Dec. 2, 1930. E. R. GODWARD 1,783,536

AUXILIARY HEATER AND VAPORIZER

Filed March 22, 1929 2 Sheets-Sheet 1

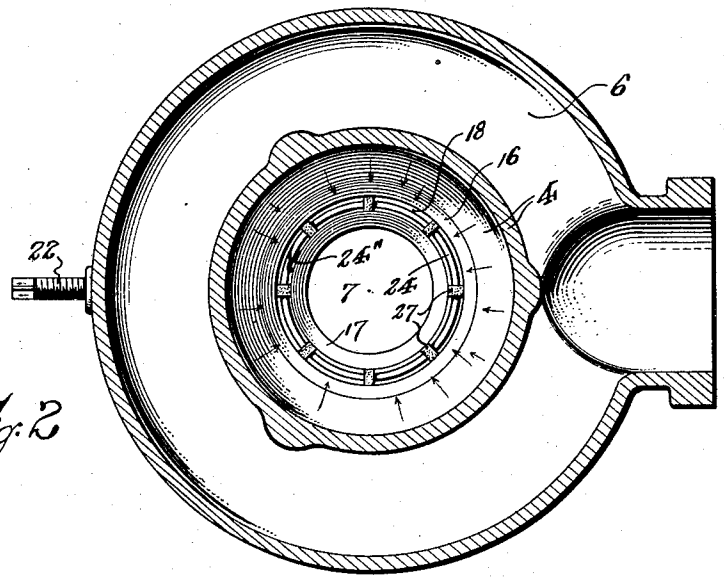



Fig. 2

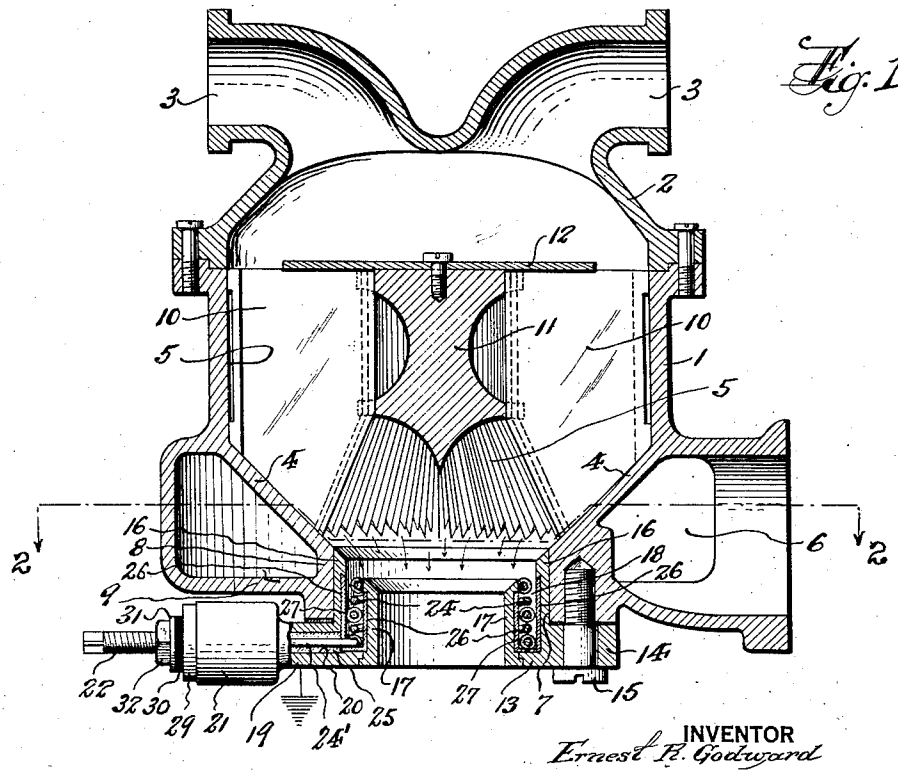



Fig. 1

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Fig. 3

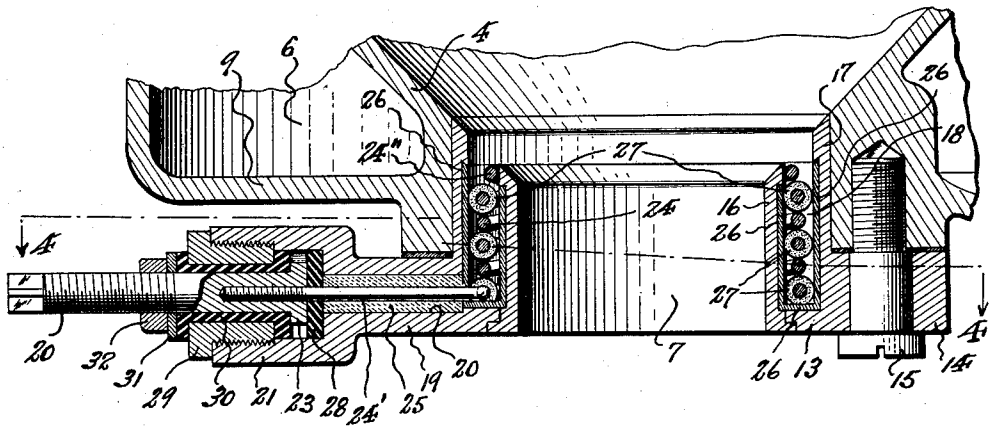
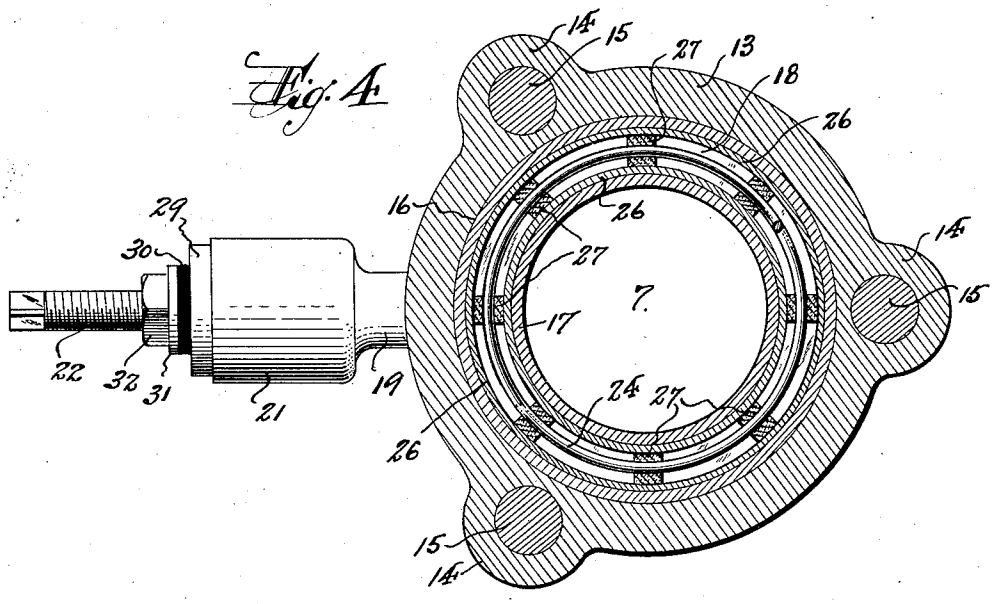



Fig. 4




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# UNITED STATES PATENT OFFICE

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## AUXILIARY HEATER AND VAPORIZER

Application filed March 22, 1929. Serial No. 349,234.

This invention relates to an improved electric heater attachment for treating wet fuel particles lagging and dropping from a fuel and air mixture stream moving through delivery means to internal combustion engine cylinders or the like; and the invention has reference to a novel electric heater attachment for general use in the fuel and air mixture delivery line between a carburetor and internal combustion engine cylinders, and for special use in connection with fuel mixture vaporizers such as disclosed in my prior United States Letters Patent No. 1,686,609, dated October 9th, 1928.

The invention has for its general object to provide a novel form and construction of combined catch-chamber and electric heater which may be arranged contiguous to a fuel mixture delivery passage, so as to catch and boil off wet fuel particles which drop out of the fuel mixture stream traversing said passage, thereby returning fuel in more or less vaporized form to the fuel mixture stream. Furthermore, the invention has for a more specific object to provide a combined catch-chamber and electric heater adapted to cooperate with a vaporizer of the kind shown in my aforesaid patent, to assist the operation of the same when starting from cold condition, especially, when utilizing fuel oil mixtures of lower grades than gasolene.

In the use of vaporizers of the kind shown in my aforesaid prior patent in connection with relatively heavy or low grade hydrocarbon fuel mixtures, full vaporizing efficiency is not attained when starting from cold condition, until, by a preliminary period of operation, the apparatus has become heated sufficiently to assure adequate transfer of heat to the surface providing plates in the vaporizer chamber. As a consequence before supplying heavy hydrocarbon fuel mixtures to the vaporizer, it is usually necessary to operate the same from initial cold condition with a relatively high grade or more volatile fuel mixture, such as carbureted gasoline, until such time as the heat derived from the engine exhaust has sufficiently raised the temperature of the apparatus and has assured transfer of heat for conduction to and through the surface providing plates adequate to be employed for continued running with the heavier or lower grade fuel. This necessity is objectionable both because it requires provision of two supplies of fuel, as well as means rendering it possible to switch from one kind of fuel to the other during operation. When the vaporizer is provided with the novel construction of electric heater attachment of this invention, cooperatively connected with the vaporizer apparatus in the manner and relation hereinafter described, I find that starting from cold condition with the relatively heavy fuel is satisfactorily accomplished.

Other objects of this invention, not at this time more particularly enumerated, will be clearly understood from the following detailed description of the same.

Illustrative embodiment of this invention is shown in the accompanying drawings, in which:—

Figure 1 is a vertical sectional view of a vaporizer equipped with the electric device of this invention; Figure 2 is a horizontal section, taken on line 2—2 in Figure 1; Figure 3 is an enlarged detail longitudinal section through the electric heater device; and Figure 4 is a horizontal section, taken on line 4—4 in Figure 3.

Similar characters of reference are employed in the above described views, to indicate corresponding parts.

Referring to the drawings, the reference character 1 indicates a casing or pot having an open upper end normally closed by a cover member 2 of suitable shape and provided with suitable discharge outlets 3 for the vaporized fuel mixture to be delivered to an internal combustion engine.

The interior of the casing or pot 1 is divided by an inverted conical bottom plate or partition 4 to provide above the same an upper vaporizing chamber 5 and a lower heater chamber 6. The fuel mixture intake 7, which leads centrally into the lower end of the vaporizing chamber 5, is formed by a centrally located throat member 8 which rises through the interior of the heater chamber 5 to extend intermediate the outer bottom

wall 9 of said casing or pot to the interior bottom plate or partition 4.

The casing or pot 1 is provided with means for introducing thereinto a heating medium, such, for example, as the exhaust gases from an internal combustion engine served by the vaporizer. The heating medium thus introduced into the heater chamber 6 transfers its heat to the bottom plate or partition 4 during normal operation of the vaporizer when an internal combustion engine, to which the latter is connected, is operating under normal conditions and is being served with a fuel mixture from the vaporizer.

Disposed within the vaporizing chamber 5 are a multiplicity of radially arranged upstanding plates 10, the lower ends of which are shaped to conform to and contact with said bottom plate or partition 4. Said plates are so spaced apart as to provide a multiplicity of radial and laterally extending passages opening at the lower portions of their inner ends into communication with said fuel mixture intake 7, and extending laterally and upwardly from the fuel mixture intake 7. These plates converge upon a central core or shank 11 with which the same are connected so as to be supported in operative relation one to the other. Connected with the upper end of said core or shank 11 is a top plate 12 of smaller dimensions than the inside dimensions of the vaporizing chamber 5, whereby the same closes the upper ends of the passages between the plate 10, except adjacent to the periphery of the said top plate which is spaced from the walls of the vaporizer chamber 5 so as to provide outlets at the upper outer ends of said passages.

The combined catch chamber and electric heater according to the principles of this invention, and which is adapted to receive unvaporized liquid fuel descending from the vaporizer chamber 5, and thereupon convert the same into a fume for return to the vaporizer chamber 5 with ingoing fuel mixture charges, comprises an annular cup member for insertion within the fuel mixture intake 7. This annular cup member consists in a base flange 13 having perforate ears 14 to register with threaded openings in the bottom wall 9 of the vaporizer whereby fastening screws 15 may be applied to secure the base flange to the bottom of the vaporizer and in registration with the intake 7 thereof. Connected with said base flange 13 so as to rise therefrom, and so as to fit telescopically into the vaporizer intake 7 is an outer annular wall 16. Also connected with said base flange 13 so as to rise therefrom, but inwardly spaced from said outer wall 16, is an inner annular wall 17. The spaced outer and inner walls 16 and 17 provide an annular cup or receiving chamber 18 contiguous to the sides of the intake 7 and having its upper end so disposed as to communicate with the sloping bottom plate or partition 4 of the vaporizing chamber 5 so as to receive wet fuel elements gravitating from said bottom plate or partition 4. Extending outwardly from said base flange 13 is a tubular extension or arm 19 having a passage 20 communicating with the lower end of said cup or receiving chamber 18. Formed at the exterior end of said extension or arm 19 is an enlarged packing-box member 21 having an internally threaded outer open end. Extending into said packing-box interior is a terminal electrode or binding post 22, having an enlarged portion or shoulder 23 at its inner end. Threaded into the inner end of said terminal electrode or binding post 22, or otherwise suitably secured thereto, is one end 24′ of an electrically conductive heater coil 24, the convolutions of which extend around and upwardly through said cup or receiving chamber 18. Said end 24′ extends through said tubular arm or extension 19 and is suitably insulated therefrom by the insulator sleeve 25. The interior walls of said cup or receiving chamber 18 are provided with a lining of insulating material 26, such as mica or other suitable material, to prevent any grounding contact of the convolutions of the heater coil with the metal of the cup or receiving chamber 18. The convolutions of the heater coil are spaced apart and maintained against contact one with another by spacer elements 27 made of some suitable electrically non-conductive material, said elements being short and spaced along the longitudinal extent of the heater coil so as to leave portions of the coil bare. The inner end 24″ of the heater coil is brought into contact and grounded on a bare metallic portion of the cup or receiving chamber 18, being preferably secured thereto by solder or by mechanical means as may be desirable. Arranged between the inner end of said terminal electrode or binding post 22 and the bottom of said packing-box cavity is an electrically non-conductive packing washer 28; also arranged around said terminal electrode or binding post 22 behind the shoulder 23 thereof, and between the same and a bushing or gland 29 threaded into said packing-box member 21 is electrically non-conductive packing material 30, a washer 31 and nut 32 being engaged on an exterior threaded end of said terminal electrode or binding post 22 to further engage and hold the insulating and packing material 30 in place. The arrangement of packing-box and the packing material and retaining elements associated therewith is provided to assure a fluid tight joint between the interior of the cup or receiving chamber 18 and the exteriorly projecting terminal electrode or binding post 22, while at the same time electrically insulating the latter from the metal of

the cup or receiving chamber and its base flange, so that no electric shorting or grounding of the heater coil can occur except at the inner end 24'' thereof. The exterior end of the terminal electrode or binding post may be suitably connected with a source of electrical energy for conduction through the heater coil, the circuit from the latter being completed through ground furnished by the metallic parts of the device, and the circuit may include either manually controlled or automatic circuit make and break devices as may be desired.

In the operation of the vaporizer, provided by the above described construction, a mixture of liquid fuel and air is delivered from a suitable carbureter device through the fuel mixture intake 7, whereupon said mixture is caused to pass through the passages intermediate the plates 10 to be there vaporized in accordance with the general method and process disclosed in my prior U. S. Patent 1,686,610, dated October 9th, 1928.

In the use of the vaporizer in connection with internal combustion engines and when functioning with low grade and heavy hydrocarbon fuel mixtures, owing to the relatively low volatility of such fuel, it has usually heretofore been necessary to start from cold condition with a more highly volatile fuel, such as gasolene, and then after operation of the engine has continued for a time, with attendant supply of hot exhaust gases to the heating chamber 6 so that a proper transfer of heat to the vaporizer plates 10 is obtained, the initial supply of gasolene fuel is discontinued and the use of the heavier grade of fuel is begun. For reasons already above mentioned, this practice is not altogether satisfactory, the desideratum being to provide means whereby starting with the heavy fuel may be facilitated without necessity of initially employing lighter or more volatile fuels. This desired result may be accomplished when the electric heater means of this invention is applied to the vaporizer in the manner and relation above described. In such case, when starting from cold condition, the supply circuit serving the electric heater coil is closed and the latter will then function to develop heat adapted to immediately warm the passages of the vaporizing chamber and the ingoing charges of carburetted fuel mixture. In the initial operation from cold conditions, the carbureter is usually choked so as to deliver from the carbureter a rich fuel mixture having a maximum of liquid fuel content. As this rich mixture enters the vaporizing chamber and passes through the passages thereof, a considerable deposit of wet fuel particles will accumulate on the surfaces of the plates 10. These wet fuel particles will gravitate on the plate surfaces, and such thereof as are not vaporized and returned to the fuel mixture streams will flow to the inclined bottom plate or partition 4, and will descend the latter so as to run into the cup or receiving chamber 18. The liquid fuel thus accumulating in the receiving chamber 18 will be thus brought into contact with the hot heater coil 24 and will, by the heating effect thereof, be boiled off so as to take the form of a fume or vapor which will rise out of the cup, and return to mingle with the ingoing fuel charges. In this manner the excess of wet fuel is readily vaporized under starting conditions and consequently there is immediately delivered to the engine cylinder a vaporized fuel mixture for combustion therein.

It will be obvious that the control of the electric current delivered to the heating coil 24 may be attained either manually or automatically; in the latter case by any suitable form of thermostatic control switch operative on the development of predetermined normal running heat conditions within the vaporizer, which latter arrangement is well within the ability of those skilled in the electrical arts to provide. It therefore follows that as the internal combustion engine warms up under the influence of the hot exhaust gases delivered from the engine cylinders, the normal operating temperature for the vaporizer will be soon attained, under which circumstances the current to the heater coil may be interrupted, and the vaporizer then allowed to operate in the normal manner without necessity for the use of the auxiliary heat provided by said heater coil.

While I have shown the heater coil with its annular cup or receiving chamber in operative relation to a vaporizer of the kind above described, it will be understood that the heater device so constituted is not limited to use in such combination, since it may also be used in combination with an intake manifold leading directly from an ordinary carbureter to the engine cylinders. In such use, the cup or receiving chamber of the heater element is aligned with the manifold passage and contiguous thereto so that any accumulations of wet fuel on the walls of this passage may descend so as to be caught in the cup or receiving chamber and thereupon vaporized by the heat of the heater coil for return to the fuel mixture streams passing through the manifold passage. In such use, the relation of the cup or receiving chamber to the manifold passage will be very similar to the relation of such cup or receiving chamber to the intake chamber of the vaporizer as above described.

I am aware that some changes may be made in the general construction and arrangement of the electric heater element per se, as well as in the details of the construction of the same without departing from the scope of the present invention. It is, therefore, to be understood that the specific disclosure of

this application is to be considered as illustrative and not in a limiting sense.

Having thus described my invention, I claim:—

1. In a vaporizer including a chamber having a fuel mixture intake opening and means to provide within said chamber a plurality of fuel mixture passages bounded by vertical walls, a downwardly sloping bottom plate engaging the lower ends of said walls, said bottom plate converging on said intake opening, means for supplying heat under normal running conditions to said bottom plate for transfer to and upward conduction through said walls and the passages bounded thereby, and an annular catch-chamber contiguous to the sides of said intake opening and having its upper open end aligned with said sloping bottom plate, an electric heater coil within said catch-chamber, means for insulating the convolutions of said coil from each other and from the walls of said catch-chamber, and means for connecting said heater coil in an electric circuit.

2. In a vaporizer including a chamber having a fuel mixture intake opening and means to provide within said chamber a plurality of fuel mixture passages bounded by vertical walls, a downwardly sloping bottom plate engaging the lower ends of said walls, said bottom plate converging on said intake opening, means for supplying heat under normal running conditions to said bottom plate for transfer to and upward conduction through said walls and the passages bounded thereby, an annular catch-chamber contiguous to the sides of said intake opening and having its upper open end aligned with said sloping bottom plate, an electric heater coil within said catch chamber, means for insulating the convolutions of said coil from each other and from the walls of said catch-chamber, an exteriorly disposed terminal for connecting said heater coil in an electric circuit, and a packing-box means for both insulating said exteriorly projecting terminal and forming a fluid tight joint about the same.

3. A combined catch-chamber and heater coil for disposition contiguous to the walls of a fuel mixture passage serving to deliver a carbureted fuel to a place of use, comprising an upwardly open annular cup aligned with the passage walls, to catch wet fuel gravitating on said walls, an electric heater coil within said cup, means for insulating the convolutions of said coil from each other and from the walls of said catch chamber, and means to connect said heater coil in an electric circuit.

4. A combined catch-chamber and heater coil for disposition contiguous to the walls of a fuel mixture passage serving to deliver a carbureted fuel to a place of use, comprising an upwardly open annular cup aligned with the passage walls to catch wet fuel gravitating on said walls, an electric heater coil within said cup having one terminal in electrically grounded connection therewith, means for insulating the convolutions of said coil from each other and from the walls of said cup, an insulated exteriorly projected terminal connected with said heater coil for connecting the latter in an electric circuit, and a packing-box means to form a fluid tight joint around said exteriorly projected terminal.

In testimony, that I claim the invention set forth above I have hereunto set my hand this 13th day of March, 1929.

ERNEST R. GODWARD.