N. D. BELINSKI.

ELECTRICAL VAPORIZER AND BURNER.

APPLICATION FILED MAY 14, 1919.

1,375,646.

Patented Apr. 19, 1921.

3 SHEETS—SHEET 1.

Fig. 1.

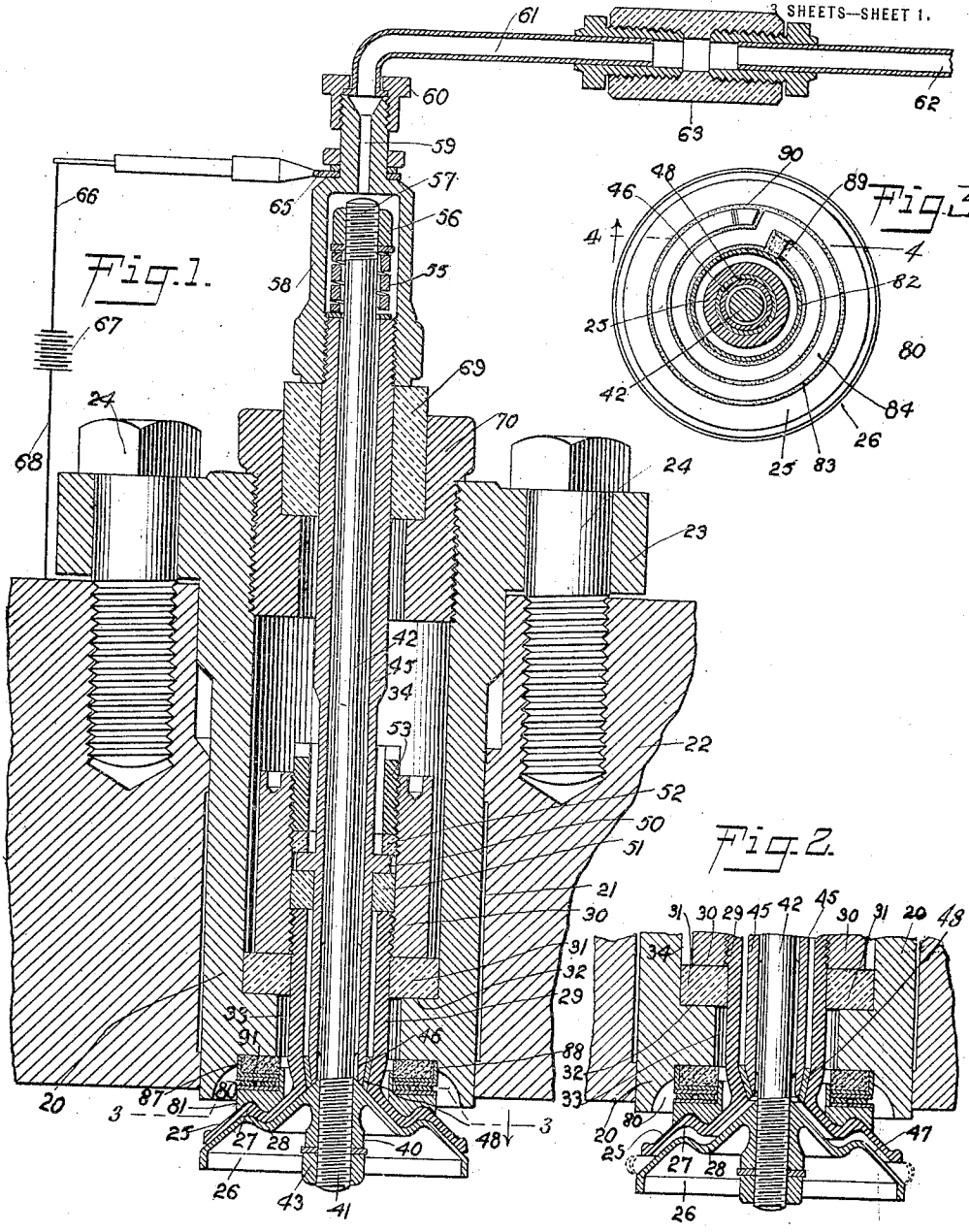
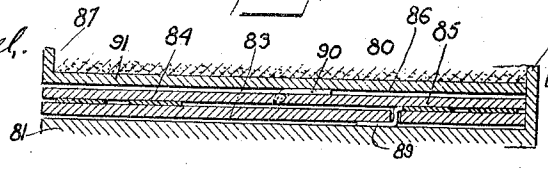


Fig. 3.

Fig. 2.

Fig. 4.



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3 SHEETS—SHEET 2.

Fig. 5.

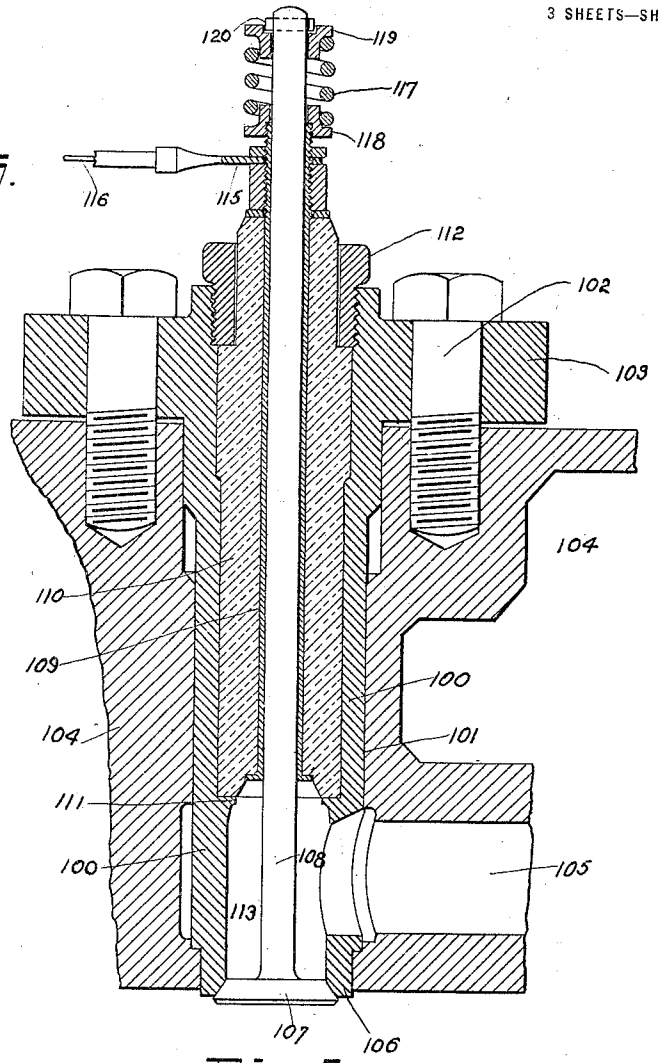
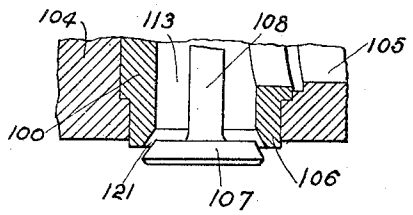


Fig. 6.



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3 SHEETS—SHEET 3.

Fig. 7.

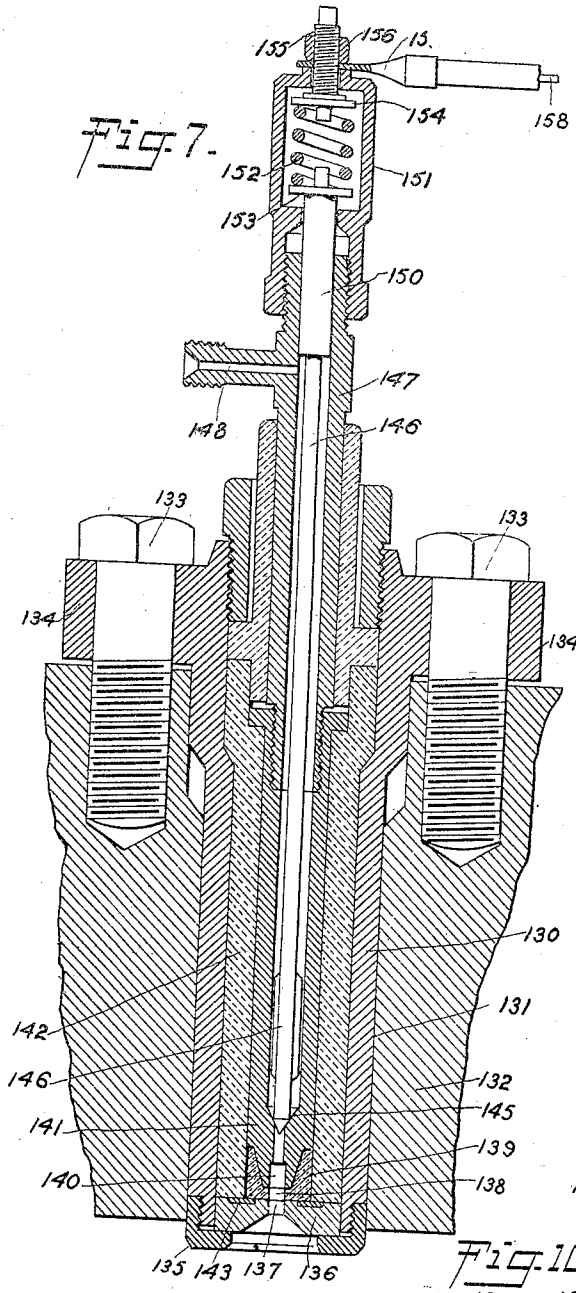


Fig. 9.

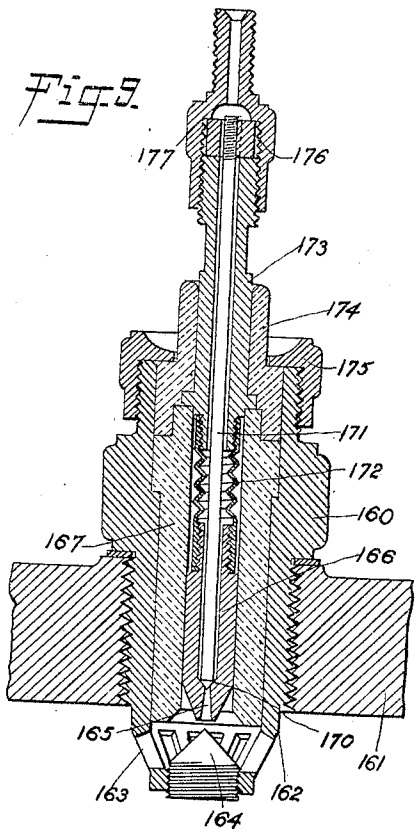


Fig. 8.

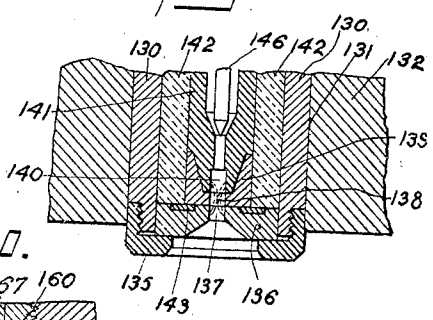
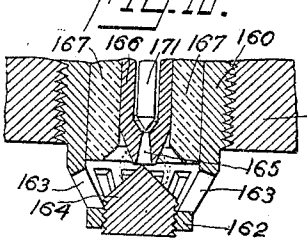


Fig. 10.



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NICHOLAS D. BELINSKI, OF NEW YORK, N. Y.

ELECTRICAL VAPORIZER AND BURNER.

1,375,646. Specification of Letters Patent. **Patented Apr. 19, 1921.**

Application filed May 14, 1919. Serial No. 297,051.

To all whom it may concern:

Be it known that I, NICHOLAS D. BELINSKI, a citizen of Poland, and formerly a resident of Warsaw, Poland, at present residing in the city of New York, borough of Manhattan, in the county and State of New York, have invented a new and Improved Electrical Vaporizer and Burner, of which the following is a full, clear, and exact description.

The invention relates to internal combustion engines, and its object is to provide a new and improved electrical vaporizer and burner arranged to convert liquid fuel into a superheated burning vapor at the time of its passage into the working chamber of an engine cylinder. Another object is to render the engine self-starting.

With these and other objects in view, the invention consists of certain novel features of construction, as hereinafter shown and described and then specifically pointed out in the claims.

A practical embodiment of the invention is represented in the accompanying drawings forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a sectional side elevation of the improved vaporizer and burner as applied to the cylinder of an internal combustion engine;

Fig. 2 is a similar view of the lower portion of the electrical vaporizer and burner with parts in a different position;

Fig. 3 is a sectional plan view of the electrical heater, the section being on the line 3—3 of Fig. 1;

Fig. 4 is an enlarged sectional side elevation of the same, the section being on the line 4—4 of Fig. 3;

Fig. 5 is a sectional side elevation of a modified form of the improved vaporizer and burner as applied;

Fig. 6 is a similar view of the lower portion of the same with the combined electrode and valve in open position;

Fig. 7 is a sectional side elevation of another modified form of the electrical vaporizer and burner;

Fig. 8 is a sectional side elevation of the lower portion of the same with parts in different position;

Fig. 9 is a sectional side elevation of another modified form of the improved electrical vaporizer and burner; and

Fig. 10 is a sectional side elevation of the lower portion of the same with the parts in a different position.

The cylindrical body 20 of the electrical vaporizer and burner fits into an opening 21 formed in the wall or head 22 of the cylinder of an internal combustion engine, and the outer end of the said body is provided with a flange 23 engaged by bolts 24 screwing into the wall or head 22 to securely fasten the valve body 20 in position on the cylinder. A combined electrode and valve seat 25 is arranged centrally below the lower end of the valve body 20 and on it is normally seated a combined electrode and valve 26. The electrode and valve seat 25 and the electrode and valve 26 are preferably made conical with corrugated portions 27 and 28 intermediate the apex and base ends, as plainly indicated in Figs. 1 and 2. The apex end of the combined electrode and valve seat 25 is provided with a tubular stem 29 screwing into a collar 30 seated on a ring 31 of an insulating material and resting on a shoulder 32 formed by concentric bores 33 and 34 arranged in the body 20. The central portion 40 of the combined electrode and valve 26 is attached to the lower threaded end 41 of a valve stem 42 by the use of a nut 43 screwing on the threaded end 41. The valve stem 42 extends centrally through a guiding tube 45, the lower end 46 of which terminates on the apex end of the combined electrode and valve 26. When the combined electrode and valve 26 moves into an open position, as shown in Fig. 2, then a combined passage and spark gap 47 is formed between the combined electrode and valve seat 25 and the combined electrode and valve 26. The lower end 46 of the tube 45 is held spaced from the stem 29 by an insulating washer 48. The tube 45 is provided with a ring collar 50 seated on a ring 51 resting on top of the stem 29 and the collar 50 is engaged by a ring nut 52 of insulating material and held in the upper portion of the collar 30. The sleeve nut 53 screws in the collar 30 to hold the ring nut 52 securely in place thus fastening the tube 45 in position. It is understood that the stem 42 is somewhat smaller in diameter than the interior diam-

eter of the tube 45 to provide a passage from the liquid fuel to be fed under pressure to the upper end of the combined electrode and valve 26 to move the latter downward by the liquid fuel into the open position shown in Fig. 2 to provide the combined passage and spark gap 47 previously mentioned.

On the upper end of the tube 45 is seated a spring 55 bearing with its upper end against a nut 56 screwing on the upper threaded end 57 of the stem 42 whereby the spring 55 normally holds the combined electrode and valve 26 in contact with the combined electrode and valve seat 25. On the upper threaded end of the tube 45 screws a cap 58 inclosing the spring 55, and the upper end of the cap 58 is provided with a nipple 59 connected by a coupling nut 60 with a section 61 of the feed pipe 62 connected with a pump or other suitable source of liquid fuel supply. The feed pipe section 61 is connected with the feed pipe 62 by a coupling 63 of insulating material. The nipple 59 of the cap 58 is connected with a contact 65 of an electrical circuit wire 66 connected with a suitable source of electrical energy 67 electrically connected by a wire 68 with the cylinder wall or head 22 and hence with the body 20. The cap 58 rests on a collar 69 of an insulating material held on a plug 70 screwing into the upper end of the bore 34 of the body 20.

Between the lower end of the body 20 and the combined electrode and valve seat 25 is arranged an electrical heater 80 for heating the combined electrode and valve seat 25, and by contact with the latter the combined electrode and valve 26, to convert the liquid fuel into a highly heated vapor which on passing through the combined passage and spark gap 47 is ignited by the spark between the lower ends of the said combined electrode and valve seat 25 and the combined electrode and valve 26. The electrical heater 80 is preferably constructed as follows: On the corrugated portion 27 of the combined electrode and valve seat 25 is seated a copper ring 81 provided at its inner edge with an upwardly extending flange 82. On the top of the ring 81 is placed a ring 83 of mica or other similar material, on which is arranged a spirally shaped heating member 84, preferably of platinum, and on which is superimposed another ring 85 of mica or other insulating material, and on top of the ring 85 is arranged a ring 86 provided with an upwardly extending flange 87 fitting into a recess 88 arranged on the under side of the body 20. One end 89 of the heating member 84 is in contact with the copper ring 81, and the other end 90 of the said heating member 84 is in contact with the metallic ring 86 thus establishing an electrical connection between the body 20 and the combined electrode and valve seat 26 and with the heating member 84 forming part of the connection. A non-heat conducting material 91 is arranged on the ring 86 to provide a heat insulation between the body 20 and the heating element 84.

The operation is as follows:

Normally the combined electrode and valve 26 is held in contact with the combined electrode and valve seat 25 by the action of the spring 55 pressing upward on the stem 42 of the combined electrode and valve 26. When the parts are in this normal position the electrical circuit is closed and hence the electrical heater 80 heats the combined electrode and valve seat 25 and the combined electrode and valve 26. When a liquid fuel is forced through the feed pipe 62 into the cap 58 and down through the tube 45 against the apex end of the combined electrode and valve 26 then the latter is moved downward by the force of the fluid and consequently the combined electrode and valve 26 moves into open position to allow the fluid to pass into the passage 47 to be highly heated and consequently converted into a vapor which on leaving the passage 47 is ignited by the spark at the lower end of the combined electrode and valve seat 25 and the combined electrode and valve 26. Thus the vapor is ignited on its entrance into the working chamber of the engine cylinder to actuate the piston therein and thus start the engine. The heat developed in the working chamber by the burning fuel heats the combined electrode and valve seat 25 and the combined electrode and valve 26 thus requiring a comparatively little heat from the heater 80 for converting the liquid fuel into a highly heated vapor.

It will be noticed that when the combined electrode and valve moves into open position, a passage is provided which gradually increases in size from the inlet end to the base or outlet end and hence the generated heated vapor readily expands and passes as a conical sheet of flame into the working chamber of the cylinder.

It will further be noticed that by the conical members 25 and 26 acting as a vaporizer, the burning fuel in the working chamber of the cylinder is properly distributed. Thus the device may be used as a substitute for the sprayer or atomizer used in the Diesel type of internal combustion engine. In the case when the fuel feeding the engine is in the form of gas, or any other combustible mixture, for example, compressed air carrying atomized crude oil, then heating and vaporizing the fuel is dispensed with and the cones may be made small and the passage for the fluid wider.

In the modified form shown in Figs. 5 and 6, the body 100 is held in a bore 101 by bolts 102 engaging a flange 103 and

screwing in the cylinder head 104 of the engine cylinder. The cylinder head 104 is provided with a gas inlet 105 connected with a suitable source of gas supply. The lower end of the body 100 is formed into a conical combined electrode and valve seat 106 on which is normally seated a combined electrode and valve 107 provided with a stem 108 extending upward through a sleeve 109 passing through a tube 110 of porcelain or other suitable material and resting on a shoulder 111 arranged on the body 100. A nut 112 screwing in the body 100 serves to hold the tube 110 in place. The lower portion of the body 100 provides a chamber 113 in communication with the inlet 105 and leading to the combined electrode and valve seat 106. On the upper end of the sleeve 109 is secured a contact 115 connected by an electric circuit wire 116 with a source of electrical energy connected with the cylinder the same as previously explained, whereby the combined electrode and valve seat 106 and the combined electrode and valve 107 are normally in the closed circuit. A spring 117 is seated at its lower end on a collar 118 attached to the upper end of the sleeve 109 and the upper end of the spring 117 bears on a collar 119 abutting against a pin 120 attached to the upper end of the valve stem 108 to normally hold the combined electrode and valve 107 in closed position, that is, in contact with the combined electrode and valve seat 106. In this case the electric heater is dispensed with and the gas under pressure passing through the inlet 105 acts on the combined electrode and valve 107 to move the latter into open position, as shown in Fig. 6. When this takes place, a passage and spark gap 121 is formed by the passage of the gas into the cylinder and for igniting said gas by the spark at the spark gap 121.

In the modified form shown in Figs. 7 and 8, the body 130 is held in the opening 131 formed in the head or wall 132 of the cylinder of an internal combustion engine and the said head is fastened in place by bolts 133 engaging a flange 134 formed on the body 130. On the lower end of the body 130 screws a retaining nut 135 supporting a disk-shaped electrode 136 having a central opening 137 in register with a central opening 138 formed in a disk 139 of mica or other similar material. The opening 138 registers with an opening 140 formed in a tubular electrode 141 held in a sleeve 142 of porcelain or other suitable material and resting on the electrode 136 with a washer 143 interposed between the lower end of the sleeve 139 and the electrode 136 to insure perfect insulation between the electrodes 136 and 141. The electrode 141 is provided with a valve seat 145 controlled by a needle valve 146 extending centrally through the electrode 141 and through a tube 147 screwing in the upper end of the electrode 141. The tube 147 is provided with an inlet 148 connected with a source of liquid fuel supply. The needle valve 146 is provided above the inlet 148 with an enlarged portion 150 extending into a cap 151 containing a spring 152 bearing with its lower end on a collar 153 secured to the top of the enlarged portion 150 of the needle valve 146 to hold the latter normally to its seat 145. The upper end of the spring 152 bears against a disk 154 arranged on a screw rod 155 provided with a nut 156 engaging a contact 157 of an electric circuit wire 158 connected with a source of electrical energy electrically connected with the cylinder head 132, the same as above described in reference to the device shown in Figs. 1 to 4. It will be noticed that the fluid passing into the tube 147 exerts an upward pressure on the enlargement 150 thus lifting the needle valve 146 against the tension of the spring 152. The needle valve 146 is thus moved off its seat 145 to allow the liquid to pass through the registering openings 140, 138 and 137 and to be ignited by the spark passing from the electrode 141 to the electrode 136 (see Fig. 8). In this type of electrical vaporizer and burner use is preferably made of an alternating current transformed into a high tension current to produce the desired annular spark at the spark gap. By the use of the mica washer the spark is concentrated and hence rendered exceedingly efficient. It is understood that the fuel is readily vaporized on reaching the passage and spark gap and ignited at this point.

In the modified form shown in Figs. 9 and 10, the body 160 is screwed into the cylinder head 161 and its lower end 162 is cone-shaped and provided with openings 163 for the passage of the vapors into the cylinder. In the bottom of the body 160 screws an electrode 164, the apex of which is in register with an aperture 165 formed in a tubular electrode 166 held in a sleeve 167 formed of porcelain or other material and fitted into the body 160. The electrode 166 is provided with a valve seat 170 normally closed by a needle valve 171 extending centrally through the electrode 166 and through a corrugated tube 172 screwed to the upper end of the electrode 166 and screwed into a sleeve 173 held on top of the sleeve 167 and fastened in place by a retaining member 174 fastened in place by a nut 175 screwing on the upper end of the body 160. The needle valve 171 extends through the sleeve 173 and connects at its upper end with a nut 176 seated on top of the sleeve 173. A nipple 177 screws on the upper end of the sleeve 173 and is connected with a suitable source of liquid fuel supply. Normally the needle valve 171 is in

closed position but when a fluid under pressure is passed through the nipple 177 and into the sleeve 173 and through the tube 172 into the electrode 166 then the pressure in the electrode forces the latter downward against the tension of the resilient tube 172 thus moving the valve seat 170 downward away from the needle valve 171 to allow the liquid fuel to pass through the opening 165 onto the cone-shaped electrode 164 to spread the liquid fuel and to ignite the same by the spark passing from the electrode 166 to the electrode 164 (see Fig. 10).

From the foregoing it will be seen that the electrical vaporizer and burner readily vaporizes the liquid fuel and ignites the same at its entrance into the working chamber, it being understood that sufficient air is present in the cylinder to insure full combustion.

It will further be noticed that any desired amount of fuel may be burned in the working chamber especially as the fuel does not depend on a specified proportion of hydrocarbon and air as is the case with carbureters. Furthermore, the burning of the vapor does not depend on the heat of compression as is the case in the Diesel engine. In consequence of that the engine supplied with this apparatus is able to run very slowly.

By the use of the described apparatus the injection of the vapor into the working chamber is produced by the pressure at which the liquid fuel is forced to the combination passage and spark gap and hence an air compressor for atomizing the fuel is not necessary.

Braking, stopping and reversing of the engine when run at full speed may be accomplished by producing successive counter-explosions in the cylinder at the beginning of the compression stroke. The desired efficiency is obtained as the combustion of the vaporized fuel proceeds rapidly and energetically on entering the cylinder.

It may be noticed that the apparatus may be used instead of the hot bulbs on the surface-ignition engines, as it performs the function of these hot bulbs to vaporize and ignite the fuel.

The cost of maintaining the electric circuit is comparatively small owing to the fact that very little heat is required for vaporization of the liquid fuel.

Both high and low tension circuits may be used.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:—

1. An electric vaporizer and burner, comprising an electric circuit, circular electrodes in the said circuit and forming an annular spark gap and passage between them, and means normally closing the passage and adapted to be opened by the pressure of the fluid to allow the latter to flow through the passage and to be ignited by the annular spark.

2. An electric vaporizer and burner, comprising an electric circuit, normally contacting electrodes in the said circuit and movable one relative to the other to form a passage for a fluid between the electrodes and to provide a spark gap for ignition of the fluid as it leaves the passage, and feeding means for feeding a fluid under pressure between the electrodes to move the same apart for forming the aforesaid passage and providing the aforesaid spark gap to ignite the fluid on leaving the passage.

3. An electrical vaporizer and burner, comprising an electric circuit, normally contacting electrodes in the said circuit, the said electrodes being movable one relative to the other to provide a spark gap, heating means for heating the electrodes, and means for feeding a combustible fluid between the electrodes to move the same apart for the passage of the fluid and for forming a spark gap to ignite the fluid as it leaves the electrodes.

4. An electrical vaporizer and burner, comprising an electric circuit, normally contacting electrodes in the said circuit and movable one relative to the other to form a passage between the electrodes and to provide a spark gap, electrical heating means in the said circuit and connected with one of the electrodes to heat the same, and feeding means for feeding a combustible fluid under pressure between the heated electrodes to open the latter, to allow the fluid to pass through the passage between the electrodes to become heated and finally ignited by the spark at the spark gap.

5. An electrical vaporizer and burner, comprising an electric circuit, a pair of coacting electrodes in the said circuit, one of said electrodes being in the form of a valve seat, a valve normally seated on the said valve seat, an electric heater for the said valve seat and in the said circuit, and means for feeding a fluid under pressure against the valve to open the latter to provide a spark gap to allow the fluid to pass between the valve and valve seat to be heated thereby and to be ignited on leaving the valve by the sparks between the electrodes.

6. An electrical vaporizer and burner for internal combustion engines, comprising a body attached to the cylinder of an internal combustion engine, a cone-shaped combined electrode and valve seat held insulated on the said body, a cone-shaped combined electrode and valve normally seated on the said combined electrode and valve seat, and means feeding a fluid under pressure onto the apex end of the said combined electrode and valve to open the latter and thereby

provide a passage for the fluid and to provide a spark gap at the edges of the valve and valve seat for igniting the fluid passing through the passage.

7. An electrical vaporizer and burner for internal combustion engines, comprising a body attached to the cylinder of an internal combustion engine, a cone-shaped combined electrode and valve seat held insulated on the said body, a cone-shaped combined electrode and valve normally seated on the said combined electrode and valve seat, a stem carrying the said combined electrode and valve, a spring pressing the said stem to normally hold the combined electrode and valve in closed position, and means feeding a fluid under pressure onto the apex end of the said combined electrode and valve to open the latter and thereby provide a passage for the fluid and to provide a spark gap at the edges of the valve and valve seat for igniting the fluid passing through the passage.

8. An electrical vaporizer and burner for internal combustion engines, comprising a body attached to the cylinder of an internal combustion engine, a cone-shaped combined electrode and valve seat held insulated on the said body, a cone-shaped combined electrode and valve normally seated on the said combined electrode and valve seat, a stem carrying the said combined electrode and valve, a spring pressing the said stem, a tube held insulated on the said body and through which extends the said tube to form a passage for a fluid leading to the apex end of the said inclined electrode and valve, and a feed pipe connected with the said tube to feed a fluid under pressure to the tube.

9. An electrical vaporizer and burner for internal combustion engines, comprising a body attached to the cylinder of an internal combustion engine, a cone-shaped combined electrode and valve seat held insulated on the said body, a cone-shaped combined electrode and valve normally seated on the said combined electrode and valve seat, a stem carrying the said combined electrode and valve, a spring pressing the said stem, a tube held insulated on the said body and through which extends the said tube to form a passage for a fluid leading to the apex end of the said inclined electrode and valve, a feed pipe connected with the said tube to feed a fluid under pressure to the tube, an electrical heater mounted on the said combined electrode and valve seat, and an electrical circuit containing the said heater, the said combined electrode and valve seat and the said combined electrode and valve.

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