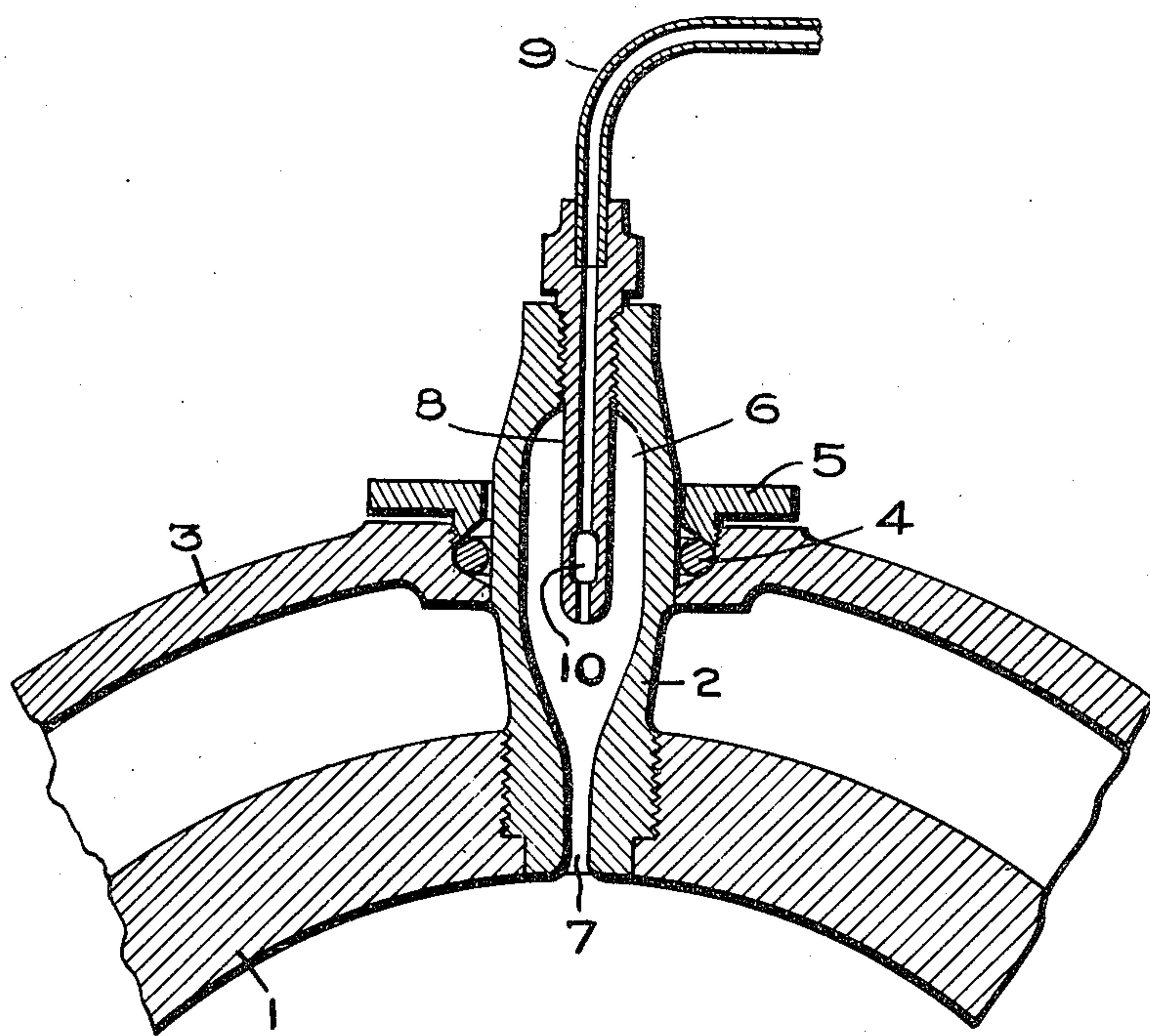


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METHOD OF AND MEANS FOR FEEDING FLUID COMBUSTIBLES TO INTERNAL COMBUSTION ENGINES.  
APPLICATION FILED SEPT. 7, 1911.

1,154,816.

Patented Sept. 28, 1915.



Witnesses:

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Inventor,  
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Att'y.

# UNITED STATES PATENT OFFICE.

KARL STEINBECKER, OF CHARLOTTENBURG, GERMANY, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

METHOD OF AND MEANS FOR FEEDING FLUID COMBUSTIBLE TO INTERNAL-COMBUSTION ENGINES.

1,154,816.

Specification of Letters Patent.

Patented Sept. 28, 1915.

Application filed September 7, 1911. Serial No. 648,018.

*To all whom it may concern:*

Be it known that I, KARL STEINBECKER, a subject of the King of Prussia, residing at Charlottenburg, Germany, have invented certain new and useful Improvements in Methods of and Means for Feeding Fluid Combustible to Internal-Combustion Engines, of which the following is a specification.

This invention relates to internal combustion engines, and especially to those in which the charge of hydrocarbon oil or other vaporizable fluid combustible is sprayed into the cylinder, subsequent to compression of a charge of pure air in the cylinder and there mixed with said air to produce an explosive vapor.

It is customary to effect the spraying of the fuel into the cylinder by means of a blast of air obtained from a suitable supply of compressed air, as from an air pump. This blast of air must be furnished to the fuel injector at a very high pressure and for numerous reasons is not an entirely satisfactory manner for introducing the charge to the cylinder. By my present invention I provide a method of and means for forcing the charge into the cylinder in an efficient and effective manner without the use of a blast of high pressure air. I effect this by providing a chamber into which the combustible is delivered by the pump, said chamber having a constricted nozzle-shaped outlet communicating with the engine cylinder. The charge is delivered to this chamber substantially coincidentally with the instant of greatest compression of the air in the cylinder. The heat of the compressed air ignites a portion of the charge in the chamber, and the resulting rise of temperature in the chamber causes a sudden expansion of the compressed air trapped above the charge, which together with the rise in pressure due to the partial combustion of the charge forcibly ejects the remainder of the combustible through the outlet into the cylinder, where it is widely diffused throughout the air contained therein, and becomes thoroughly mixed therewith. This process is aided by the fact that in case the introduction of the combustible takes place at the inner dead point of the piston, the original compression pressure decreases very rapidly in conse-

quence of the outward movement of the piston. It will be observed that the spraying of the combustible into the cylinder is effected directly and automatically, so that great certainty of operation is attained.

The accompanying drawing is a section of a portion of an engine cylinder equipped for carrying out my invention.

At a suitable point in the wall of the cylinder 1, corresponding with the compression space therein, is drilled a hole for the plug 2, which is preferably screwed into place, as shown. If the engine has a water jacket 3, a hole is provided therein for the plug, the joint being properly packed; as for instance by a gasket 4 compressed by a gland 5. The plug is cored out to form a chamber 6 which has a constricted nozzle-like mouth 7 opening into the cylinder 1. A nozzle 8 enters the opposite end of the chamber, being preferably screwed in, as shown. The pipe 9 delivers the oil or other combustible to the nozzle 8, the supply being intermittent and derived from a suitable pump, not shown. The bore of the nozzle 8 has a small enlargement or cavity 10 near its tip and inside the chamber 6.

The method of operation is as follows: When the engine piston compresses the air in the compression space of the cylinder, the air in the chamber 6 is similarly compressed and its temperature raised correspondingly. At the instant when the compression stroke of the piston is nearly or substantially completed the pump delivers a charge of oil through the nozzle 8. The narrow mouth 7 together with any air which is still flowing from the cylinder through the nozzles 7 prevents the charge from escaping immediately from the chamber 6, and at the same time such flowing air carries along particles of the charge tending thereby to form a combustible mixture in the chamber 6. The upper surface of said charge presents a sufficient area to the highly heated compressed air in said chamber to cause the ignition of a portion of the charge. The increase of pressure produced in the chamber due to this partial combustion, and to the raising of the temperature of the compressed air in the chamber 6, throws all the combustible into the cylinder, spraying or vaporizing it completely and effecting a thorough mixture



with the air, so that combustion occurs instantly. The cavity 10 in the nozzle stores a sufficient quantity of combustible for the next stroke of the engine, and since this  
 5 portion of the nozzle is within the chamber it is exposed to great heat which pre-heats the charge in the cavity 10, so that said charge will ignite more readily when forced into the chamber 6.

10 In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but  
 15 I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new and desire to secure  
 20 by Letters Patent of the United States, is,—

1. The method of introducing a charge of liquid combustible into an internal combustion engine cylinder, which consists in compressing air in the cylinder and in a communicating chamber having an outlet portion with a constricted passage between it  
 25 and the cylinder, and delivering the charge to the outlet portion of the chamber, thus exposing the rear surface of the charge to and causing it to be ignited by the heat of  
 30 the compressed air in the chamber, the higher pressure due to the combustion and rise in temperature of the contents of the chamber acting to force the charge through  
 35 the passage into the cylinder.

2. The method of operating an internal combustion engine which consists in compressing air in the engine cylinder and a chamber communicating with the cylinder by  
 40 a constricted outlet to a degree sufficient to ignite the fuel charge by the heat due to compression, and delivering a liquid fuel charge into the chamber at substantially the time of greatest compression so that the charge  
 45 practically fills said outlet and its rear surface or portion is ignited by the heated air in the chamber, the resultant rise of pressure in the chamber due to the combustion therein acting on the rear of the charge to forcibly  
 50 eject the remainder of the charge

through the outlet into the hot compressed air in the cylinder.

3. The method of introducing a charge of fuel into an internal combustion engine of the high compression type having a cylinder  
 55 and a chamber which communicates with the clearance space of the cylinder through a restricted passage, which consists in introducing the fuel into the passage so that it substantially fills the same after the engine  
 60 piston has substantially completed its compression stroke and compressed the air in the cylinder and chamber to a pressure so high that its temperature is above that of  
 65 the ignition temperature of the fuel whereby the rear portion of the charge of fuel will be ignited by the air in the chamber and force the charge of fuel through the passage into the cylinder.

4. The combination with an internal combustion engine cylinder, of a plug connected thereto, said plug having a chamber formed therein which communicates with the cylinder through a constricted nozzle-like  
 75 mouth, and a fuel nozzle projecting from a point outside the plug to a point well within the chamber and adjacent to said constricted nozzle-like mouth, said fuel nozzle having a cavity formed therein within the chamber  
 80 for storing a charge of fuel.

5. A device for carrying out the method herein described, comprising an engine cylinder, a plug having a screw-threaded end that is secured in the wall of the engine cylinder, said plug containing a chamber provided with a constricted nozzle-like mouth opening out through the screw-threaded end into the cylinder, and a fuel supply nozzle secured in the opposite end of the plug, said  
 85 nozzle extending into the chamber and having a longitudinal passage through it provided with an enlarged cavity near its tip for storing a charge of fuel.

In witness whereof, I have hereunto set my hand.

KARL STEINBECKER.

Witnesses:

ERICH ÜBERLÉE,  
 GUST. HÜLBROCK.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."