

1,054,641.

Fig. 1.

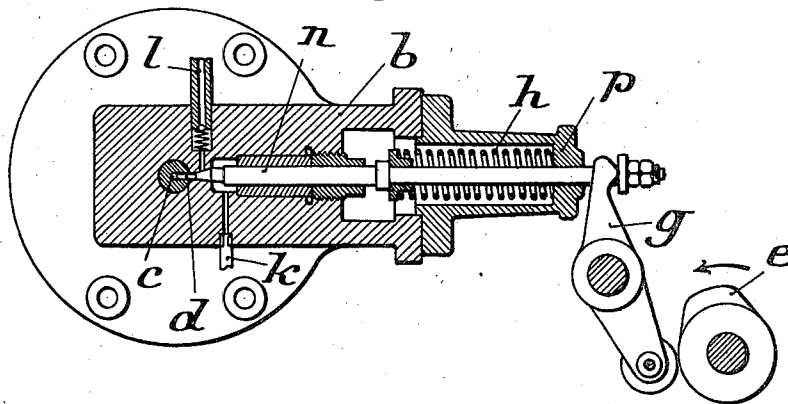
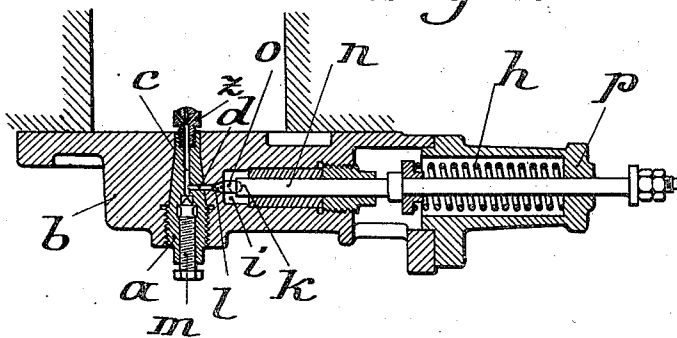


Fig. 2.



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COMBUSTION-ENGINE OF THE INJECTION TYPE.

1,054,641.

Specification of Letters Patent.

Patented Feb. 25, 1913.

Application filed January 10, 1911. Serial No. 601,843.

To all whom it may concern:

Be it known that I, LUDWIG GENTZEN, engineer, a subject of the German Emperor, residing at 5 Franzstrasse, Mülheim-on-the-Rhine, Germany, have invented certain new and useful Improvements in Combustion-Engines of the Injection Type; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in combustion engines of the injection type in which the fuel is blown into the cylinder of the engine by means of compressed air while the said cylinder is filled with air at high compression. In engines of this type it is difficult to inject the fuel centrally of the cylinder, that is in the direction of the longitudinal axis of the same, as is necessary for thoroughly mixing the fuel with the air contained within the cylinder. To this effect in combustion engines now in use the needle valve for controlling the fuel supply has been arranged parallel to the axis of the cylinder and the said valve has been operated by a driving shaft perpendicular to the main valve-operating shaft, the latter being parallel to the axis of the cylinder.

The object of my improvements is to construct the apparatus for admitting the mixture of air and fuel to the cylinder in a more simple way, so that various parts of the valve-operating mechanism can be dispensed with, without however interfering with the proper function of the valve-operating mechanism.

A further object of the improvements is to construct the injection apparatus in such a way, that the fuel is more thoroughly atomized.

With these and other objects in view my invention consists in arranging the fuel and air valve with its axis perpendicular to the axis of the cylinder and providing an injection channel within the cylinder wall or the cylinder head which begins at the said valve, and which is bent at a right angle in such a way, that the fuel and air are discharged into the cylinder substantially in line with the direction of the stroke of the piston, or in other words within the longitudinal axis of the cylinder or parallel thereto. By thus constructing the injector and the valve con-

trolling mechanism, the fuel and air valve can be directly operated by the cam shaft. Furthermore by providing the fuel and air channel with a bend substantially at a right angle the fuel is more thoroughly atomized, because the jet of compressed air and fuel is perpendicularly thrown against a surface, so that it is deflected to the nozzle portion of the injector in a whirled state.

A further object of the improvements is to provide means whereby the injection channel can be cleaned without removing the valve. For this purpose the nozzle portion communicates with a channel within the cylinder or its head which is in line with the nozzle and extends rearward therefrom through the wall of the cylinder or its head. Normally the said channel is closed by suitable means, such for example as a screw plug.

In order that my invention may more thoroughly be understood an example embodying the same has been shown in the accompanying drawing in which the same letters of reference have been used in all the views to indicate corresponding parts.

In said drawing Figure 1, is a vertical cross-section of the engine taken on the longitudinal axis of the valve for controlling the supply of fuel and air and Fig. 2, is a horizontal cross-section taken on the longitudinal axis of the cylinder.

Referring to the example illustrated in the drawing the nozzle for injecting the mixture of air and fuel into the cylinder is provided within a block *a* of tapering form which is adapted to be placed into the cylinder head *b* from the rear thereof. The longitudinal axis of the said block is in the direction of the stroke of the piston, and preferably within the longitudinal axis of the cylinder. The said block is provided with an axial bore or discharge channel *c* which in the preferred form extends entirely through the same and is normally closed by a screw plug *m*, or some other removable closing element. At its inner end the said channel is provided with a nozzle *z* of any known or preferred construction. At a right angle a supply channel *d* branches off from the channel *c*, and this supply channel is adapted to be closed by a needle valve *o* disposed axially of the channel *d*. A rod *n* which carries the needle valve extends rearwardly therefrom and through a casing *p* secured to the cylinder head.

Within the latter a spring *h* is located which with one end bears against a flange on the rod *n* and with its opposite end against a seat formed within the casing *p*. The said
 5 spring has the tendency to normally force the needle valve into closing position. A rocking arm *g* pivotally mounted on a relatively fixed part of the frame of the engine is arranged to raise the needle valve
 10 from its seat. It is actuated by a suitable cam *e* arranged on the cam-shaft or valve-operating shaft of the engine and rotating therewith in the direction of the arrow shown in Fig. 1. Near its front end the
 15 rod *n* extends through a chamber *i* to which leads the pipe *k* for supplying compressed air. The fuel is admitted through a passage *l* which is branched off from a part of the channel *d* adjacent to the conical part
 20 of the needle valve. The air as well as the fuel are forced into the cylinder by means of a pump or the like, as is known in the art. After removing the screw plug *m* the channel *c* can be cleaned by blowing there-
 25 through compressed air.

It will be observed that the passage for fuel and air which is formed by the channels *d* and *c*, is of a practically uniform cross section from the valve *o* to the outlet
 30 or nozzle *z*. That is to say, the passage formed by said channels is free from enlargements which by reducing the velocity of the stream would give the fuel particles an opportunity to become deposited on the
 35 walls of the passage. The atomizing of the fuel occurs partly at the valve seat, and is perfected or completed at the junction of the channels *c*, *d*, by the sudden deviation of the stream of fuel and air at a sharp angle,
 40 without any enlargement of the passage which might cause the fuel particles to be deposited. The jet issuing from the nozzle

z is therefore a very fine spray of fuel and air.

While in describing the invention reference has been made to a combustion engine the longitudinal axis of which is horizontal I wish it to be understood that my invention is not limited to the arrangement shown, and that various changes may be
 50 made in the construction shown without departing from the gist of my invention.

I claim herein as my invention:

In a combustion engine of the type in which a mixture of fuel and compressed
 55 air is injected into the power cylinder while the latter is filled with compressed air, the combination with the power cylinder, of a common valve for controlling the supply of fuel and air to the cylinder and disposed
 60 with its axis substantially perpendicular to the axis of the cylinder, said cylinder being provided with a channel arranged to discharge the mixture of air and fuel into the cylinder substantially in the direction of the
 65 stroke of the piston, and with a fuel and air supply channel in the direction of the valve's axis, controlled by the valve and connected with the said discharge channel, at a sharp angle, said channels being free from
 70 enlargements from the valve to the outlet of the discharge channel, mechanical means for operating said valve periodically, said discharge channel extending rearwardly through the wall of the cylinder, and means
 75 for normally closing said discharge channel at its rear end.

In testimony, that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

LUDWIG GENTZEN.

Witnesses:

LOUIS VANDORY,
 BESSIE F. DUNLAP.