H. N. WHITTELSEY.

LIQUID FUEL HEATER.

APPLICATION FILED SEPT. 24, 1914.

1,219,516.

Patented Mar. 20, 1917.

2 SHEETS—SHEET 1.

Fig. 1

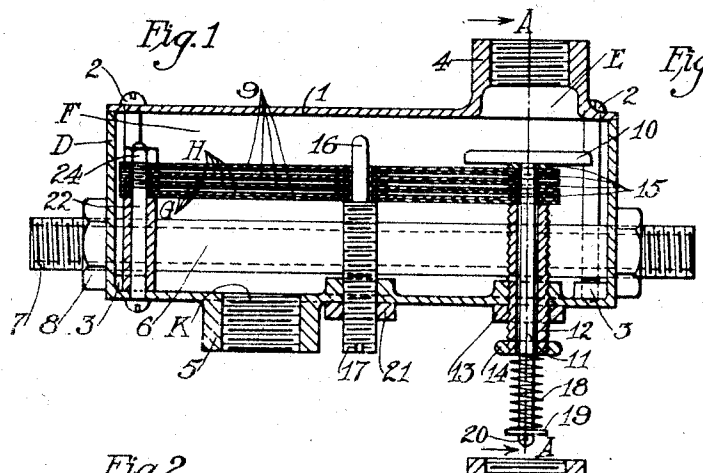


Fig. 3

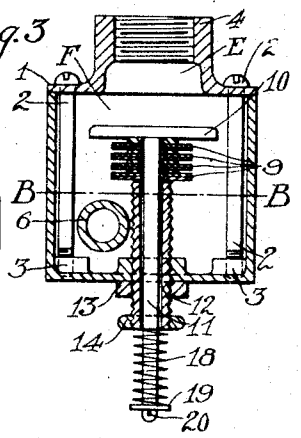


Fig. 2

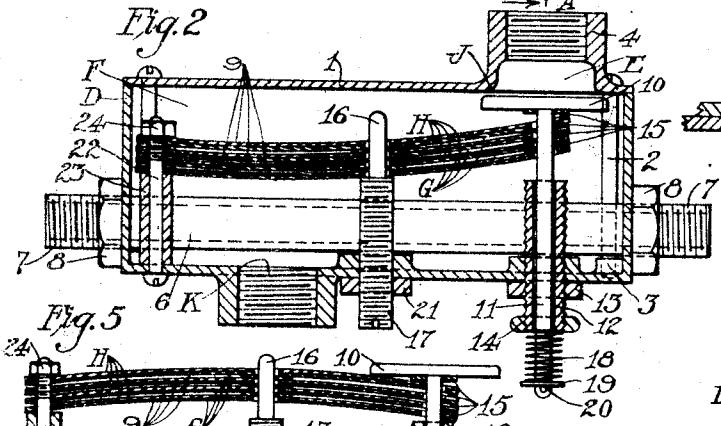


Fig. 4

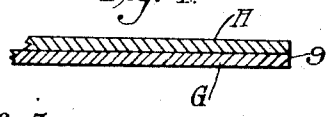


Fig. 5

Fig. 7

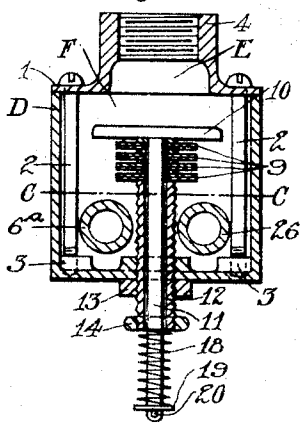


Fig. 6

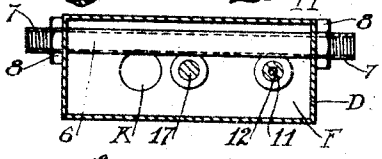
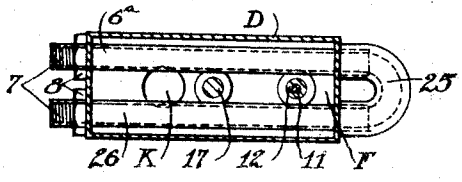


Fig. 8



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2 SHEETS—SHEET 2.

Fig. 9

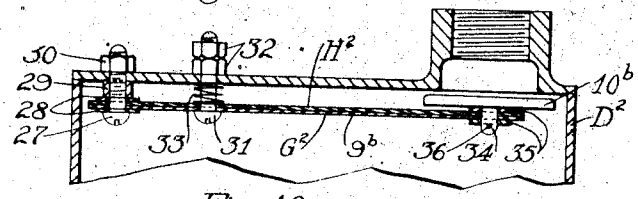


Fig. 10

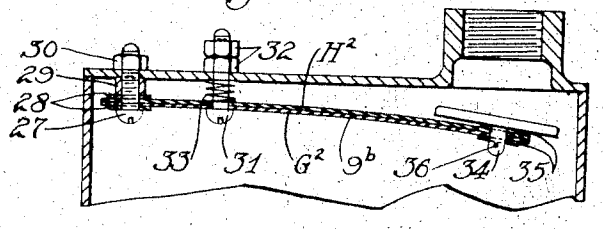


Fig. 11

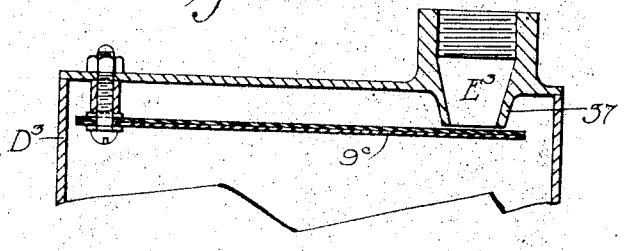
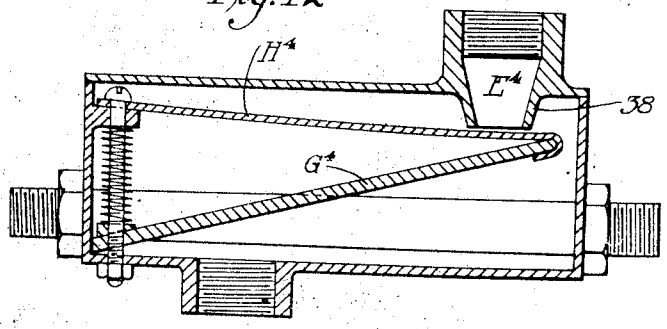


Fig. 12



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UNITED STATES PATENT OFFICE.

HENRY NEWTON WHITTELSEY, OF GREENWICH, CONNECTICUT, ASSIGNOR TO WHITTELSEY COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

LIQUID-FUEL HEATER.

1,219,516. Specification of Letters Patent. Patented Mar. 20, 1917.

Application filed September 24, 1914. Serial No. 863,375.

To all whom it may concern:

Be it known that I, HENRY NEWTON WHITTELSEY, a citizen of the United States, and a resident of Greenwich, county of Fairfield, State of Connecticut, have invented certain new and useful Improvements in Liquid-Fuel Heaters, of which the following is a specification accompanied by drawings.

This invention relates to a device for preheating the liquid fuel supplied to the carbureting or vaporizing apparatus or cylinder direct of an internal combustion engine, and the device is particularly applicable for heating liquid fuels not readily vaporized at atmospheric temperatures or having a material portion of constituents not so vaporized, examples of such fuels being heavy gasolenes, kerosene, fuel oil, alcohol, etc., although the invention may have a general use in heating other liquids.

In my copending application, Ser. No. 861,554, filed Sept. 14, 1914, I have described and claimed certain apparatus for this purpose and in the present application I have disclosed further modifications of the same invention.

In accordance with the invention, my device affords means for adding heat to the liquid fuel, to enable the temperature of the fuel to be raised above the atmospheric temperature, thereby materially increasing the vapor pressure of the fuel and producing the beneficial result of increased vaporization when the fuel is released or discharged in the carbureter, vaporizer or engine cylinder space.

I prefer to employ the heat of the exhaust gases as the heating medium and the present improvements relate particularly to the automatic means for controlling the exhaust heat supplied to the heating chamber of my device, in order to efficiently regulate the temperature of the fuel with the variations in the temperature and pressure of the exhaust gases incident to variations in power of the engine. The device is of the same general type as that disclosed in my copending application above referred to, and the present invention is illustrated in the accompanying drawings, in which—

Figure 1 is a longitudinal sectional elevation of one form of the device;

Fig. 2 is a similar view with some of the parts in a different position;

Fig. 3 is a transverse sectional elevation on the line A—A of Fig. 1;

Fig. 4 is a detail broken view, in longitudinal section, of a thermostatic member;

Fig. 5 is a detail broken view partly in vertical section of one position of the thermostatic members;

Fig. 6 is a horizontal sectional view on a smaller scale, taken on the line B—B of Fig. 3;

Fig. 7 is a transverse sectional elevation similar to Fig. 3 of a modification;

Fig. 8 is a horizontal sectional view on line C—C of Fig. 7;

Fig. 9 is a longitudinal sectional elevation broken away of the upper portion of a modified form of the device;

Fig. 10 is a view similar to Fig. 9 with the parts in a different position;

Fig. 11 is a longitudinal sectional elevation broken away, of the upper portion of another modification; and

Fig. 12 is a longitudinal sectional elevation of a further modification.

Referring to the drawings, and more particularly to Figs. 1 to 6 inclusive, one suitable form of the device is illustrated, in which D is a suitable casing ntaining a heating chamber F, preferab having the removable cover 1, adapted to be secured to the casing, as by means of the screws 2 taking into the bosses 3 in the base of the casing.

As shown in this instance, the cover 1 is provided with the inlet port E having an internally screw threaded neck 4 adapted for taking an exhaust gas conduit connection from the exhaust manifold or line of an internal combustion engine, since, as hereinbefore stated, I prefer to utilize the exhaust

gases as the heating medium. The casing D is also provided with an outlet port K, having the internally screw threaded neck 5, which may take a discharge conduit, so that when the device is properly connected, the exhaust gases flow through the heating chamber when both ports are open.

The casing D is preferably made as small and as light as conveniently possible and may be formed of aluminum or other light metal. A liquid fuel conduit 6, forming the fuel chamber, preferably of copper, extends through the casing preferably in a longitudinal direction, affording the heating surface, and is fitted with suitable means, as the screw threaded ends 7, for attachment for instance in the fuel supply line adjacent the carbureter or vaporizer, so that the liquid fuel flowing through the fuel chamber 6 is subjected to the heat of the exhaust gases in the heat chamber F. The conduit 6 is held firmly in the casing by the jam nuts 8.

In order to automatically control the flow of exhaust gases through the casing, I have shown suitable devices, preferably in the form of sensitive thermostatic members subject to the influence of the heat of the exhaust gases in the heat chamber F and adapted to expand and contract with variations of temperature in said heating chamber. In constructing the thermostatic members, I take advantage of the property of difference in expansion of two metals or alloys, or a metal and an alloy under the influence of applied heat. By constructing such thermostatic members in the form of strips, each composed of metals or alloys having different coefficients of expansion, the tendency of the greater expanding metal or alloy to expand in a straight line, is opposed by the less expanding metal or alloy, thus causing the former to expand and contract in arcs of continually varying radii as the temperature of the applied heat varies. However, the less expanding metal may be made to form the arcs, with the greater expanding metal forming the chords, in which case the less expanding metal would follow arcs of continually varying radii as the temperature of the applied heat varies, due to the material change in length of the chords. In the former case the curvature increases with the increase of temperature and in the latter case decreases with such increase.

The sensitive thermostatic strips 9 may be formed in any desired manner but I have obtained satisfactory results with strips such as shown in detail in Fig. 4 in which the greater expanding metal G may be brass, having the less expanding nickel-iron alloy H rolled or riveted thereon. This construction materially increases or amplifies the change of the radii of the arcs of circles formed, for the arc may then be considered to be made up of infinitesimal small arcs each with its chord, the length of the arc and the length of the chord being nearly of the same dimension, and therefore the difference of expansion is most manifest. If these thermostatic strips 9 are set straight at normal temperature, say 60° F., such as shown in Fig. 1, then under the influence of greater temperature than 60° F. they bend as illustrated in Fig. 2, and with less temperature than 60° F. they bend in the opposite direction, as illustrated in Fig. 5.

I so construct and mount the thermostatic members, that the expansion and contraction is utilized in an efficient manner for actuating suitable means for controlling the inlet port E. I have shown the inlet port preferably arranged at one end of the cover 1, and a valve 10, preferably in the form of a disk valve, coöperates with the flat valve seat J. By means of this construction the entering exhaust products impinge directly upon the face of the valve 10 instead of upon the sensitive thermostatic members, and the gases are then deflected throughout the heat chamber. The valve also closes quickly against the flat seat J.

The valve spindle or stem 11 slides through a sleeve 12, extending through the bottom of the casing opposite the inlet port E, and this sleeve may be adjustable in any suitable manner, in this instance the sleeve being externally screw threaded and provided with the locking nut 13. A knurled head 14 may be provided for adjusting the sleeve 12.

The outer end of the valve stem outside of the casing, as shown, is preferably provided with a spring 18 which may be in the form of a coiled spring placed over the end of the stem and confined between the sleeve 12 and the washer 19 held by the pin 20. By this means the valve 10 and thermostatic members are held snug, which permits the installation of the device at any angle.

The thermostatic members or strips 9 as shown in Figs. 1 to 6 are placed one upon the other and separated by the washers 15. The reduced end 16 of a screw threaded stud 17 passes through all the strips at a point intermediate their length, which point may be substantially midway of their length. The stud 17 forms a guide and support for the strips and this stud is preferably adjustable inwardly and outwardly as desired, and locked in position by means of the lock nut 21. The adjustable feature of this stud 17 enables the raising or lowering of the thermostatic members, thus raising or lowering of the valve 10, thereby causing the latter to close earlier or later and therefore providing for changing the temperature setting for the heat chamber.

The ends of the strips at one side of the casing are loosely held by the bolt 22 which

passes through the sleeve 23 and is provided with the nut 24. The opposite ends of the strips 9 are free to move in accordance with the expansion and contraction due to variations of temperature and as shown the valve stem 11 passes through these movable ends of the strips. A washer 15 is provided under the head of the valve 10 which prevents a heated valve from contacting with the strips. Separating washers 15 are preferably provided between the strips themselves and between the strips and the end of the sleeve 12.

In Figs. 1 to 6 inclusive the strips 9 are arranged with the brass or greater expanding metal G of each strip facing toward the bottom of the casing, while the alloy faces H, are on the side toward the cover of the casing. Fig. 1 shows the thermostatic members in normal position with the valve 10 open. Fig. 2 shows the strips 9 in bowed or distorted position under expansion, due to heat with the valve 10 nearly closed, and in this position the free ends of the strips have moved away from the sleeve 12 to carry the valve toward its seat. Fig. 5 shows the strips 9 in the form they would assume under a temperature lower than normal, which would cause the strips to arch, as indicated.

In accordance with the form of the invention so far described, the thermostatic members 9 have one end secured within the casing by means of the bolt 22, the middle portion is supported by the adjustable stud 17, and the other ends are free to move as said members expand and contract with variations of temperature and the valve is actuated by the movable ends.

Figs. 7 and 8 show a device like that already described, except that the device is provided with a fuel chamber consisting of the conduit 6^a, a return bend 25, and a return conduit 26 passing through the casing, thus exposing a greater length of conduit to the heat of exhaust gases, thereby increasing the heating surface. Any suitable or desirable arrangement of the fuel chamber may be provided, exposing such surface to the exhaust gases as necessary, for the transmission of the heat to the fuel, and it may be cast integral with the casing.

In the operation of the device the thermostatic control is set to maintain a given predetermined temperature in the heat chamber, and as the operation of the engine varies, thereby varying the temperature and pressure of the exhaust gases, the thermostatic members 9 automatically raise the valve 10 immediately the temperature rises, and lower said valve 10 immediately the temperature falls below the temperature setting, thereby automatically controlling the quantity of exhaust gas admitted, according to the temperature in the heating chamber. As the quantity of such gas is extremely large, compared to the quantity of fuel being used by the engine, it is only necessary to provide proper heating surface to consistently raise the temperature of the fuel to a predetermined temperature with reference to the temperature of the heat chamber. Therefore the thermostatic control may be set either for a predetermined temperature of the heat chamber or a predetermined temperature of the fuel.

The fuel chamber I prefer in conduit form as it affords the maximum heating surface for the fuel contained.

The plurality of thermostatic members 9 are advantageous in providing material power for closing the valve 10 in cases where the exhaust pressures may be high.

The adjustment of the thermostatic control embodied in the stud 17 is not absolutely necessary, because in manufacture the correct setting of the thermostatic strips may be made for maintaining the predetermined temperature, or other forms of adjustment may be provided. However, this adjustment is very valuable for certain uses of the invention.

In Figs. 9 and 10 a modification of the device is shown in which only one sensitive thermostatic member or strip 9^b is shown in the casing D^2 having one end loosely supported within the casing by means of the bolt 27 having the washers 28, sleeve 29 and nut 30. The adjustable bolt 31 forms an inner support, as shown, for the strip 9^b, having the lock nuts 32 and the spring 33, the latter being interposed in a manner to hold the strip 9^b against the head of the bolt 31. It is evident the adjustable feature of this bolt 31 permits the temperature setting of the thermostatic member. The valve 10^b is carried at the other end of the strip 9^b in any suitable manner and as shown the valve stem 34 passes through an aperture in the strip and washers 35 are placed on each side of the strip. A pin 36 or other fastening device holds the stem 34 to the strip. Fig. 9 shows the strip 9^b under the influence of material heat with the valve 10^b nearly closed, and Fig. 10 shows the strip 9^b bowed or curved in its normal position. In accordance with this construction the alloy face H^2 of the strip is toward the valve, while the brass face G^2 or greater expanding portion is on the other side.

Fig. 11 illustrates a device similar to that shown in Fig. 9, except that the valve is omitted and the inlet port E^3 has a depending lip 37 forming a valve seat against which the strip 9^c itself abuts under the influence of heat to close the inlet port.

Fig. 12 illustrates a modification in which the inlet port E^4 has the depending lip 38 forming the valve seat, against which the tie

strip H^4 abuts due to the greater expansion of the strut strip G^4. In this case members H^4 and G^4 constitute the thermostat.

Obviously further modifications of the device could be devised without departing from the spirit of the invention.

I claim and desire to obtain by Letters Patent the following:

1. A device for heating liquid fuel, comprising a casing having inlet and outlet ports to permit the flow of a gaseous heating medium through the casing, a liquid fuel chamber in the casing, with inlet and outlet means, a thermostat located in said casing for the heating medium, and actuated by the heat of said medium for automatically regulating the flow of said medium and thereby maintaining the temperature of the liquid fuel between predetermined limits, and means securing said thermostat enabling a free end to effect the regulation of said flow of the heating medium.

2. A device for heating liquid fuel, comprising a casing having inlet and outlet ports to permit the flow of a gaseous heating medium through the casing, a liquid fuel chamber in the casing, with inlet and outlet means, a thermostat located in said casing for the heating medium, and actuated by the heat of said medium for automatically regulating the flow of said medium and thereby maintaining the temperature of the liquid fuel between predetermined limits, a valve for the inlet port of the casing, means securing said thermostat enabling a free end to actuate the said valve and effect the regulation of said flow of the heating medium, and supporting means for said valve affording provision for setting said casing at any angle or position whatsoever, without interfering with the automatic operation of the device.

3. A device for heating liquid fuel, comprising a casing having inlet and outlet ports to permit the flow of a gaseous heating medium through the casing, a liquid fuel chamber in the casing, with inlet and outlet means, a thermostatic member having one end secured within the casing and the other end free to move as said member bends with variations of temperature, and means actuated by said member for controlling said inlet port.

4. A device for heating liquid fuel, comprising a casing having inlet and outlet ports to permit the flow of a gaseous heating medium through the casing, a liquid fuel chamber in the casing with inlet and outlet means, a thermostatic member in the form of a strip adapted to bend with variations of temperature, one end of said strip being free to move, and means actuated by said free end for controlling the flow of the heating medium through the casing.

5. A device for heating liquid fuel, comprising a casing having inlet and outlet ports to permit the flow of a gaseous heating medium through the casing, a liquid fuel chamber in the casing with inlet and outlet means, a thermostatic member in the casing in the form of a strip composed of layers of metals having different coefficients of expansion, said strip being loosely secured within the casing at one end, free to move at the other end and supported between the ends, and a valve for the inlet port carried by the movable end of said strip.

6. A device for heating liquid fuel, comprising a casing having inlet and outlet ports to permit the flow of exhaust gases through the casing, a liquid fuel chamber in the casing, with inlet and outlet means, a plurality of thermostatic members in the form of strips, each composed of a plurality of different metals, said strips all being secured within the casing at one end and free to move at their other ends, and means actuated by the movable ends of said strips for controlling said inlet port.

7. A device for heating liquid fuel, comprising a casing having inlet and outlet ports to permit the flow of exhaust gases through the casing, a liquid fuel chamber in the casing with inlet and outlet means, a plurality of thermostatic strips capable of bending under variations of temperature, said strips all being loosely secured within the casing at one end and free to move at their other ends, means for supporting and guiding the strips intermediate their length, and means actuated by the free ends of said strips for controlling the flow of the heating medium through the casing.

8. A device for heating liquid fuel, comprising a casing having inlet and outlet ports to permit the flow of exhaust gases through the casing, a liquid fuel chamber in the casing with inlet and outlet means, a disk valve in the casing movable to and from the said inlet port, whereby the exhaust gases impinge directly upon the valve, and a thermostatic member in the casing connected to directly actuate the valve by an end, and composed of metals having different coefficients of expansion.

9. A device for heating liquid fuel, comprising a casing having inlet and outlet ports to permit the flow of a gaseous heating medium through the casing, a liquid fuel chamber in the casing, a plurality of thermostatic strips loosely secured at one end within the casing supported between the ends, and free to move to and from the inlet port at the other end, a disk valve for the inlet port, and a valve spindle loosely engaged by the movable ends of said strips, whereby the valve is actuated by the bending of the strips due to variations of temperature in said casing.

10. A device for heating liquid fuel, com-

prising a casing having inlet and outlet ports to permit the flow of a gaseous heating medium through the casing, a liquid fuel chamber in the casing, a plurality of thermostatic strips loosely secured at one end within the casing, supported by an adjustable stud between the ends, and free to move to and from the inlet port at the other end, a disk valve for the inlet port, and a valve spindle loosely engaged by the movable ends of said strips, whereby the valve is actuated by the bending of the strips due to variations of temperature in said casing, and a spring for the valve spindle outside the casing for maintaining the valve and thermostatic strips in position irrespective the angle of installation of the device.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

HENRY NEWTON WHITTELSEY.

Witnesses:
K. G. Le Ard,
A. C. Parham.