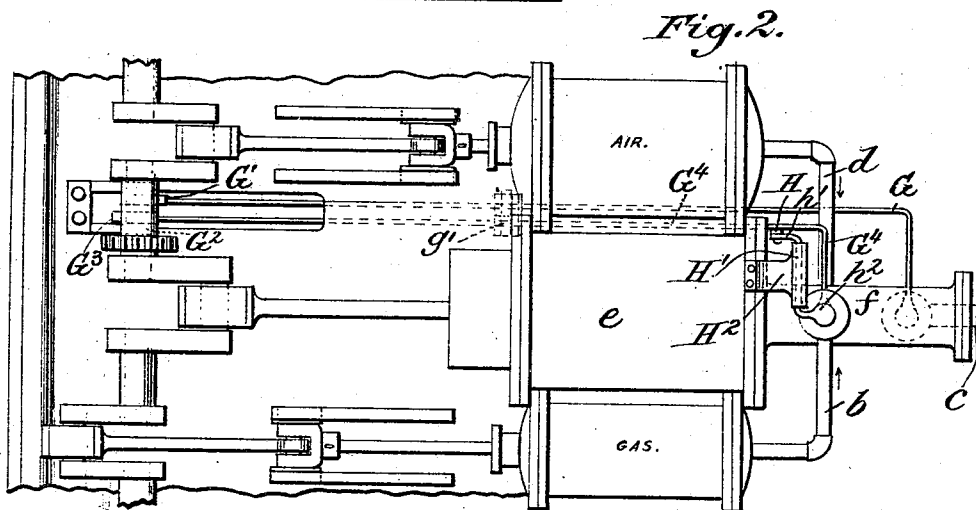
No. 682,567.

Patented Sept. 10, 1901.

F. REICHENBACH.
INTERNAL COMBUSTION ENGINE.

(Application filed July 5, 1901.)

(No Model.)



WITNESSES:

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UNITED STATES PATENT OFFICE.

FRITZ REICHENBACH, OF BERLIN, GERMANY.

INTERNAL-COMBUSTION ENGINE.

SPECIFICATION forming part of Letters Patent No. 682,567, dated September 10, 1901.

Application filed July 5, 1901. Serial No. 67,174. (No model.)

To all whom it may concern:

Be it known that I, FRITZ REICHENBACH, civil engineer, a subject of the King of Prussia, German Emperor, residing at No. 5 Tel-tower street, in the city of Berlin, in the Kingdom of Prussia, German Empire, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

In order to obtain an automatic ignition of the explosive mixture, internal-combustion engines have been constructed in which a part of the residues may remain in the cylinder and can be compressed in the same, so as to get a higher temperature, by means of which the explosive mixture may be ignited as soon as it comes in contact and gets mixed with the hot residues. There exist internal-combustion engines of this kind in which either the already-finished mixture or the mixture proper of the fuel and the air is led into the hot residues or in which first the air only is mixed with said residues, whereafter the fuel is introduced into this mixture of residues and air. Internal-combustion engines of the aforementioned kind or kinds have not met with success, because in the case in which the finished mixture was introduced into the hot residues the arising flame struck back into the supply channel or pipe conducting the explosive mixture into the cylinder and because in the other case, in which first only the air is led into the compressed hot residues, the temperature of these latter was so much reduced that an automatic explosion could not be obtained. Both the aforementioned drawbacks may, however, be completely overcome by leading the fuel and the air separately into the cylinder and at the same or nearly the same time. The explosive mixture is thus formed only within the cylinder or the compression-chamber and the flame produced by the explosion of the mixture in contact with the compressed hot residues cannot strike back either into one or into the other supply-pipe, because neither the fuel nor the air is capable of conducting the flame.

One form of apparatus embodying my invention is illustrated in the drawings, in which—

Figure 1 is a longitudinal vertical section,

partly in elevation, the gear-wheels for driving the cam-shaft being indicated by the dotted lines. Fig. 2 is a plan view of so much of the apparatus as is necessary to illustrate the invention.

The piston *a*, which reciprocates in the cylinder *e*, is shown in that position in which a part of the residues is compressed in the rear part of the cylinder *e*, as well as in the compression-chamber *f*. The first part of the combustion-gases has been led away through the exhaust-pipe *c*, whereafter the exhaust-outlet was closed by a valve *g*, arranged to be actuated in any suitable way—as, for example, by a valve-lever *G*, pivoted at *g'* and having its forward end provided with a roller *g²*, arranged to be operated in the usual way by a cam *G¹* on the cam-shaft *G²*, which cam is so adjusted and constructed that the exhaust-valve will be held open during the first part of the backward stroke of the piston and will be closed sufficiently before the completion of said backward stroke to enable the piston to compress the residues, and thereby develop enough heat to cause the ignition of the fuel and air when afterward admitted to the compression-chamber *f*. The pipe *b*, supplying the fuel, and the pipe *d*, supplying the air, also terminate at the compression-chamber *f*, the communication between each pipe *b* and *d* and the compression-chamber *f* being controlled by a suitable valve, these valves being indicated at *h* and *i*, respectively, Fig. 1. These valves *h* and *i* are arranged to be simultaneously operated by means of a cam *G³*, fixed on the cam-shaft *G²* and arranged to act on a roller *g³*, carried by a lever *G⁴*, fulcrumed at *g'*, said lever having one end in engagement with the valve-stem of the valve *i*. To this lever is connected a rod *H*, which is pivoted to the arm *h'* of a rock-shaft *H¹*, journaled in a bracket *H²*, mounted on the engine-cylinder, the rock-shaft having a second arm *h²*, which bears against the valve-stem of the valve *h*. By this arrangement the valves *h* and *i* will be opened simultaneously by the contact of the cam *G³* with the roller *g³*, this cam *G³* being so adjusted and constructed that it will not open the valves *h* and *i* until the residues have been compressed in the cylinder and the piston is

ready to commence its forward stroke. Moreover, the valves *h* and *i* will be closed at a suitable point of the forward stroke of the piston in order to allow for an expansive action of the gases, if this be desired. When the residues have been compressed by the piston *a*, the valves *h* and *i* are opened either exactly at the same time, or nearly so, so that the fuel and the air flow into the compression-chamber, forming with each other the explosive mixture which then is ignited by the heat of the compressed residues. The piston *a* is thus caused to move forward, and on moving backward it expels the combustion-gases through the exhaust-pipe *c*, the valve *g* of which is opened for a certain time. At the proper moment the valve *g* is closed and the remaining combustion-gases are compressed in consequence of the further motion of the piston, when the valves *h* and *i* are opened again, so that a fresh part of the fuel and the air may again pass into the compression-chamber and into the compressed-hot residues therein contained. The air and the fuel may be cooled, if desired, during the compression period, and they may be afterward heated by waste gases or any other suitable means. Further, the inner wall of the cylinder *e* may be lined with heat-isolating substances or materials of any suitable kind.

Having now described my invention, what I desire to secure by a patent of the United States is—

1. In an internal-combustion engine, the combination, with a cylinder having a compression-chamber and an exhaust-outlet, of a piston movable in the cylinder, means for closing the exhaust-outlet before the piston completes its backward stroke, whereby a part of the residues of combustion are com-

pressed, and means for supplying air and fuel separately and simultaneously to the compression-chamber upon the completion of the compression of the residues of explosion.

2. In an internal-combustion engine, the combination, with a cylinder having a compression-chamber, an exhaust-outlet, an air-inlet, and a fuel-inlet separate from the air-inlet, of a piston movable in the cylinder, valves in the exhaust-outlet, the air-inlet and the fuel-inlet, means for closing the exhaust-valve before the piston has completed its backward stroke, whereby the residues of combustion are compressed, mechanism for forcing air through the air-inlet valve upon the completion of the backward stroke of the piston, and separate means for simultaneously forcing fuel through the fuel-inlet valve.

3. In an internal-combustion engine, the combination, with a cylinder having a compression-chamber, an exhaust-outlet, an air-inlet and a fuel-inlet separate from the air-inlet, of a piston movable in said cylinder, an exhaust-valve in the exhaust-outlet, an air-inlet valve in the air-inlet, a fuel-inlet valve in the fuel-inlet, means for closing the exhaust-valve before the piston has completed its backward stroke, whereby the residues of combustion are compressed, means for simultaneously opening the air and fuel inlet valve upon the completion of the backward stroke of the piston, and independent devices for separately supplying air and fuel to the air and fuel inlet.

In witness whereof I have hereunto set my hand in presence of two witnesses.

FRITZ REICHENBACH.

Witnesses:

HENRY HASPER,
WOLDEMAR HAUPT.