Oct. 30, 1923. 1,472,264

M. BECK

FUEL VAPORIZER FOR EXPLOSIVE ENGINES

Filed Feb. 5, 1920 2 Sheets-Sheet 1

Fig. 1

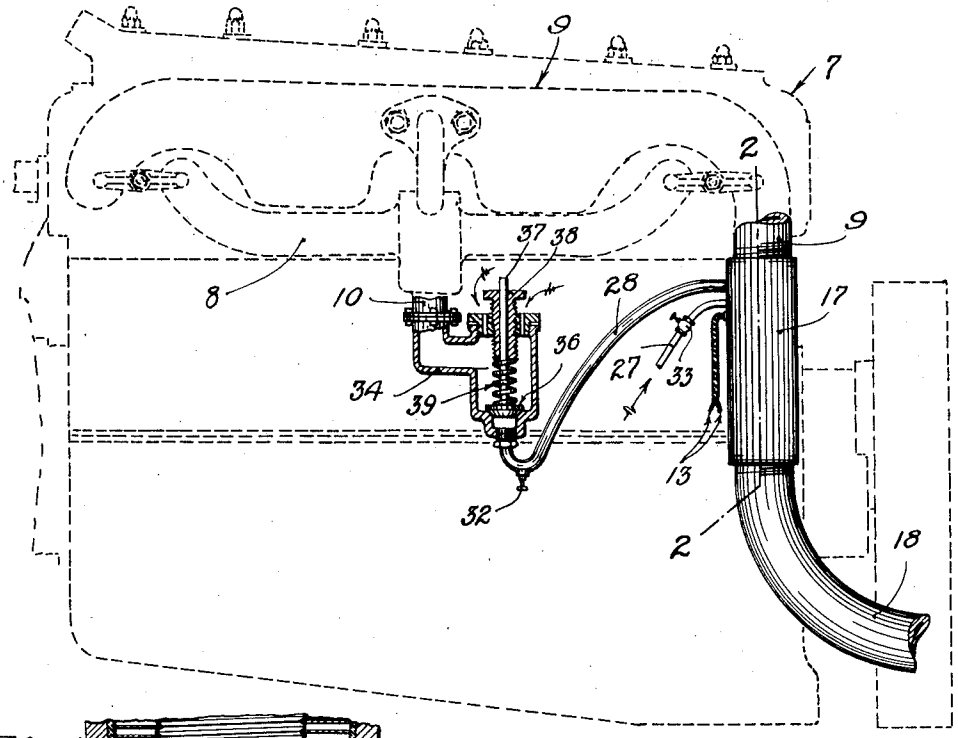


Fig. 5

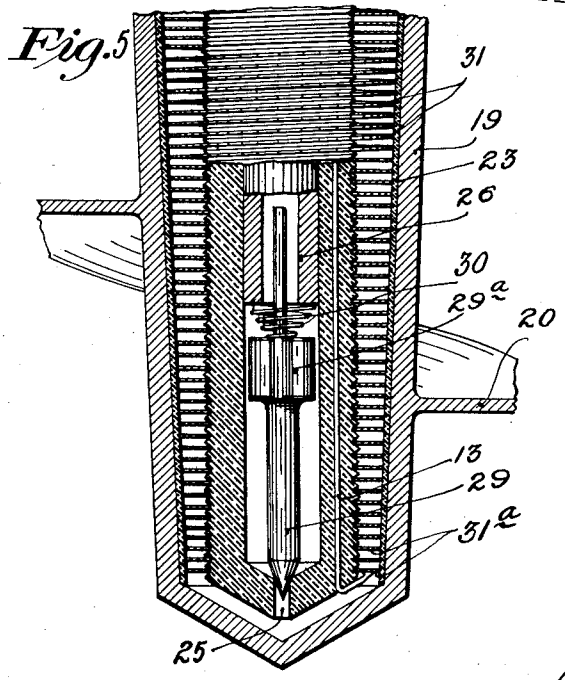
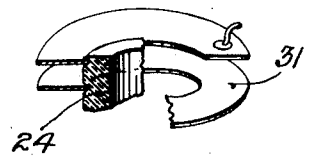


Fig. 6



Inventor
Michael Beck
By his Attorneys
Williamson & Merchant

Oct. 30, 1923. 1,472,264

M. BECK

FUEL VAPORIZER FOR EXPLOSIVE ENGINES

Filed Feb. 5, 1920 2 Sheets-Sheet 2

Fig. 2

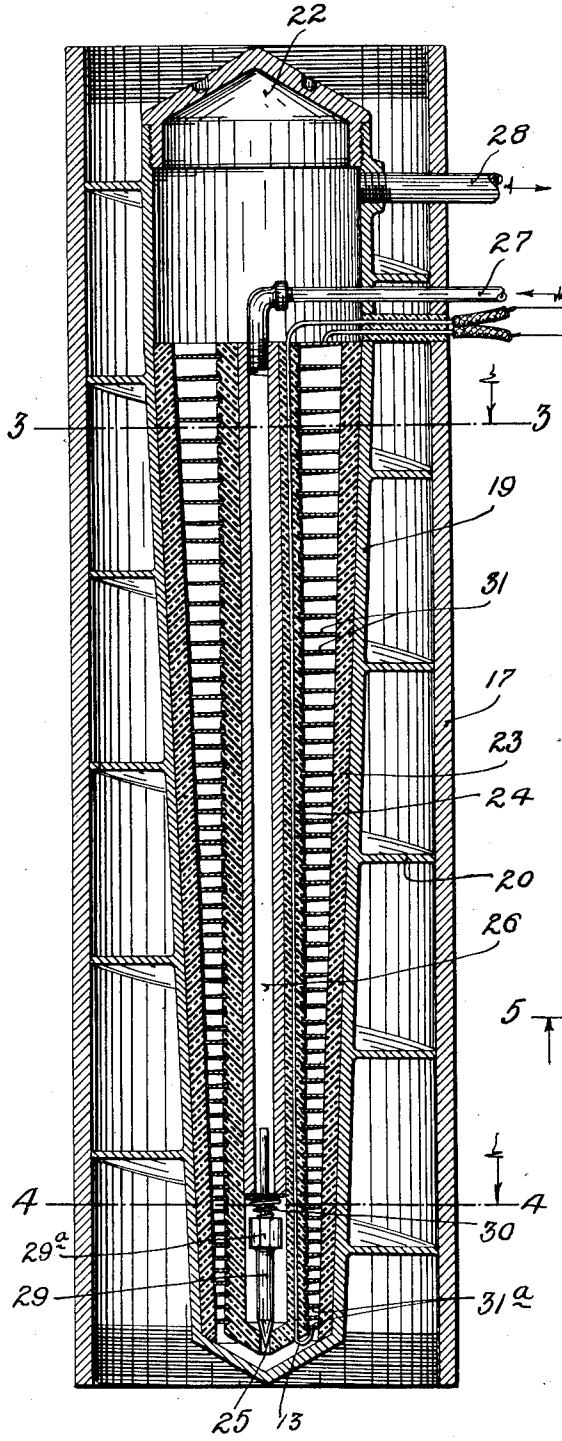


Fig. 3

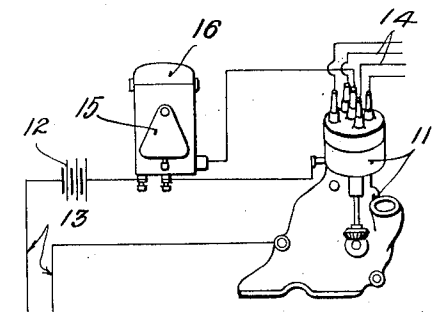
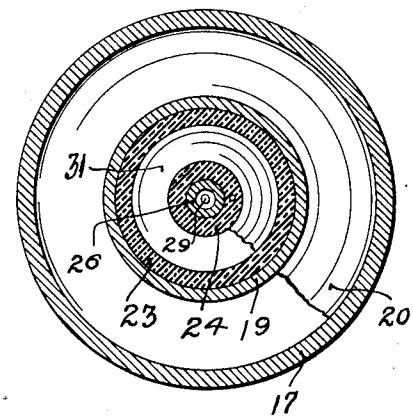
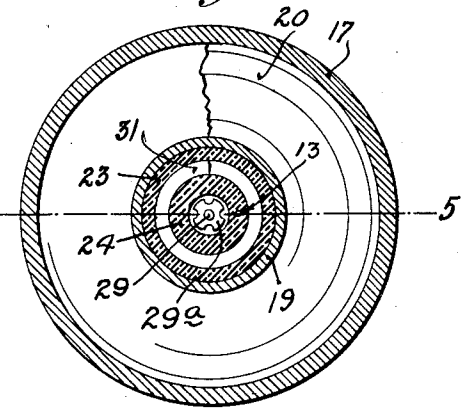


Fig. 4





Inventor
Michael Beck
By his Attorneys
Williamson Merchant

Patented Oct. 30, 1923. 1,472,264

UNITED STATES PATENT OFFICE.

MICHAEL BECK, OF MINNEAPOLIS, MINNESOTA.

FUEL VAPORIZER FOR EXPLOSIVE ENGINES.

Application filed February 5, 1920. Serial No. 356,384.

To all whom it may concern:

Be it known that I, MICHAEL BECK, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Fuel Vaporizers for Explosive Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My present invention relates to internal combustion or explosive engines and has for its object to provide an improved fuel vaporizer therefor, whereby the heavier hydrocarbon, such as kerosene, may be efficiently used, both in starting and in running the engine.

In a broad sense, the present invention is in the nature of a modification or refinement of the fuel heater for explosive engines disclosed and claimed in Letters Patent of the United States, 1,214,501, granted to M. and N. B. Beck, of date, February 6th, 1917.

In the fuel vaporizer of the present invention, there is not only a novel relative arrangement of vapor and exhaust passages, but there is incorporated therein, also, an electric heater for generating and heating the vapor, and this heater, as a further and important novel feature, is connected in the ignition circuit, so that it will be brought into action when the ignition circuit is closed and will be cut out of action when the ignition circuit is open.

As a further and important novel feature, the fuel supply conduit to or in the vaporizer is provided with a normally closed valve adapted to be magnetically opened and the heating element is utilized as a solenoid for opening the said valve when the ignition circuit is closed and for permitting said valve to close when the ignition circuit is open.

In the accompanying drawings which illustrate the invention, like characters indicate like parts throughout the several views.

Referring to the drawings:

Fig. 1 is a view partly in side elevation, partly in vertical section and partly in dotted diagram showing the manner in which my improved vaporizer is adapted to be connected to an explosive engine;

Fig. 2 is a vertical section on the line 2—2 of Fig. 1, showing the vaporizer proper in vertical section, and also indicating diagrammatically, the manner in which its heating element is connected in the ignition circuit of the engine;

Fig. 3 is a horizontal section taken on the line 3—3 of Fig. 2;

Fig. 4 is a horizontal section taken on the line 4—4 of Fig. 2;

Fig. 5 is a fragmentary section taken approximately on the line 5—5 of Fig. 4; and

Fig. 6 is a fragmentary perspective showing a portion of the coiled heating element and a fragment of the insulating core around which it is wound.

Of the parts of the engine illustrated, the numeral 7 indicates a cylinder casting, the numeral 8 the intake manifold, the numeral 9 the exhaust manifold and the numeral 10 the vapor intake tube of said intake manifold.

Of the parts of the ignition system, the numeral 11 indicates the timer, the numeral 12 the battery or source of electrical energy, the numeral 13 the primary leads, the numeral 14 the secondary wires, the numeral 15 the switch in one of the primary leads 13, and the numeral 16 the coil box.

The vaporizer proper has a cylindrical outer shell 17, the upper end of which is connected to the exhaust manifold 9, and the lower end of which is connected to an exhaust pipe 18.

Located within the outer shell 17 is an inner metallic shell 19 that is spaced from said outer shell, but is provided with outstanding spiral flanges 20 that contact with the interior of said outer shell. The inner shell 19, as shown, has an integral lower head and its upper end is closed by a detachable head 22 shown as screw-threaded therein. To increase the cross section of the annular exhaust space between the outer shell 17 and inner shell 19, and also for another important purpose which will presently appear, the inward shell 19 is downwardly tapered.

All but the uppermost portion of the inner shell 19 is lined with a tapered tubular shell 23 of porcelain or other material that is a good electrical insulator.

Located within the insulating shell 23, concentric therewith, but spaced therefrom is a straight or non-tapered tube 24 of porcelain or other material that is an electrical insulator. The tube 24 is closed at its lower end, except for a fuel delivery port 25 which,

when opened, delivers the fluid fuel directly into the bottom of the inner shell 19. The tube 24 is supported in the position stated by means which will presently be noted.

Inserted into the insulating tube 24 and extending nearly to the bottom thereof is a metal fuel delivery pipe 26 which, at its upper end, is connected to a fuel supply pipe 27 that extends outward through one side of the vaporizer and is connected to a suitable source of supply, such as an elevated supply tank.

The vapor chamber formed in the upper end of the inner tube 19 is connected to one end of a vapor delivery pipe 28 that also extends out through one side of the vaporizer.

The port 25, in the lower end of the tube 24 is normally closed by a needle-pointed valve 29, the reduced stem of which, as shown, projects upward into the lower end of the pipe 26, but does not closely fit the same. A light coiled spring 30, compressed between the lower end of the pipe 26 and the shouldered head 29^a of the valve 29 assists in holding the valve 29 normally in a port closing position.

The novel electrical heating element is in the form of a flat thin sheet metal spiral blade 31 that fits the conical annular or tapered space between the insulating shell 23 and insulating tube 24, and, preferably, is engaged with a spiral thread formed in the exterior of the latter. By reference, particularly, to Fig. 2, it will be noted that the spiral blade 31 has convolutions that increase in horizontal width, progressively, from the lower to the upper portion thereof, so that the said spiral element will have the greatest electrical resistance at its lower portion, and progressively decreasing electrical resistance toward its upper portion. This is important because, under the action of an electrical current passed therethrough, the heating element may be hottest at its lowest portion, or otherwise stated, will be made progressively hotter and hotter from its upper to its lower extremity. In fact, the small cross section of this spiral heating element will cause the same to be so highly heated that it may be advisable to make the last two or three convolutions 31^a, of said element, of platinum which will stand white heat without damage. The said spiral element 19 will be very thin, to wit, only about the thickness of ordinary paper, so that it will act as a resistance coil for the ignition circuit. The main body portion of said heating element will preferably be of any of the well known alloys, such as used for making heating elements in electrical heaters and which alloy has a high electrical resistance necessary to the heating thereof by the electric current.

Attention is here called to the fact that the spiral heating element 31 will also act as a solenoid, which, when energized, will magnetically lift the valve 29 and cause the same to open the fuel port 25, said valve 29, or some part thereof, must, of course, be made of steel, iron, or other magnetic metal.

It is also important to note that in the preferred arrangement illustrated, the convolutions of the spiral element 31 are given increasing spread or pitch, progressively, from its lower toward its upper end. This, together with the increasing horizontal width of the spiral forms a gas or vapor passage that has progressively increasing cross section and conducting capacity from its lower toward its upper extremity, and, as an important feature, as will presently be noted.

The primary lead wires 13 of the ignition system are connected, one to the upper extremity of the spiral heating element 31 and the other to the lower extremity of said heating element 31, the said latter noted lead 13, as shown in Fig. 2, being brought down through and embedded in the inner insulating tube 24.

The vapor outlet pipe 28 is provided with a suitable valve 32 for controlling the flow of vapor therethrough, and the fuel supply pipe 27 is provided with a suitable valve 33 for controlling the supply of fluid fuel through the vaporizer.

The said pipe 28 is connected to the bottom of a casing 34 that is directly connected to the intake tube 10 of the intake manifold 8 of the engine. This casing 34 is provided with air intake ports and has an inwardly opening check valve 36 that normally closes the intake from the vapor delivery tube 28. As shown, this valve 36 has a stem 37 that works through a sleeve 38 adjustably screw-threaded through the top of the casing 34. The numeral 39 indicates a light coiled spring surrounding the stem 37 and compressed between the valve 36 and the sleeve 38. By adjustments of the sleeve 38, the tension of the spring 39 on valve 36 may be varied, so as to vary the amount of vapor in proportion to air, that will be drawn into casing 34. The said casing 34 and parts just described constitute an air supplying device for reducing the richness of the hydrocarbon vapor the proper extent to produce an explosive hydrocarbon vapor of the desired richness for delivery into the engine.

Operation.

The operation of the device described, briefly summarized, is substantially as follows:

Under the suction produced when the engine is in action, partial vacuum will be maintained in the top of the inner shell 19, so that a suction will be produced in the spiral vapor conduit formed between the

convolutions of the spiral blade 31, and this suction will draw upward the hydrocarbon liquid or vapor, providing, of course, that valve 29 is raised so as to open port 25. This valve will thus be raised when the switch 15 is set to close the ignition circuit; and the instant that this ignition circuit is closed, the spiral blade or heating element 31 will be made hot, and, as already indicated, especially hot at its lower portion where the hydrocarbon fuel first comes into contact therewith, so that such fuel or oil will be almost instantly generated into a vapor. This vapor will be drawn upward through the spiral channel and permitted to continuously expand while all the time being subject to heat from the spiral blade. As the gas is permitted to progressively expand, it will absorb more and more heat, so that it will be delivered to the top of the inner shell 19 at quite high temperature, but, of course, not at such high temperature as to cause the same to ignite. All the while that the vapor is moving upward through the said spiral conduit or channel, it will also be subjected to heat radiated from the exhaust from the engine, which latter is caused to take a spiral travel between the spiral radiating blade or flange 20.

This vaporizer is, therefore, adapted to generate hydrocarbon vapors from kerosene, or even from the heavier hydro-carbon liquid, and to produce an initial vapor for starting the engine, as well as for running the same after it has been started.

What I claim is:

1. A fuel vaporizer for explosive engines comprising a casing having an exhaust gas conduit and a vaporizing chamber, a fuel delivery pipe having a port opening into said vaporizing chamber, a valve normally closing said port, and electro-magnetic means for moving said valve into a port opening position, said electromagnetic means comprising a helical heating plate.

2. A fuel vaporizer for explosive engines comprising a casing having an exhaust gas conduit and a vaporizing chamber, a fuel delivery pipe having a port opening into said vaporizing chamber, a valve normally closing said port, and a magnet operative when energized, to move said valve into a port opening position, in combination with the ignition system of the engine, the said magnet being connected in the circuits therewith so that said valve will be held in a port opening position when the ignition circuit is closed, said magnet comprising a helical plate forming a fuel conduit.

3. A fuel vaporizer for explosive engines comprising a casing having an exhaust gas conduit and a vaporizing chamber and an electric heating element in said vaporizing chamber, in combination with the ignition system of the engine, said heating element being connected in the ignition circuits so that the said heating element will be made hot when the ignition circuit is closed, said heating element comprising a thin helical plate.

4. A fuel vaporizer for explosive engines comprising a casing having an exhaust gas conduit and a vaporizing chamber and an electric heating element in said vaporizing chamber, in combination with the ignition system of the engine, said heating element being connected in the ignition circuits so that the said heating element will be made hot when the ignition circuit is closed, the said heating element being of spiral form and affording also a spiral vapor conduit.

5. A fuel vaporizer for explosive engines comprising a casing having an exhaust gas conduit and a vaporizing chamber and an electric heating element in said vaporizing chamber, in combination with the ignition system of the engine, said heating element being connected in the ignition circuits so that the said heating element will be made hot when the ignition circuit is closed, the said heating element being of spiral form and affording also a spiral vapor conduit, and the convolutions of said spiral heating element having progressively increased width and progressively increased pitch in an upward direction.

6. A vaporizer for explosive engines comprising a casing interposed in the exhaust pipe of an engine and having an exhaust gas passage and a spiral vaporizing passage, the convolutions of which latter have progressively increasing width and progressively increasing pitch in the direction of the passage of fuel therethrough.

7. A fuel vaporizer for explosive engines comprising a casing having an exhaust gas conduit and a vaporizing chamber and an electric heating element in said vaporizing chamber, in combination with the ignition system of the engine, said heating element being connected in the ignition circuits so that the said heating element will be made hot when the ignition circuit is closed, and said gas conduit surrounding said vaporizing chamber and having means for connection to the exhaust manifold of the engine and having spiral ribs connected to said vaporizing chamber.

8. A fuel vaporizer for explosive engines comprising inner and outer metal shells spaced to afford an exhaust passage, of a tapered lining tube of insulating material fitting the interior of said inner metal shell, a tube of insulating material extended through said lining tube concentric therewith and having at its lower end a port opening into the lower end of said inner metal shell, a fuel supply pipe leading through said inner insulating tube to the port thereof, and a thin sheet metal spiral

of progressively increasing width wound in the space between said lining tube and central insulating tube and affording a spiral vaporizing passage of the progressively increasing cross section, said inner metal shell having a vapor delivery pipe extended from its upper portion.

9. A fuel vaporizer for explosive engines comprising inner and outer metal shells spaced to afford an exhaust passage, of a tapered lining tube of insulating material fitting the interior of said inner metal shell, a tube of insulating material extended through said lining tube concentric therewith and having at its lower end a port opening into the lower end of said inner metal shell, a fuel supply pipe leading through said inner insulating tube to the port thereof, and a thin sheet metal spiral of progressively increasing width wound in the space between said lining tube and central insulating tube and affording a spiral vaporizing passage of the progressively increasing cross section, said inner metal shell having a vapor delivery pipe extended from its upper portion, a valve in the lower portion of said inner insulating tube normally closing the fuel port thereof, and an electric circuit including the said metal spiral whereby the latter is insulated as a heating element and has a solenoid to move said valve into a port opening position.

10. A fuel vaporizing device for an internal combustion engine comprising a helical plate of metal constituting an electrical conductor, a casing at each side of said plate forming a helical passage for the fuel, said plate also being constructed and arranged to form a fuel controlling solenoid.

11. A fuel vaporizer for explosive engines comprising an elongated vaporizing chamber, a fuel delivery pipe extending longitudinally of said chamber having a port at one end opening into said vaporizing chamber, a valve controlling said port, a solenoid for said vaporizing chamber adapted to control said valve, a heating chamber surrounding said vaporizing chamber and connected to the exhaust of the engine at its end remote from the end of said vaporizing chamber having said port therein.

12. The structure set forth in claim 11, said port and valve extending axially of said fuel delivery pipe.

13. The structure set forth in claim 11, said vaporizing chamber being tapered toward one end and said solenoid comprising a helical plate forming a helical passage through said chamber.

14. The structure set forth in claim 13, the pitch of the convolutions of said helical plate increasing toward the large end of said vaporizing chamber.

15. A fuel vaporizer for explosive engines comprising an elongated frusto-conical vaporizing chamber, a fuel delivery pipe extending axially of said chamber having an axial port at one end opening into said vaporizing chamber, a valve disposed axially of said pipe for controlling said port, a solenoid extending about said pipe and in said vaporizing chamber throughout the length thereof for controlling said valve, said solenoid constituting a heating element, and a heating chamber surrounding said vaporizing chamber and having a connection to the exhaust manifold of the engine at is end which is adjacent the end of the vaporizing chamber remote from said port and valve.

In testimony whereof I affix my signature in presence of two witnesses.

MICHAEL BECK.

Witnesses:
BERNICE G. BAUMANN,
HARRY D. KILGORE.