Oct. 31, 1950 J. RODNESKY 2,528,081

FUEL PREHEATER

Filed July 29, 1947

FIG. 1.

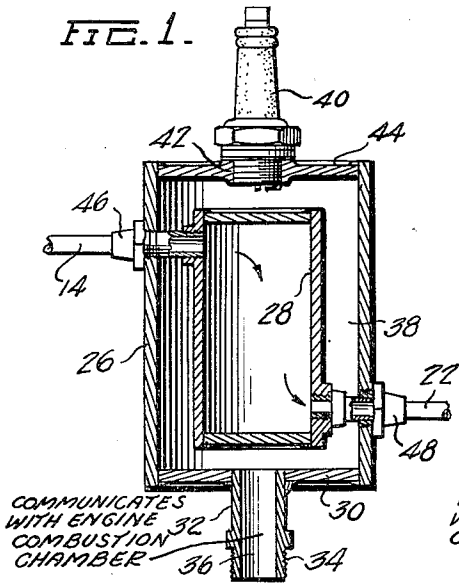


FIG. 2.

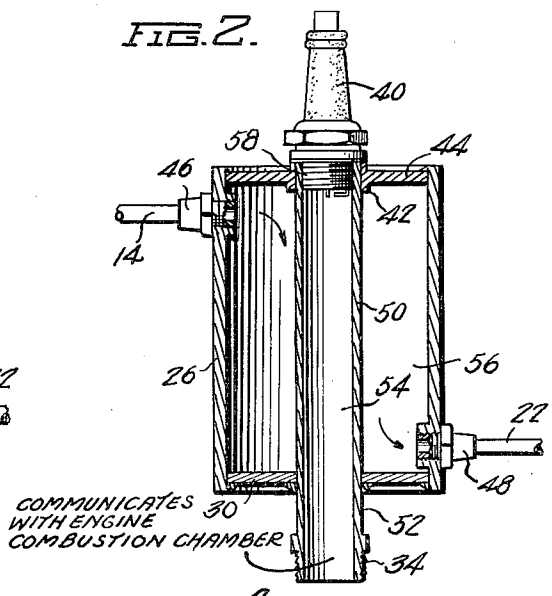


FIG. 3.

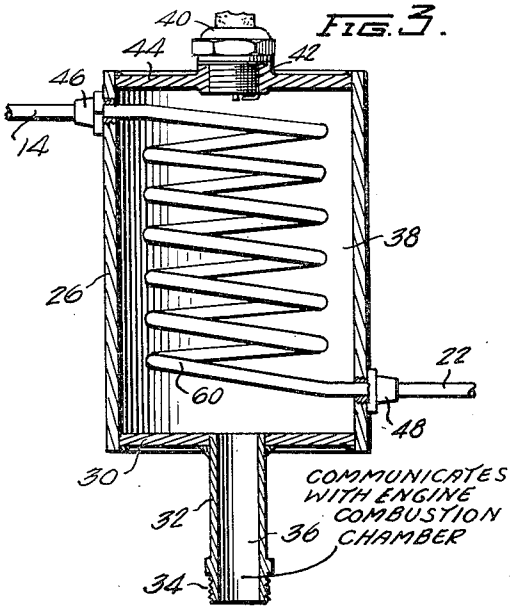
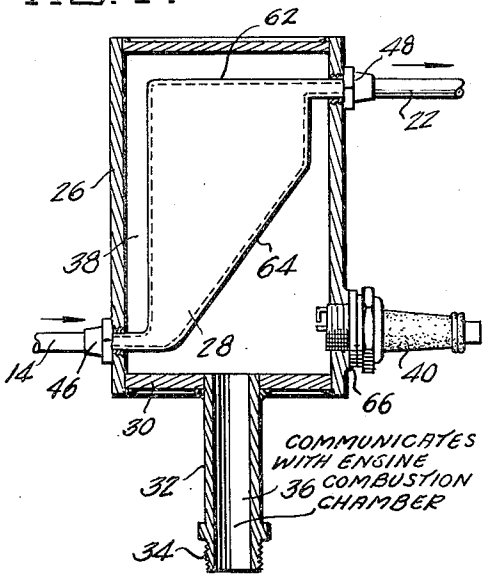


FIG. 4.



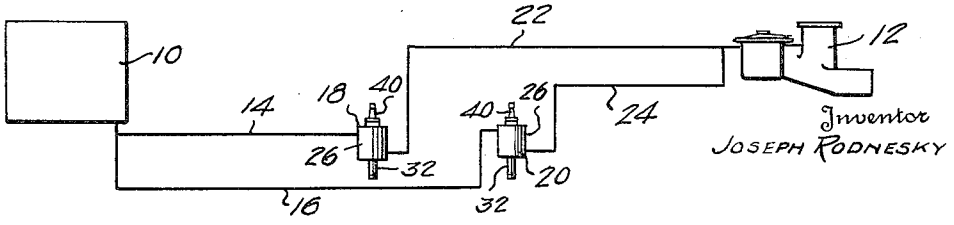


FIG. 5.

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FUEL PREHEATER

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9 Claims. (Cl. 123—122)

1

The present invention relates generally to internal combustion engines.

More particularly the invention relates to an improved fuel preheater adapted to be employed in conjunction with the fuel feeding system of an internal combustion engine for volatilizing the fuel or increasing the energy content thereof to improve the operating efficiency of the engine.

It has long been recognized by those skilled in the internal combustion engine art that only a fraction of the available chemical energy of the fuel is able to be effectively utilized in the performance of useful work. As a rough estimate it has been stated that approximately one-third of the available energy is lost as waste heat, and one-third due to incomplete combustion, leaving approximately one-third of the energy for the performance of useful work.

In the search for ways to improve engine operating efficiency the trend has been towards the use of more volatile and correspondingly more expensive fuels in an effort to improve the vaporization and mixing of the air-fuel mixture to thereby achieve more nearly perfect combustion. I have found, however, that by properly preheating the fuel before it is fed to the engine cylinders it is possible to use a relatively low grade fuel such as kerosene or fuel oil in a conventional internal combustion engine, such as an automobile engine, without injuring the latter and with the production of increased operating efficiency and reduced operating costs.

Accordingly, the principal object of this invention is to provide a fuel preheater embodying novel principles of construction to enable a relatively cheap, low grade fuel to be successfully used in modern internal combustion engines.

Another object of the invention is to provide a fuel preheating system for use with an internal combustion engine wherein at least two preheating units are connected in parallel by conduits extending between the fuel supply tank and the engine carburetor.

A further object of the invention is to provide a fuel preheater for use with an internal combustion engine which comprises a pair of interrelated chambers, one of which includes a portion adapted to be screwed into the conventional spark plug socket of an engine cylinder and has a spark plug mounted therein so that fuel flowing through the other chamber may be heated by the gases of combustion produced by operation of the spark plug to ignite the fuel mixture within the cylinder.

Another object of the invention resides, in the

2

several embodiments thereof, in the provision of improved fuel preheating apparatus of the type described having interrelated chambers formed in accordance with novel principles of construction to obtain maximum preheating efficiency.

Other objects of the invention will become apparent during the course of the following description.

In the drawing I have shown several embodiments of the invention. In this showing:

Fig. 1 is a longitudinal cross-sectional view through one embodiment of the invention;

Fig. 2 is a longitudinal cross-sectional view through a modified form of preheater;

Fig. 3 is a longitudinal cross-sectional view similar to Figs. 1 and 2 but illustrating another modified form of fuel preheater;

Fig. 4 is a longitudinal cross-sectional view similar to Figs. 1–3 but illustrating still another embodiment of the invention; and

Fig. 5 is a diagrammatic view illustrating the application of the improved preheaters to the fuel supply system of a multi-cylinder internal combustion engine.

Referring to the drawing and in particular to Fig. 5 thereof, the fuel supply system for an internal combustion engine in accordance with the present invention comprises a fuel tank 10 and a carburetor 12, each of which may be of any suitable construction and located in conventional manner with respect to an internal combustion engine. A pair of parallel fluid conduits 14 and 16 extend from the fuel tank 10 to a pair of fuel preheaters designated generally by reference numerals 18 and 20, respectively. A similar pair of parallel fluid conduits 22 and 24 extend from the fuel preheaters 18 and 20, respectively, to the carburetor 12, the entire assembly constituting a fuel preheating system, the preheating units of which are connected in parallel relationship between the fuel tank and the carburetor.

Referring to Figure 1 of the drawing, one embodiment of improved fuel preheater in accordance with the present invention comprises a generally cylindrical hollow outer casing 26 having a similarly shaped but smaller inner casing 28 in spaced fluid-tight relation therewith. The bottom end wall 30 of the outer chamber 26 is provided with a tubular projection 32 which may be suitably secured thereto as by means of welding or the like and includes an externally threaded portion 34 adapted to be engaged with similar internal threads formed in the usual spark plug opening (not shown) of an engine cylinder. The

projection 32 is open to provide an unobstructed passage 36 adapted to afford communication between the interior of an engine cylinder and a space 38 formed between the outer casing chamber 26 and the inner casing 28.

A conventional spark plug 40 is threaded into a boss 42 formed in the top end wall 44 of the outer casing 26 and may be connected in the usual manner to the engine ignition system. Fluid coupling devices 46 and 48 are provided at opposite sides adjacent the top and bottom, respectively, of the outer chamber 26 and are adapted to connect the inlet and discharge conduits 14 and 22 in a fluid-tight manner to the interior of the inner chamber 28. The various arrows show schematically in Figure 1 the direction of flow of the fuel through the inner casing 28 and also the direction of flow of gases from an engine cylinder into the space 38.

In the modified form of apparatus illustrated in Figure 2, the fuel to be preheated is fed directly into the outer casing 26 instead of through the wall of the outer casing to the inner casing. In this case, the inner casing is constituted by a substantially straight tubular member 50 firmly secured in the end walls 44 and 30 of the outer casing 26 and having a portion 52 projecting outwardly beyond the bottom end wall 30 of the outer casing adapted to be engaged within the spark plug opening of an engine cylinder. The gases of combustion produced by operation of the spark plug 40 in this modification are contained entirely within the space 54 of the tubular member 50, the fuel circulating through the annular space 56. It will also be noted in this modification that the spark plug 40 is threaded at 58 into the top of the tubular member 50, the latter being secured in a fluid-tight manner within the boss 42.

The modified form of fuel preheater illustrated in Figure 3 of the drawings is generally similar to that illustrated in Figure 1. In this case, however, the fuel preheating chamber is in the form of a helically coiled tube 60 which is preferably made of copper or the like and is mounted in spaced fluid-tight relation within the outer casing 26. It will be noted that the construction illustrated in Figure 3 provides a relatively large space for the circulation of the gases of combustion and by reason of the elongated path of the fuel through the tube 60 improved contact with the heated gases of combustion is insured.

The modified form of apparatus illustrated in Figure 4 is also quite similar to that illustrated in Figure 1. In this modification, however, the inner casing 28 takes the form of a truncated hollow cylinder having its circular base 62 at the top and its elliptical base 64 at the bottom thereof. It will also be noted in this modification that the spark plug 40 is mounted in a threaded boss 66 formed in the side wall of the outer chamber 26 adjacent the bottom of the latter in such position as to be roughly opposed to the elliptical face 64 of the inner chamber 28. By this arrangement, which constitutes a preferred construction of the apparatus, the circulation of the gases of combustion within the outer casing 26 is improved while at the same time a relatively large contact area is provided on the inner chamber 28. The sloping elliptical end wall 64 also improves the necessary scavenging action within the outer chamber 26 and provides for an improved rate of flame propagation from the spark plug to the engine cylinder.

While I have illustrated a number of modified forms of my invention, it will be apparent that the use of one form or the other is to be governed by the particular circumstances of each case, such as the precise nature of the fuel to be employed, the operating temperatures of the internal combustion engine with which the preheater is to be used, the cylinder pressures and piston velocities of the engine, and so forth. It will also be understood that in each case there will be no departure from the basic principles of the invention, the combined fuel preheater and spark plug taking the place of the conventional engine spark plug and serving to preheat or vaporize the fuel prior to its admission to the carburetor.

Each form of the invention is adapted for use with an internal combustion engine to render practicable the use of heavier fuels than gasoline, for example, kerosene and fuel oils. During the operation of the engine, unburned fuel mixtures will be forced upwardly into the chamber 38 in Figure 1, for example, and the fuel mixture will be fired by the spark plug 40. At each explosion of the fuel substantial heat will be generated and there will be a considerable absorption of the heat by the fuel flowing through the casing 28. The chamber of the heavier fuel thus will be raised to the point of vaporization. This renders the fuel capable of use in an engine primarily designed to use gasoline as its fuel.

The operation of each of the other forms of the invention will be obvious. In each case, the device is provided with a threaded projection which is screwed into the spark plug opening of one cylinder of an engine, and an opening is provided for the reception of such spark plug so as to fire the explosive mixture which flows into the firing chamber from the cylinder. In each case, there is a continuous flow of the fuel through or around the firing chamber so as to absorb heat in the manner stated.

It will be obvious that it is unnecessary to use one of the devices in connection with each cylinder of a multi-cylinder internal combustion engine. For relatively small engines, for example a two or four-cylinder engine, it is necessary to use only one of the devices. For an engine having more cylinders, however, one of the devices may not have the necessary capacity for gassifying sufficient fuel to meet the demands of the engine. In such case, two of the devices, as indicated by the numerals 18 and 20 in Figure 5, will be employed, each being tapped into one of the conventional spark plug openings. Such an arrangement will provide double the capacity of a single device.

I claim:

1. Fuel preheating means for an internal combustion engine having a plurality of cylinders provided with spark plug openings, a fuel tank and a carburetor, comprising a plurality of preheating units, each unit comprising inner and outer casings in sealed fluid tight relation to each other and providing a space therebetween, one of said casings being connected at one end to said fuel tank and at its other end to said carburetor whereby liquid fuel will flow through such casing, the other casing having a threaded projection engageable in the spark plug opening of one of said cylinders, and a spark plug threaded in the other of said casings to ignite fuel therein

from the associated engine cylinder to heat fuel passing through said first named casing.

2. A fuel preheating device for an internal combustion engine having a cylinder provided with a spark plug opening, a fuel tank and a carburetor, comprising an outer casing, an inner casing in fixed fluid tight relation to said outer casing and spaced therefrom, one of said casings having means at its top and bottom respectively connectible to said tank and to said carburetor for the flow of fuel through such casing, a tubular projection on the other casing adapted to be threaded in the spark plug opening, and a spark plug monnted in said last named casing to ignite fuel therein from said cylinder to preheat fuel passing through said first named casing.

3. A fuel preheating device for an internal combustion engine having a cylinder provided with a spark plug opening, a fuel tank and a carburetor, comprising a casing having a reduced tubular projection adapted to be threaded in the spark plug opening, said casing having another opening for the threaded reception of a spark plug to fire fuel in said casing, and an inner casing spaced from and in fluid tight relation within said outer casing, said inner casing having means adapting it for connection respectively with said tank and said carburetor for the flow of fuel therethrough to be preheated by the fuel ignited by said spark plug.

4. A fuel preheating device for an internal combustion engine having a cylinder provided with a spark plug opening and a carburetor, comprising a cylindrical casing having a reduced tubular projection adapted to be threaded in the spark plug opening for the flow of fuel into said casing from the engine cylinder, said casing having an opening for the threaded reception of a spark plug to fire fuel therewithin, an inner cylindrical casing arranged within and in spaced relation to said first named casing, and a pair of fuel ducts communicating with said inner casing and projecting in fluid tight relation through said outer casing, one of said ducts being connected to the carburetor and the other being adapted for the introduction of liquid fuel into said inner casing to be preheated by the fuel ignited in said first named casing by the spark plug.

5. A fuel preheating device for an internal combustion engine having a cylinder provided with a spark plug opening, and a carburetor, comprising a casing having a tubular projection at one end adapted to be threaded in said spark plug opening and having an opening in its other end for the threaded reception of a spark plug for firing fuel entering said casing from the engine cylinder, and a helically coiled tube within said casing having its ends projecting therethrough in fluid tight relation therebetween, one end of said tube being connectible to the carburetor and the other end being adapted for the introduction of liquid fuel to be heated by the fuel ignited in said casing by the spark plug.

6. A fuel preheating device for an internal combustion engine having a cylinder provided with a spark plug opening, and a carburetor, comprising a casing having a tubular projection at one end adapted to be threaded in said spark plug opening and having an opening for the threaded reception of a spark plug for firing fuel entering said casing from the engine cylinder, a truncated cylindrical casing within and spaced from said first named casing, said inner casing having a circular top and a sloping elliptical bottom, the spark plug being threaded in said outer casing generally opposite said elliptical bottom, and a pair of fuel ducts extending through one side of said outer casing in fluid tight relation therewith and communicating with said inner casing, one of said ducts being connectible with the carburetor and the other being adapted for the introduction of fuel to be preheated in said inner casing by the burning fuel ignited in said first named casing by the spark plug.

7. A fuel preheating device for an internal combustion engine having a spark plug opening, and a carburetor, comprising a tube having one end externally threaded for reception in the spark plug opening and having its other end internally threaded for the threaded reception of a spark plug for igniting fuel in said tube, a casing surrounding said tube in fluid tight relation therewith and forming a preheating chamber, and a pair of ducts communicating with the interior of said casing for connection respectively with a source of liquid fuel and with the carburetor for the passage of fuel through said chamber to be preheated by the fuel ignited by the spark plug.

8. As a fuel preheating means for an internal combustion engine having a cylinder provided with a threaded spark plug opening, a unitary device comprising a pair of chambers in sealed fluid type relation to each other and arranged one within the other, a tubular projection communicating with one of said chambers and externally threaded for reception in the spark plug opening of the cylinder, said one chamber being defined by a casing having an internally threaded opening corresponding to the spark plug opening of the engine cylinder for the reception of the threaded end of a spark plug therein, and inlet and outlet ducts communicating with the other chamber.

9. As a fuel preheating means for an internal combustion engine having a cylinder provided with a threaded spark plug opening, a unitary device comprising a pair of casings one of which forms a chamber therewithin, said casings being spaced to form a second chamber therebetween, one of said casings being provided with a tubular extension having a threaded end for reception in the spark plug opening of the engine cylinder, said one casing having an opening internally threaded to correspond to the threads of the spark plug opening of the engine cylinder, said tubular extension forming a passage communicating between the interior of the engine cylinder and one of said chambers and the other of said chambers having fuel inlet and outlet ducts.

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