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INTERNAL COMBUSTION MOTOR AND METHOD OF CONSTRUCTING

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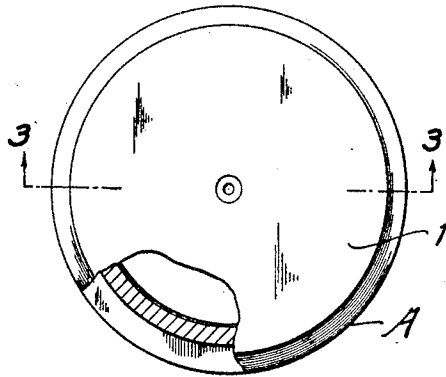


FIG. 1

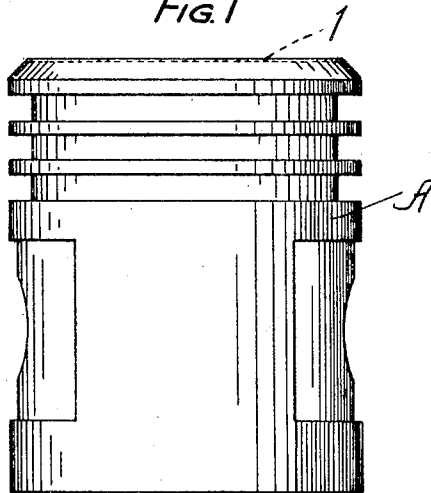


FIG. 2

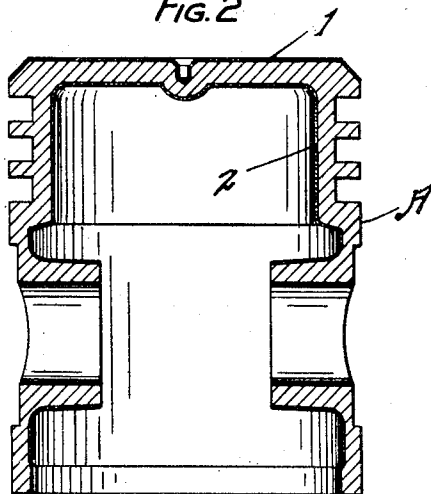


FIG. 3

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INTERNAL COMBUSTION MOTOR AND
METHOD OF CONSTRUCTING

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4 Claims. (Cl. 123—191)

This invention appertains to the art of engineering and particularly to the promotion of the efficiency of internal combustion engines under the working conditions of their operation.

This application is filed as a continuation in part of an earlier filed application, Serial No. 246,688, filed December 19, 1938.

Considerable difficulty has been encountered in the art of designing internal combustion motors in controlling "knocking" under heavy loads and from the formation of "shellac" or "varnish" on the piston skirts and of hard carbon on the piston heads. It is known that the temperature at which the parts of the motor operate which are subjected to the heat of the burning fuel and the rate of heat transfer through such parts materially affect the difficulties referred to. I have found that improved results in the operation and the life of certain of these parts may be obtained by applying a coating of vitreous enamel, of a type to be described, to parts of an internal combustion motor. The improved results obtained are indicative of an increased rate of heat transfer through the parts of the motor to which the coating is applied and, in my aforementioned application, this coating was characterized as a vitreous enamel which would increase the transfer of heat. The coating of vitreous enamel disclosed in the present application is the same as disclosed in my earlier filed application, the purpose of this application being to more completely describe the manner in which the vitreous enamel is applied and the characteristics thereof which distinguish it from other enamels which would be incapable of producing the desired results.

In the practice of my invention, it is contemplated to apply to the piston or pistons of the engine, cylinder barrels and to the engine head primarily, though not necessarily exclusively, a coating of vitreous enamel for the purpose stated, namely, that of obtaining improved efficiency and operation of the internal combustion motor through the increase in heat transfer which is obtainable by the application of such coatings to such motors when the piston parts, engine head and cylinder barrels are made of ferrous metal or ferrous alloys.

In addition to the foregoing, the invention contemplates not only the employment of the vitreous coating referred to, but the utilization of such coating as a carrier for suitable refractory materials which assist in maintaining the integrity of the vitreous coating substance.

It has been found that the employment of the

invention as above generally characterized affords a tangible increase of efficiency in the motor operation as is exemplified by the fact that tests have shown that an ordinary cast iron piston construction as used in the motor will knock at a timing point 4% nearer the dead center of the engine and under a 10% smaller load as compared with a similar piston to which my vitreous coating has been applied according to my invention as hereinafter more fully set forth, all other conditions in the operation of the two types of piston equipped engines being the same.

Actual comparative tests have also shown that a coating of vitreous enamel on the inside only of a cast iron piston, or on the top only of the piston, or on both the inside and top of the piston, results in the visible formation of a materially lesser amount of "varnish" or "shellac" on the skirt of the piston as compared to that formed on an uncoated cast iron piston where the pistons were used in an internal combustion engine under identical conditions of operation. The "varnish" or "shellac" referred to is caused by the oil contacting the heated surface of the piston and leaving a residue or product which frequently causes sticking of the piston rings with a consequent decrease in the efficiency and life of the motor.

A full understanding of the present invention will be had upon reference to the accompanying description and to the annexed drawing, in which one exemplification or use of the invention in internal combustion motor construction is illustrated.

In the drawing:

Figure 1 is an end view of the flame side of the top or head of a piston of an explosive or hydrocarbon fuel burning motor, said view being broken away to show the manner in which the vitreous coating is applied to the interior wall of said piston.

Figure 2 is a side elevation of a piston showing by dotted lines the coating applied to the head of the piston at the flame side thereof.

Figure 3 is a vertical sectional view of the piston showing the invention applied thereto, and the view being taken on the line 3—3 of Figure 1.

As a simple mode of illustrating the method and construction of an internal combustion motor part to which the invention is applied, there is shown in the drawing a conventional form of cast iron piston such as commonly used in different kinds of internal combustion motors.

In accordance with conventional practice of applying enamels, the surface of the iron to which the vitreous enamel is to be applied is first thoroughly cleaned as by sand blasting or pickling and the enamel, in a watery suspension commonly referred to as an "enamel slip" in the enamelling art, is then applied by spraying, or by dipping the surface in the enamel slip. Thereafter, the enamel is fired on by heating in a suitable furnace.

In respect to the coating 1, it is contemplated that the vitreous enamel shall contain alumina as an enamel mill addition, preferably in the amount of approximately 10% of the total amount of coating. Or, instead of using alumina as the enamel mill addition carried in the enamel body, zirconia may be employed. The purpose of these additions is to enable the enamel to stand up better when directly subjected to the flame of the burning fuel.

It is obvious that where a refractory substance such as zirconia or alumina is provided in the vitreous enamel coating body the heat resistance qualities of the coating are enhanced, and this is desirable having in view the purposes of the invention.

Generally speaking, the coating 2 is not employed as a carrier for any alumina, zirconia, or refractory substance as above set forth, though it may be used as such according to the particular types of engines in conjunction with which the invention is employed.

The vitreous enamel employed for the purposes of this invention is an inorganic enamel having as its base feldspar, flint, borax, soda ash, or the like, as distinguished from the organic enamels and has thus far been referred to broadly as one which will increase the transfer of heat through the ferrous metal part to which it has been applied. More specifically, such a vitreous enamel is one which while being fused or sintered will be sufficiently fluid to run into the pores of the metal and will mature when heated to a temperature of approximately 1000° C. and one which contains a substance or has properties which will cause the enamel to be substantially integrally and permanently bonded to the ferrous surface to which it is applied. The material which is added to the enamel to give it its necessary bonding or adhering characteristics is preferably cobalt oxide although other equivalent substances such as nickel, copper, cerium, or manganese oxides may be employed for this purpose. It is necessary that the vitreous enamel employed contain such an adherence promoting substance in order to provide a satisfactory bond between the ferrous metal and the enamel which is essential to the desired effect with respect to heat flow characteristics.

By the expression "satisfactory bond" is meant a bond in which the dividing line between the metal is discernible only on relatively high magnification. An enamel thus bonded to the surface of metal when struck a blow as by a hammer will not tend to separate from the surface of the metal whereas an enamel which contains no adherence promoting substance will break cleanly from the metallic surface when struck such a blow. It is believed that a vitreous enamel which contains an adhering or bonding promoting substance such as cobalt oxide causes the oxide film on the ferrous base to be dissolved by some action of the enamel thereby enabling the desired bond to be had. Accordingly, it will be further understood that a vitreous enamel which will effect the

desired increase in the transfer of heat is one which will unite with the ferrous metal surface in a manner to provide a satisfactory bond.

From the foregoing, it will be understood that compositions of black and white enamels, varying in accordance with the knowledge of the enamelling art may be employed, as long as such enamels will increase heat transfer or contain an adherence promoting substance, for the purpose of the coatings 1 and 2, and while these coatings will be generally used together on a piston in the manner exemplified, either one may be employed separately from the other.

In practice it is contemplated that the inside of the engine head may have the coating of vitreous enamel applied thereto, this being the flame side, of course, and the effective results obtained will be an increase in the heat transfer action effected in the same manner as found in enamelled ferrous alloy pistons. It is also contemplated that the aforementioned vitreous enamel be applied to the cooling fins of an air cooled internal combustion engine for effecting an increase of heat transfer therethrough.

Not only is the employment of the vitreous enamel in the manner described useful in ordinary explosive type internal combustion engines, but the same principle will afford advantageous results in so far as the heat transfer increase is concerned when the enamel is applied to pistons and cylinder heads of Diesel motors or engines, and in air cooled engines.

It is obvious that when the enamel coatings are used as described, especially those coatings which are directly applied to the flame side of the piston head and the flame side of the cylinder head of internal combustion motors, the surface coating will not only enhance the heat transfer action, but will be correspondingly heat resistant when a refractory addition is carried in the coating body.

By the employment of the invention in the manner described above, I have found that much improved engine operation by way of greater power output, less knocking, and cooler running, results. The enamel coating, of course, forms a convenient means for holding non-metallic substances such as refractories to produce its heat resistant effects appertaining to the particular parts subjected to the action of the burning hydrocarbon directly in the combustion zone of the motor.

It is within the purview of the invention that one or more coats of the vitreous enamel may be applied to the motor parts according to the requirements believed best for efficient engine operation on the part of a person skilled in the art to which the invention appertains.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States, is:

1. The method of treating a ferrous metal part of the combustion chamber of an internal combustion motor, which consists in the application of a heat transfer coating of a vitreous enamel to the part, said vitreous enamel containing cobalt for substantially permanently and integrally bonding itself to the surface of the part to which it is applied.

2. A ferrous piston of an internal combustion motor which is directly subjected to the heat of burning motor fuel, combined with a coating of vitreous enamel applied to a surface of said piston, said enamel containing cobalt and having

the properties of increasing the transfer of heat through the piston.

3. A ferrous part of an internal combustion motor having a surface directly subjected to the flame of the burning motor fuel, combined with a coating of vitreous enamel applied to said surface, said enamel having adherence promoting properties to provide a substantially permanent and integral bond with the surface to which it is applied, said enamel further having a refractory 10 provided therein to increase the ability of the same to withstand the action of the flame.

4. A ferrous part of an internal combustion motor having a surface directly subjected to the flame of the burning motor fuel, combined with a coating of vitreous enamel applied to said surface, said enamel containing cobalt to provide adherence promoting qualities for effecting a substantially permanent and integral bond with the surface to which it is applied.

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