Feb. 12, 1924. 1,483,177

J. H. HUNT ET AL

SUCTION BURNER

Filed May 19, 1921 6 Sheets-Sheet 1

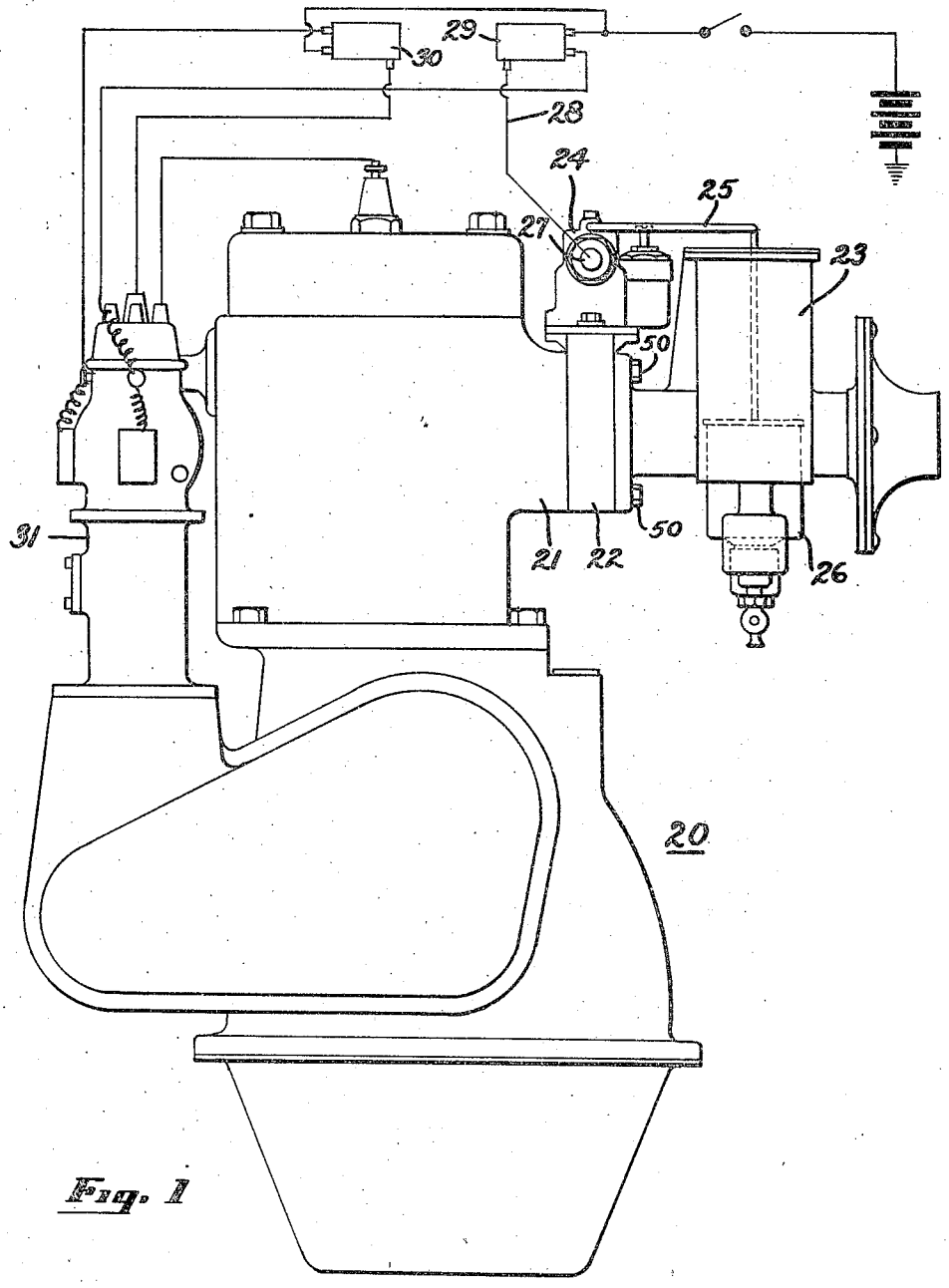


Fig. 1

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J. H. HUNT ET AL

SUCTION BURNER

Filed May 19, 1921 6 Sheets-Sheet 2

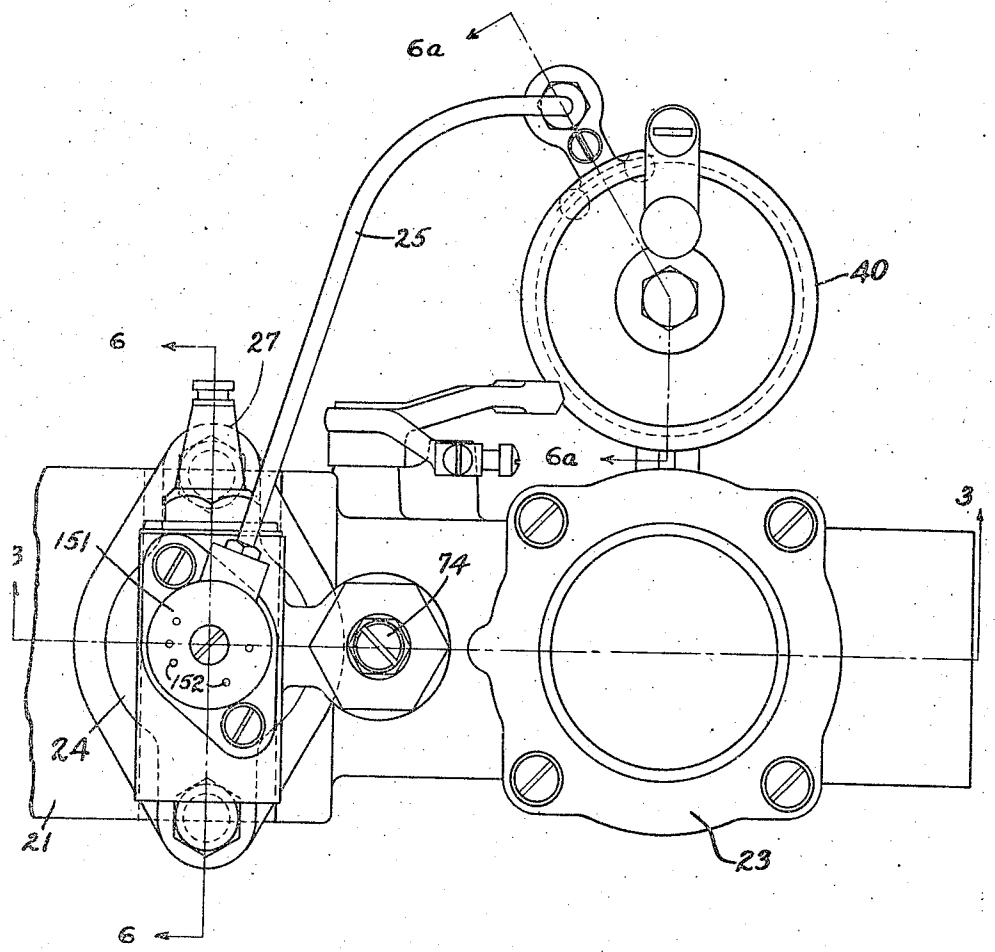


Fig. 2

Witnesses
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SUCTION BURNER

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Fig. 4

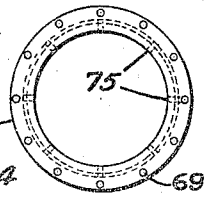


Fig. 5

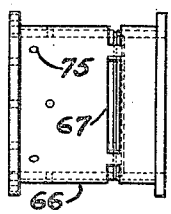


Fig. 3

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SUCTION BURNER

Filed May 19, 1921 3 Sheets-Sheet 4

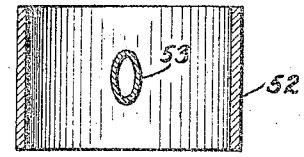


Fig. 7

Fig. 6

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SUCTION BURNER

Filed May 19, 1921 6 Sheets-Sheet 5

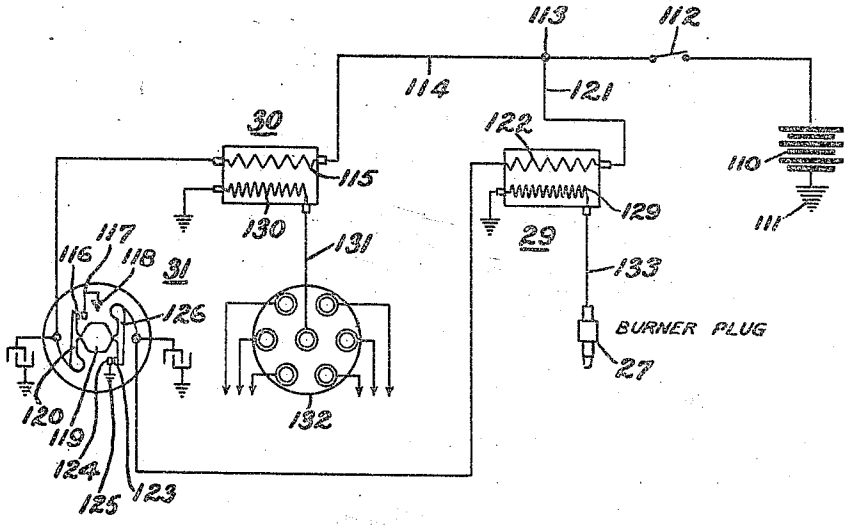


Fig. 8

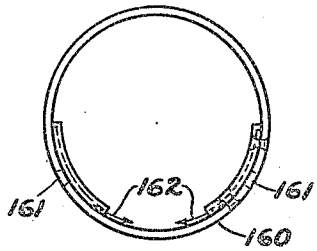


Fig. 9

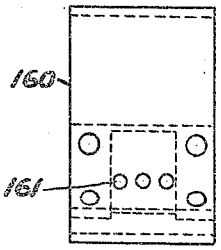


Fig. 10

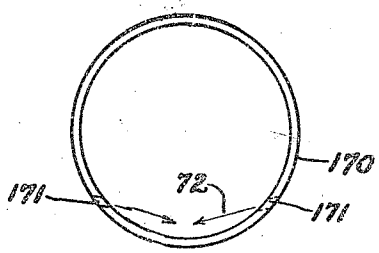


Fig. 11

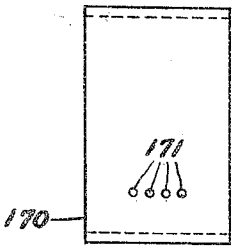


Fig. 12

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Feb. 12, 1924. 1,483,177

J. H. HUNT ET AL

SUCTION BURNER

Filed May 19, 1921 6 Sheets-Sheet 6

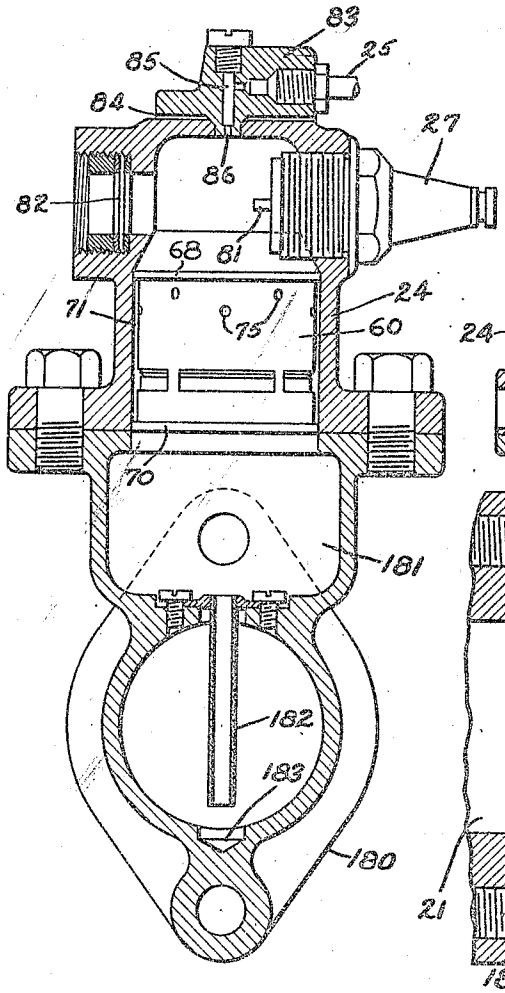


Fig. 13

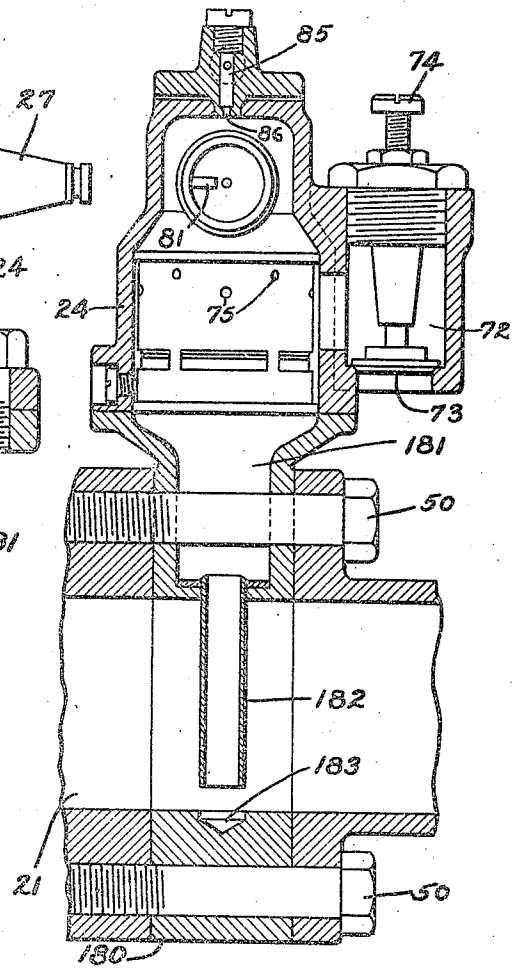


Fig. 14

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Patented Feb. 12, 1924. 1,483,177

UNITED STATES PATENT OFFICE.

JOHN H. HUNT AND JOHN T. FITZSIMMONS, OF DAYTON, OHIO, ASSIGNORS TO THE DAYTON ENGINEERING LABORATORIES COMPANY, OF DAYTON, OHIO, A CORPORATION OF OHIO.

SUCTION BURNER.

Application filed May 19, 1921. Serial No. 470,981.

To all whom it may concern:

Be it known that we, JOHN H. HUNT and JOHN T. FITZSIMMONS, citizens of the United States of America, residing at Dayton, county of Montgomery, State of Ohio, have invented certain new and useful Improvements in Suction Burners, of which the following is a full, clear, and exact description.

This invention relates to fuel charge heaters for internal combustion engines, and particularly to the type of heater disclosed in the United States Patent No. 1,337,989 issued to John Good May 10, 1921.

This invention has among its objects the provision of improved means for distributing combustion air in the burner to secure complete combustion without spitting or popping of the burner.

A further object is to conduct the products of combustion of the burner into the engine intake in such a manner as to vaporize condensation of the fuel charge.

Other and further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein preferred embodiments of the present invention are clearly shown.

In the drawings:—

Fig. 1 is an end elevation of an engine equipped with the burner embodying the present invention;

Fig. 2 is a plan view of the burner and carburetor;

Fig. 3 is a sectional view taken on line 3—3 of Fig. 2;

Figs. 4 and 5 are end and side views, respectively, of the air distributing sleeve shown in section in Fig. 3;

Fig. 6 is a sectional view taken on lines 6—6 and 6^a—6^a of Fig. 2;

Fig. 7 is a sectional view of the adapter inserts taken on line 7—7 of Fig. 3;

Fig. 8 is a wiring diagram of the engine and burner ignition;

Figs. 9 and 10 are end and side views, respectively, of a modified form of adapted insert;

Figs. 11 and 12 are end and side views, respectively, of a further modified form of adapter insert; and

Figs. 13 and 14 are sectional views similar to Figs. 6 and 3, respectively, of a modified form of burner.

Referring first to Fig. 1, engine 20 is provided with intake 21 to which is bolted burner adapter 22 and carburetor 23. Adapter 22 supports burner head 24 connected by pipe 25 with carburetor bowl 26. Head 24 supports a spark plug 27 connected by wire 28 with coil 29. Coil 30 cooperates with timer-distributor 31 to supply engine ignition as will be explained hereinafter.

Referring to Figs. 2 to 7 inclusive, carburetor 23 may be any automobile type, but as shown, is one commonly employed in the Hudson car, a well known make of automobile. Carburetor 23 comprises a bowl 40, float valve 41, passage 42 connecting bowl 40 with a well 43 into which dips a sleeve 44. A metering pin 45 is slidable in said sleeve 44 and its position is determined by the engine suction which adjusts the position of piston 46 operating in cylinder 47. The fuel charge passage 48 is controlled by a butterfly valve 49.

The burner adapter 22 forms a support for burner head 24 and together with carburetor 23 is secured to the engine by bolts 50. Adapter 22 provides a flame or combustion chamber 51 surrounding an adapter insert or sleeve 52 which forms a connection between the engine intake 21 and the fuel passage 48. A flattened tube 53 extends through the top of insert 52 and terminates adjacent the lower surface of insert 52. Tube 53 is flattened in order to "stream line" it whereby to reduce frictional resistance against the incoming fuel charge.

The burner head 24 detachably supports an air distributing sleeve 60 within which is a space for the more complete combustion of the burner flame. The sleeve 60 is constructed of upper and lower sections 61 and 62 having adjacent edges 63 and 64, respectively, beveled so as to provide an obliquely and downwardly extending annular crevice 65. These sections are secured in relative position by a cover sleeve 66 having spaced openings 67, so that the crevice 65 is practically a continuous opening. The flange 68 of section 61 is provided with small holes 69,

but the flange 70 of section 62 is solid. These flanges 68 and 70 space the sleeve 60 from the walls of head 24 to provide an annular air receiving space 71 in communication with the atmosphere through passage 72 controlled by a valve 73. The lift of valve 73 is limited by a screw stop 74. Adjacent flange 68, the section 61 and cover sleeve 66 are provided with staggered holes 75.

The space in burner head 24 above the sleeve 60 is the flame ignition zone or space where the fuel spray is ignited and begins to burn. It will be noted that the plug points 80 and 81 are located at one side of the axis of the head so that the fuel spray will begin to burn on the outside thereof. A mica inspection window 82 is provided for observing the character of the flame.

Burner head 24 supports a nozzle block 83 separated from the head by an asbestos gasket 84. Block 83 provides a nozzle passage 85 having a restricted neck 86. Pipe 25 connects passage 85 with a fuel well block 90, which is shaped to adapt it for attachment to the side of an ordinary fuel bowl. Bowl 40 is provided with a notch 91 and a hole 92 located above the normal fuel level 93 and with a hole 94 located below said level. Block 90 is provided with passages 95 and 96 communicating with holes 92 and 94, respectively. Passage 96 connects with a fuel well nozzle passage 97 closed at the bottom by plug 98 and connected at the top with pipe 25. Intermediate the ends, the passage 97 is provided with a restriction 99. A nozzle 100 is screw threaded for adjustment in passage 97 and has a portion 101 projecting above the adjacent opening from passage 95 and terminating just below the restriction 99. Portion 101 is provided with small holes 102 adjacent the upper end thereof.

Referring to the wiring diagram, Fig. 8, a battery 110 grounded at 111 is connected by switch 112 with junction 113. Wire 114 leads from junction 113 to primary 115 of coil 30, connected to contacts 116, 117 grounded at 118. Cam 119 and lever 120 controls the separation of contacts 116 and 117. Wire 121 leads from junction 113 to primary 122 of coil 29, connected to contacts 123, 124 grounded at 125. Cam 119 and lever 126 control the separation of contacts 123, 124.

Secondary 130 of coil 30 is connected by wire 131 with distributor head 132 from whence distribution is effected to six engine plugs (not shown). Secondary of coil 29 is connected by wire 133 with burner plug 27.

To start the engine, the crank shaft is rotated manually or by a suitable starting motor, the ignition switch 12 having been closed to produce timer controlled ignition for engine and burner. While the engine is pumping in fuel charge through passage 48, suction will be produced in the bowl 40 causing air to enter at notch 91 and pass through passages 95 and 97. Fuel will be lifted up through the nozzle 100 and will spill out through the holes 102 and mingle with the air. Air and fuel particles will pass through pipe 25 to nozzle 85 and outlet 86 producing a downwardly flowing spray which is ignited adjacent the outside thereof by a spark at the plug points 80, 81. While this is going on, suction is being produced in passage 72 causing valve 73 to lift. Air will be pumped into passage 72 and annular space 71, whence the air is distributed by sleeve 60. Some tiny jets of air will pass out holes 69 as indicated by arrows 140 to supply air for the surface combustion of the flame. It is intended that the spray passing from jet 86 be so rich as not to be a quick combustible mixture but so as to readily ignite at the outside of the jet when it meets the tiny air jets referred to. It is not desired to stir up the particles of the flaming spray to any substantial degree until they have reached the zone of more complete combustion within the sleeve 60. Jets of air will also rush out of holes 75 to begin stirring up the flame for more complete combustion, but the sheet of air passing obliquely downwardly from annular crevice 65 completely mixes combustion air with burning fuel particles in order to effect complete combustion within the adapter flame chamber 51.

The flame in chamber 51 thoroughly heats the adapter insert 52 through which heat is transmitted to the fuel charge as it passes to the engine. The products of combustion of the burner finally find their way down the tube 53 and the flame finally impinges up the lower surface of the insert 52 to vaporize any condensation of the fuel charge which may have trickled down the sides of the adapter insert or flowed back from the intake 21 while the engine was standing cold.

Air for surface combustion of the fuel spray may enter at holes 150. This flow of air can be adjusted by using one of a series of replaceable discs 151 each having a different sized hole 152. However, it has been found that the burner will operate properly with only the jets from holes 69 to support surface combustion of the fuel spray.

It has been found that the system of air distribution disclosed gives satisfaction, as combustion is complete and there is no popping of the burner due to too quick combustion of the fuel spray. This is believed to be due to gradually increasing the agitation of the flame and the mixing of combustion air with it as the flame proceeds from the ignition zone down to the zone of complete combustion.

Figs. 9 and 10 show a modified form of adapter insert 160. The burner flame enters

holes 161 and is directed downwardly as indicated by arrows 162 along the lower surface of the insert. Figs. 11 and 12 show a further modified form of adapter 170. The flame enters a series of slanting holes 171 as indicated by arrows 172. The object is the same as for the flame tube 53.

In the modified form of adapter 180 shown in Figs. 13 and 14, no insert is provided but the flame is conducted from a combustion chamber 181 down a flame tube 182, and the flame impinges upon fuel charge condensation which may collect in a puddle within a recess 183.

While the forms of mechanisms herein shown and described constitute preferred forms of embodiments of the invention, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What we claim is as follows:—

1. In a fuel charge heater for internal combustion engines, the combination with a burner head and a heating chamber member adapted for heating the engine fuel and communicating with the engine intake; of a nozzle for admitting fuel spray; ignition means for said spray; means for admitting combustion air to said burner head; and means for distributing combustion air including provisions for directing air toward said nozzle.

2. In a fuel charge heater for internal combustion engines, the combination with a burner head and a heating chamber member adapted for heating the engine fuel and communicating with the engine intake; of a nozzle for admitting fuel spray; ignition means for said spray; means for admitting combustion air to said burner head; and means for distributing combustion air including provisions for directing air toward said nozzle and along the interior wall of said burner head.

3. In a fuel charge heater for internal combustion engines, the combination with a burner head and a heating chamber member adapted for heating the engine fuel and communicating with the engine intake; of a nozzle for admitting fuel spray; ignition means for said spray; means for admitting combustion air to said burner head; and means for distributing combustion air including provisions for directing air toward said nozzle and also directly across said spray.

4. In a fuel charge heater for internal combustion engines, the combination with a burner head and a heating chamber member adapted for heating the engine fuel and communicating with the engine intake; of a nozzle for admitting fuel spray; ignition means for said spray; means for admitting combustion air to said burner head; and means for distributing combustion air including provisions for directing air directly across said spray and also away from said nozzle toward said heating chamber.

5. In a fuel charge heater for internal combustion engines, the combination with a burner head and a heating chamber member adapted for heating the engine fuel and communicating with the engine intake; of a nozzle for admitting fuel spray; ignition means for said spray; means for admitting combustion air to said burner head; and means for distributing combustion air and including provisions for directing an annular sheet of air away from said nozzle and toward said heating chamber.

6. In a fuel charge heater for internal combustion engines, the combination with a burner head and a heating chamber member adapted for heating the engine fuel and communicating with the engine intake; of a nozzle for admitting fuel spray; ignition means for said spray; means for admitting combustion air to said burner head; and means for distributing combustion air including provisions for directing air toward said fuel nozzle and also away from said nozzle toward said heating chamber.

7. In a fuel charge heater for internal combustion engines, the combination with a burner head and a heating chamber member adapted for heating the engine fuel and communicating with the engine intake; of a nozzle for admitting fuel spray; ignition means for said spray; means for admitting combustion air to said burner head; and means for distributing combustion air including provisions for directing air toward said fuel nozzle and along the interior walls of said head, for directing air directly across said spray, and also away from said nozzle toward the heating chamber.

8. In a fuel charge heater for internal combustion engines, the combination with a burner head and a heating chamber member adapted for heating the engine fuel and communicating with the engine intake; of a nozzle for admitting fuel spray; ignition means for said spray; means for admitting combustion air to said burner head; and means for distributing combustion air including provision for directing a substantially annular sheet of air across the burner flame and toward the heating chamber.

9. In a fuel charge heater for internal combustion engines, the combination with a burner head and a heating chamber member adapted for heating the engine fuel and communicating with the engine intake; of a nozzle for admitting fuel spray; ignition means for said spray; means for admitting combustion air to said burner head; and means for distributing combustion air including provision for directing a substantially annular sheet of air across the burner flame and toward the heating chamber, and

for directing small jets of air across the burner flame at points between said sheet of air and the burner nozzle.

10. In a fuel charge heater for internal combustion engines, the combination with a burner head and a heating chamber member adapted for heating the engine fuel and communicating with the engine intake; of a nozzle for admitting fuel spray; ignition means for said spray; means for admitting combustion air to said burner head; and means for distributing combustion air including provisions for directing a substantially annular sheet of air across the burner flame and toward the heating chamber, and for directing small jets of air toward the nozzle and along the interior walls of the burner adjacent the nozzle.

11. In a fuel charge heater for internal combustion engines, the combination with a burner head and a heating chamber member adapted for heating the engine fuel and communicating with the engine intake; of a nozzle for admitting fuel spray; ignition means for said spray; means for admitting combustion air to said burner head; and means for distributing combustion air including provisions for directing a substantially annular sheet of air across the burner flame and toward the heating chamber, for directing small jets of air toward the nozzle and along the interior walls of the burner adjacent the nozzle, and for directing small jets of air directly across the burner flame between the nozzle and the sheet of air.

12. In a fuel charge heater for internal combustion engines, the combination with a burner head and a heating chamber member adapted for heating the engine fuel and communicating with the engine intake; of a nozzle for admitting fuel spray; ignition means for said spray; means for admitting combustion air to said burner head; and means for distributing combustion air including provisions for admitting to the flame a relatively small amount of air at points relatively near to the nozzle and for admitting to the flame a relatively large amount of air at a relatively greater distance from the nozzle.

13. In a fuel charge heater for internal combustion engines, the combination with a burner head and a heating chamber member adapted for heating the engine fuel and communicating with the engine intake; of a nozzle for admitting fuel spray; ignition means for said spray; means for admitting combustion air to said burner head; and means for distributing combustion air including provisions relatively near the nozzle for directing air toward the nozzle for the surface combustion thereof, and for admitting further air for further combustion of the spray at points more remote from the nozzle.

14. In a fuel charge heater for internal combustion engines, the combination with a fuel burner; of a conductor for engine fuel charge in thermal relation to said burner; and means for directing products of combustion of said burner upon the lower portion of the interior wall of said conductor.

15. In a fuel charge heater for internal combustion engines, the combination with a fuel burner; of a conductor for engine fuel charge in thermal relation to said burner and provided with a pocket for collecting liquid fuel; and means for directing products of combustion of said burner upon the lower portion of the interior wall of said conductor.

16. In a fuel charge heater for internal combustion engines, the combination with a burner head; of a nozzle for admitting fuel spray; ignition means for said spray; means for admitting combusion air to said burner head; and a sleeve detachably secured within the burner head including provisions for directing air away from the nozzle and for directing air toward the nozzle.

17. In a fuel charge heater for internal combustion engines, the combination with a burner head; of a nozzle for admitting fuel spray; ignition means for said spray; means for admitting combustion air to said burner head; and a sleeve detachably secured within the burner head including provisions for directing an annular sheet of air away from the nozzle.

18. In a charge heater for internal combustion engines, the combination with a burner head; of a nozzle for admitting fuel spray; ignition means for said spray; means for admitting combustion air to said burner head; and a sleeve detachably secured within the burner head including provisions for directing air toward the nozzle.

19. In a fuel charge heater for internal combustion engines, the combination with a burner head; of a nozzle for admitting fuel spray; ignition means for said spray; means for admitting combustion air to said burner head; and a sleeve detachably secured within the burner head including provisions for directing air across the spray and toward the nozzle.

20. In a fuel charge heater for internal combustion engines, the combination with a burner head; of a nozzle for admitting fuel spray; ignition means for said spray; means for admitting combustion air to said burner head; and a sleeve detachably secured within the burner head including provisions for directing air across the spray and away from the nozzle.

21. In a fuel charge heater for internal

combustion engines, the combination with a burner head; of a nozzle for admitting fuel spray; ignition means for said spray; means for admitting combustion air to said burner head; and a sleeve detachably secured within the burner head including provisions for directing air across the spray, toward the nozzle and away from the nozzle.

22. In a fuel charge heater for internal combustion engines, the combination with a burner head; of a nozzle for admitting fuel spray; ignition means for said spray; means for admitting combustion air to said burner head; and air distributing means located within the burner head including provisions for causing combustion air to be mixed with the spray at points varying distances from the nozzle, said provisions being constructed to provide for increasing the admission of air the greater the distance from the nozzle.

23. In a fuel charge heater for internal combustion engines, the combination with a burner head; of a nozzle for admitting fuel spray; ignition means for said spray; means for admitting combustion air to said burner head; and an air distributing sleeve detachably secured within the burner head, and comprising spaced sections having their adjacent edges beveled to provide an obliquely extending annular crevice, and means for securing the sections in spaced relation.

24. In a fuel charge heater for internal combustion engines, the combination with a burner head and a heating chamber; of a sleeve located within the heating chamber and providing a duct for engine fuel; and a tube extending within said sleeve for conducting the products of combustion of the burner to the engine intake and for directing said products upon the sleeve.

25. In a fuel charge heater for internal combustion engines, the combination with a burner and heating chamber; of a sleeve located in thermal relation to the heating chamber and providing a duct for engine fuel; and a tube supported by the sleeve for conducting the products of combustion of the burner to the engine intake and for directing said products upon a wall of the insert.

In testimony whereof we hereto affix our signatures.

JOHN H. HUNT.
JOHN T. FITZSIMMONS.

Witnesses:
H. E. SOLLENBERGER,
WALTER W. RIEDEL.