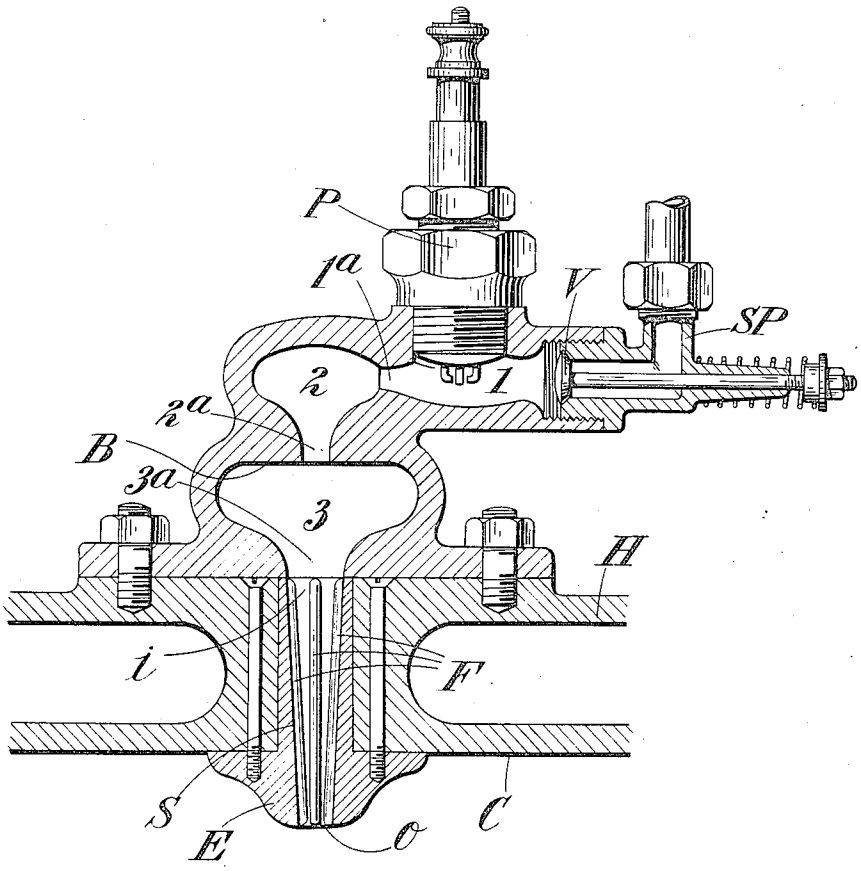
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IGNITION DEVICE FOR INTERNAL COMBUSTION ENGINES.

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1,375,424. Patented Apr. 19, 1921.



INVENTOR.

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IGNITION DEVICE FOR INTERNAL-COMBUSTION ENGINES.

1,375,424. Specification of Letters Patent. Patented Apr. 19, 1921.

Application filed January 19, 1920. Serial No. 352,424.

To all whom it may concern:

Be it known that I, FREDERICK ARTHUR SMITH, a subject of the King of England, residing at Brasted, Kent, England, have invented certain new and useful Improvements in Ignition Devices for Internal-Combustion Engines, of which the following is a specification.

This invention relates to ignition-devices for internal-combustion engines the devices being of the kind in which a sparking-plug or other electric igniter is employed to ignite a charge in an ignition-chamber forming an annex to and communicating with the engine-cylinder so that the said charge when ignited issues as a spurt of flame into the engine-cylinder.

It is known to place between the igniting tube and the exploding chamber of an internal-combustion engine one or several small exploding chambers which communicate with each other by small openings whose bore increases toward the igniting tube to cause a gradual decrease of pressure in those chambers when they are receiving gases under pressure from the exploding chamber of the engine, so that when a light has been applied to the gases in the igniting tube (or most distant chamber) and the opening to the atmosphere of the said tube has been closed, the flame enters the first exploding chamber, exploding the mixture therein. This causes sufficient pressure to ignite through the connecting openings the mixture in the following chamber, and so on until the main exploding chamber is reached.

The working of this apparatus thus acts so to reduce the pressure in the igniting tube that mixture reaching it from the engine cylinder may be sufficiently reduced in pressure to be able to burn in the said tube when in open communication with the atmosphere.

The subject of the present invention is an ignition device which at its inner end has an inlet for an ignition charge of explosive mixture and is provided with an electric igniter and at its outer end terminates in a spout or flame-nozzle that extends toward or into the combustion-chamber of the engine, and which comprises a succession of chambers terminating at the inner end of the spout, each said chamber having a contracted outlet and being shaped so that its inner wall forms a baffle to check backflow toward the igniter, with or without fins in the bore of the said spout. A regenerative action is also obtained from the device in the manner hereinafter explained.

This apparatus enables a special charge of highly-ignitible mixture (for instance petrol and air) to be compressed in the ignition chamber by the compression-stroke of the engine before the said charge is fired by the electric igniter therein, so that a strong jet of flame may be discharged into the next chamber, which chamber may contain a much less easily-ignitible mixture (for instance ignition charge largely mixed with paraffin and air forming part of the power-charge that has been compressed into the said chamber by the engine). All power-charge entering this chamber will however have been warmed by coming in contact with parts of the apparatus heated by previous explosions.

Not only is ignition of the less ignitible mixture thus secured, but fouling of the sparking electrodes by contact with the heavier combustible is prevented.

The accompanying drawing is a vertical central section through one construction of improved ignition-device according to this invention, in place in the cylinder-end of an engine.

With reference to the drawing, the cylinder-head has in it an ignition-device comprising a sparking-plug P, and a tapering spout S or flame-nozzle with its inner end *i* of larger bore than its outer end *o*. The spout extends away from the sparking-plug into the combustion-chamber space at C. Above, or farther in than the sparking-plug is the rear portion of a chamber 1 which extends away from the sparking-plug in the opposite direction, *i. e.* away from the spout S. The lower end of the spout has upon it an enlargement E within the combustion-chamber space C and there are fins F which extend radially into the bore of the spout S from the wall thereof.

A succession of chambers made up of the fore part of the chamber 1 and of chambers

2 and 3 leads from the sparking-plug P to the spout S. They are successively larger as the spout is approached and each of them has a contracted outlet 1^a, 2^a or 3^a. Between the chambers 2 and 3 is a baffle B, formed by the bottom of the chamber 2, to check back-flow.

The supply of auxiliary ignition-fluid which may consist of a highly-ignitible mixture of petrol and air is delivered by way of the supply-pipe SP and valve V into the chamber 1, and flows onward toward the spout S while the engine is making its suction stroke. During the compression stroke the ignition fluid is compressed into the inner parts of the series of chambers and chamber 3 (and to a less extent chamber 2) is nearly or wholly filled with the engine-mixture which may be not readily ignitible, as for instance a mixture of paraffin and air, but which has been well warmed up by coming in contact with the fins F and other parts heated by previous explosions. The ignition-fluid is ignited by the plug P and issues as a spurt of flame through the outlet 1^a so that the gases in chambers 2 and 3 are then ignited and a strong combined jet of flame issues through the spout S. Consequently the spout S becomes hot, together with the enlargement E, by reason of the heat of the flame which is forced through the spout as a result of the ignition of the charge and of the heat of the gases within the cylinder. As a further consequence the spout (and also the hot wall of parts of the chambers) acts regeneratively upon the gaseous fluid within the spout and around the outside of the enlargement E and the lower part of the chamber 3 being hot, assists in this regenerative action, thus improving the ignitibility of the main charge in the space C and also heating in the spout and chambers the compressed ignition-charge and making it easily ignitible by the spark from the sparking-plug P. This regenerative effect is enhanced by the fins F.

Radiation-vanes may if required be provided on any of the parts of the illustrated ignition-device that it may be desirable to cool.

The sparking-plug or other electrical igniter may if desired be placed in the chamber 2 instead of in the chamber 1.

An ignition-device according to the present invention will operate satisfactorily in an engine in which the main charge is of low volatility, and will reduce the fouling of the electrical ignition-device while insuring a good projection of ignition-flame into the engine-cylinder.

It is important that the aforesaid spout should be kept hot but not so hot as to bring about pre-ignition; to secure this result the upper part of the ignition-device is kept cool by radiation or otherwise, which cooling may if necessary be aided by radiation-fins. It is also important that the nozzle should be so proportioned and constructed that the part of the ignition-charge contained within it shall everywhere in it be within the reach of the regenerative action of the hot wall of the spout.

That the bore of the spout preferably tapers from the outer end to a wider inner end is desirable because such a form added to the succession of chambers aforesaid not only is productive of a high velocity in the flame projected therefrom but also produces turbulence (and therefore intimate contact with the hot regenerative walls) in any part of the ignition-charge which may be backed up into it from the engine-cylinder below.

I am aware that a tapering conduit through which flame from an ignition-chamber is projected into the cylinder of an internal-combustion engine is not new and to such I make no claim.

What I claim as my invention and desire to secure by Letters Patent is:—

1. An ignition device which at its inner end has an inlet for an ignition charge of explosive mixture and is provided with an electric igniter and at its outer end terminates in a spout or flame-nozzle that extends toward or into the combustion-chamber of the engine, and which comprises a succession of chambers terminating at the inner end of the spout, each said chamber having a contracted outlet and being shaped so that its inner wall forms a baffle to check back-flow toward the igniter.

2. An ignition device which at its inner end has an inlet for an ignition charge of explosive mixture and is provided with an electric igniter and at its outer end terminates in a spout or flame-nozzle that extends toward or into the combustion chamber of the engine, and which comprises a succession of chambers terminating at the inner end of the spout, each said chamber having a contracted outlet and being shaped so that its inner wall forms a baffle to check back-flow toward the igniter, said spout having fins in the bore thereof.

3. An ignition device for combustion chambers of internal combustion engines, comprising an inner chamber having an inlet for a combustible charge, means for igniting the charge therein, and successive chambers intermediate said combustion chamber and said inner chamber and in communication therewith, each of said successive chambers having a contracted outlet and being so shaped that the inner wall forms a baffle to check back flow toward the igniting means.

4. An ignition device for combustion chambers of internal-combustion engines, comprising an inner chamber 1 having an inlet for a combustible charge and a valve

V controlling said inlet, a sparking plug P for igniting the charge in said inner chamber, a spout S. E. F. *i. o.* that extends into the combustion chamber, and successive chambers 2 2^a B, 3 3^a intermediate said inner chamber and said spout and in communication therewith, each of said successive chambers having a contracted outlet and being so shaped that the inner wall forms a baffle to check back flow toward the sparking plug, substantially as described.

In testimony whereof I affix my signature.

FREDERICK ARTHUR SMITH.