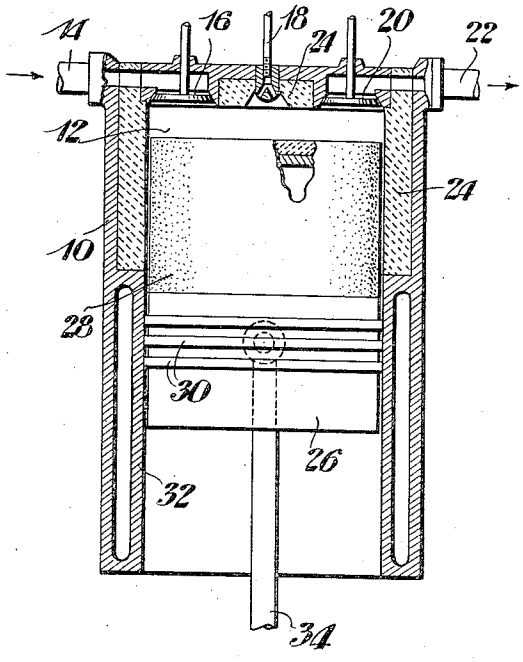
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CATALYTIC COMBUSTION BY MEANS OF REFRACTORIES

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GEORGE H. WYCKOFF Inventor

By his Attorney

Edmund G. Borden

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GEORGE H. WYCKOFF, OF MOUNTAIN LAKES, NEW JERSEY, ASSIGNOR TO DOHERTY RESEARCH COMPANY, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE

CATALYTIC COMBUSTION BY MEANS OF REFRACTORIES

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The present invention relates to the promotion of combustion in internal-combustion engines.

It has been proposed to use refractory linings in the cylinders of internal-combustion engines and to use refractory coverings on the pistons or on piston extensions in such engines for the purpose of minimizing the loss of heat through the cylinder walls and through the piston during working stroke. It has been proposed, also, to use a thin coating of catalytic material, more specifically material containing cerium oxide, on the inner surfaces of the combustion space of internal-combustion engines to obtain improvement in efficiency of combustion.

One object of the present invention is to provide a cylinder lining for internal combustion engines which will provide a minimum loss of heat due to radiation and give a catalytic effect for the promotion of combustion.

It is evident that any cylinder lining materials used for minimizing the loss of heat from the interior of an engine through the cylinder walls and pistons must have a high insulating capacity; in other words, the specific resistance to heat flow should be large. However, if the material is unable to withstand the maximum pressures developed within the engine at the temperatures so occurring at the time of combustion, a given material can not be used even though it has a high specific resistance. The material used must therefore retain a high compression strength at high temperatures. It is evident also, that a very thin layer of material having a high heat resistance may prevent the escape of as much heat as a thicker layer of material having a lower heat resistance. It is therefore desirable that the material to be used as a lining for cylinders of internal-combustion engines should have not only a high specific resistance to heat flow, but should also be capable of withstanding the pressures and temperatures developed within the engine when used in relatively thick layers.

As the heat lost through the walls of a cylinder and piston is reduced the temperatures of the inner surfaces of these walls necessarily increases and the total radiation from said inner surfaces also increases. The increased radiation from the surfaces of the combustion space of the engine is an advantage in that radiation of certain wave lengths has a specifically favorable effect on promoting combustion. Further, an increase of the total radiation acts to increase the radiation of the most desirable wave lengths for promoting combustion. The proper selection of refractory substances for linings therefore may have a very desirable effect on combustion in the cylinder due to their increasing effect on the radiation. After combustion has been completed within the engine cylinder the lining surfaces radiate energy into the products of combustion within the cylinder as they are cooled by expansion both during the power stroke and at the time of exhaust. It is desirable therefore that the lining materials should have a high radiation constant and it has been found that different materials have different radiation constant. If the radiation constant is not sufficiently high the surface of the linings will become heated to such a high temperature due to low radiation exchanges to the products of combustion so that preignition will occur within the cylinder when operating on certain cycles. This has been found to be particularly true when operating on the ordinary Otto cycle.

Moreover, certain substances possess the characteristic of selective radiation. As above indicated, radiation of certain given wave lengths is much more active in promoting combustion than radiation of other wave lengths. It is evident therefore that materials having a greater percentage than the average of their total radiation in the most favorable wave lengths for promoting combustion are more desirable for use within engine cylinders than those whose radiation is equally distributed throughout the wave length range, or those having selective radiation of a wave length range not particularly favorable to the promotion of combustion.

It has been found, further, that the presence of small quantities of radioactive substances in materials used as linings for the combustion spaces of internal-combustion en-

gines has a favorable effect in promoting combustion.

Native zircon (zirconium silicate) possesses the desired characteristics, as above discussed, in high degree. This substance can be bonded or made to cohere by the use of small quantities of certain foreign substances so that it can be used in relatively thick layers on the inner surfaces of cylinders for internal-combustion engines and on the pistons or piston extensions of such engines. Moreover, the resistance to heat flow from linings and piston coverings formed of native zircon is such that the total radiation loss from high power cylinders in which the temperatures reach the disassociation point of a heavy fuel oil may be kept to approximately 5%. At the same time, the specific radiation favorable to combustion given off by the zircon linings is high and the total radiation is sufficient to prevent preignition when used in Otto engines. Furthermore, the native zircon sands found in Florida and vicinity, while supplied to the trade in high degree of purity, contain a fraction of 1% of substances of a radio-active nature and the radiation or rays given off by the linings of this material have been found to be very effective in promoting combustion in engines, partly due to the effects of the radio-active material.

In the accompanying drawing, the figure is a sectional view of the cylinder and piston of an internal-combustion engine with linings therein which embody the preferred form of the invention.

In the drawing, 10 is the cylinder of an internal-combustion engine having a combustion space 12. Air for supporting combustion is introduced into the space 12 from the pipe 14 through the intake valve 16. If desired, the fuel for the engine may be introduced into cylinder 10 at the same time as the air, in the form of a carbureted mixture. In this case, the engine may be operated according to the ordinary Otto cycle. If desired, however, after the air has been taken into the cylinder heavy oil fuel may be sprayed into it from the pipe 18 as is customary in the operation of the so-called Diesel engine. In case the heavy oil fuel is used, the air introduced into the cylinder preferably is compressed and preheated to the ignition point of the fuel, prior to its entering the cylinder. If desired, the air may be compressed within the cylinder to the point of ignition as is commonly done in Diesel engine practice. However, hot tube or other form of ignition apparatus may be used if desired.

After the fuel has been ignited and burned in the engine, the products of combustion expand in the usual manner and are exhausted through an exhaust valve 20 and pipe 22.

Methods of and apparatus for introducing fuel as a carbureted mixture or as a spray are well known in the art and are not illustrated or described in detail herein. Moreover, methods of operating intake and exhaust valves of internal combustion engines and apparatus for carrying out such methods are also well known in the art and need no illustration or description herein.

The inner surfaces of the combustion space of the cylinder 10 and preferably the entire surface of the cylinder uncovered by the piston at the outer end of its stroke are covered by plates or linings 24 or bonded zircon, preferably of the composition found in Florida or in other deposits of zircon possessing small amounts of radio-active impurities. The piston 26 of cylinder 10 moreover is preferably provided with an extension having a relatively thick covering 28 also of zircon and preferably of the radio-active variety. By the arrangement of piston and piston extension just mentioned the piston rings 30 can bear against the inner surface of a water cooled section 32 of the cylinder 10. This feature, however, forms no part of the present invention. The piston rod 34 preferably is connected to a crank shaft (not shown) in the ordinary manner.

The engine according to the present invention may be governed in any preferred or ordinary manner.

Having thus described my invention, I claim:

1. In an internal-combustion engine, a cylinder the combustion space of which is covered at least in part by a lining containing a radio-active substance and having sufficient thickness to materially reduce the passage of heat through the wall of the cylinder.

2. An internal-combustion engine, the combustion space of which is at least partially covered by a lining of zircon including a radio-active substance.

3. An internal-combustion engine whose surfaces exposed to combustion are substantially entirely covered by heat insulating coverings containing a radio-active substance.

4. An internal-combustion engine whose surfaces exposed to burning fuel are formed entirely of heat insulating coverings of zircon containing a small percentage of radio-active substance.

5. An internal-combustion engine having a cylinder provided with heat insulating linings containing a radio-active substance on its inner surfaces and having a piston provided with a extension having a similar covering.

In testimony whereof I affix my signature.

GEORGE H. WYCKOFF.