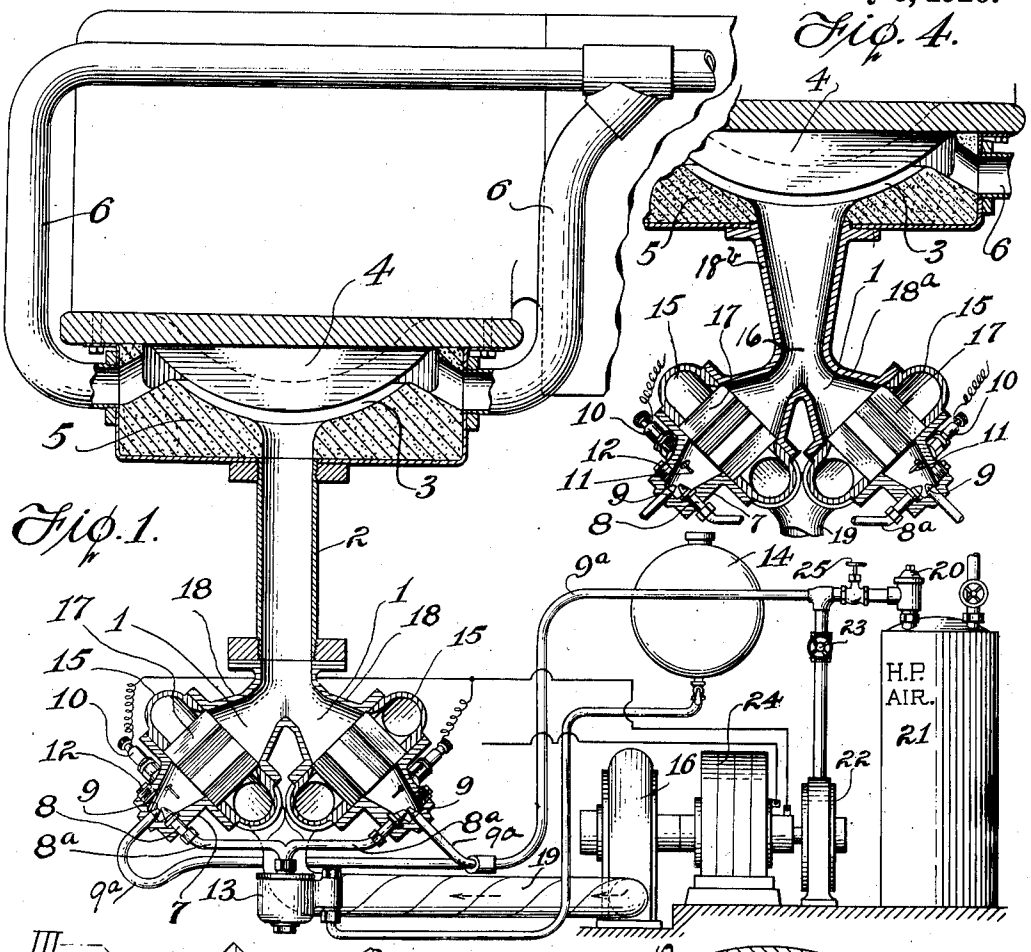
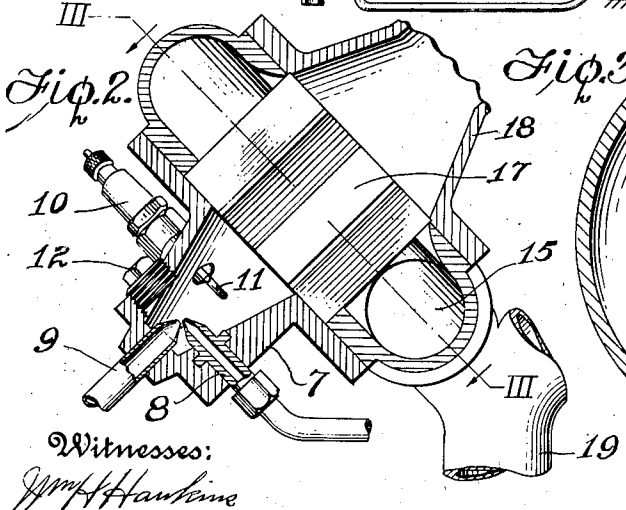
J. GOOD.

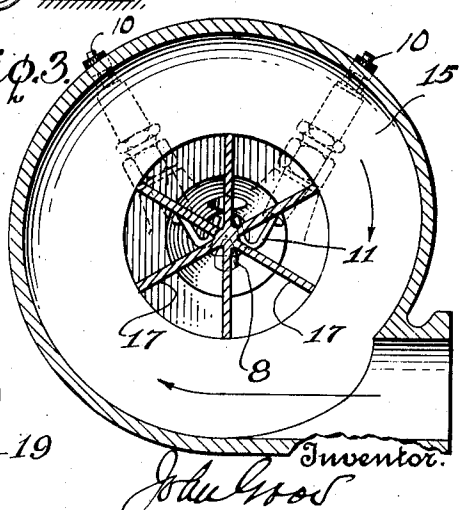
HEATING APPARATUS.

APPLICATION FILED FEB. 8, 1916.

1,345,361. Patented July 6, 1920.







Witnesses:

Wm. H. Hawkins

Inventor.

John Good

By Attorneys

Bruce & Spencer

UNITED STATES PATENT OFFICE.

JOHN GOOD, OF BROOKLYN, NEW YORK, ASSIGNOR TO GOOD INVENTIONS CO., OF BROOKLYN, NEW YORK, A CORPORATION OF NEW YORK.

HEATING APPARATUS.

1,345,361. Specification of Letters Patent. Patented July 6, 1920.

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To all whom it may concern:

Be it known that I, JOHN GOOD, a citizen of the United States, residing in Brooklyn, in the county of Kings and State of New York, have invented the following described Improvements in Heating Apparatus.

The invention consists in an organization of elements for burning liquid fuels of low volatility, such as kerosene, low grade gasolene and the so called commercial fuel oils, in confined spaces of narrow compass and of obtaining intense localized combustion therefrom, whereby the apparatus is adapted for heating the thick vaporizer plates of large size oil engines, to start them in action with the least delay, as well as for other purposes where rapid heat development is required but open flames are dangerous or not desired.

In the accompanying drawings,

Figure 1 is a sectional view of the improved apparatus with the air, fuel and certain appurtenant parts illustrated more or less diagrammatically;

Fig. 2 is an enlarged longitudinal section of one of the burner chambers;

Fig. 3 a cross-section of Fig. 2 on line III—III thereof; and

Fig. 4 a preferred and modified form.

The apparatus of Fig. 1 comprises two burner heads 1, convergently and symmetrically connected to a tube 2 constituting a flame casing and mixing space, the upper end of which constitutes or opens into a heat transfer chamber 3. In the present case this chamber is a bowl-form space between the exterior surface of the hot plate 4 of an oil engine and a surrounding wall 5 made of heat-insulating material, the outlet from the chamber being by way of two pipes 6 which lead to the exhaust pipe of the engine or to some other point of safe discharge. Oil engines having hot plate vaporizers such as here indicated are well known in the art and do not require description. Their vaporizer plates require to be heated in order to start the combustion cycle, an operation which has heretofore and generally been accomplished by directing the flame of a blow lamp against it in the open air of the engine room. According to the present invention, the plate 4 is completely inclosed by and in fact forms part of, the wall of the heat transfer chamber, at least during the heating process, and the flame and combustion gases move through the tube 2 and chamber 3, under pressure and at high velocity, impinging directly and forcibly on the plate itself, which is placed transverse to the flame casing, as indicated. The chamber 3 and tube 2 are made of imperforate walls to confine the flame, which is under pressure, as just stated, but at no time exposed to or visible from the outside of the apparatus. As a consequence of this fact, it will be apparent that risk of fire to surrounding material is minimized and that the apparatus is thereby adapted for use on marine oil engines and in other places where exposed flames are undesirable.

The individual burner heads 1 are two in number in the present case and duplicates of each other, although this is not necessary. I have ascertained that the duplication of relatively small size burners, directing their fuel sprays or flames into a common flame casing such as the tube 2, results in the attainment of higher temperatures than can be efficiently had from a single burner of twice the capacity. More than two of such burners may be thus assembled with a common flame-casing giving a corresponding increase of temperature rise. Each burner head is closed at its end by a cap 7, which is imperforate, save for the holes in which the spray-producing means, the igniting means and the clean-out plug are located. The fuel spray is produced in the present case by means of oil and air nozzles 8 and 9, mounted in the end cap 7, in atomizing relation and so as to project the spray centrally through the burner casing and toward or into the flame casing. One or all of the spray-producing means are so organized with respect to the velocity and fineness of the atomization as to produce a spray which will ignite in an initially cold state, for which purpose an electric ignition is used, consisting of two spark plugs 10, each having an electrode 11 intercepting the spray and adapted to spark through it directly in front of the nozzles. The ends of the electrodes are bent upwardly and toward each other, as shown in Fig. 3, whereby the drops of liquid which tend to accumulate on them are drained away from the spark gap. The screw plug 12 provides access to the atomizing nozzles, to clean them if they should clog, but it is normally closed.

The liquid fuel for the two nozzles 8 is taken through the pipes 8ª from a single fuel supply in the form of a constant level float chamber marked 13, or other equivalent source, connected with a fuel tank 14, and such supply will of course be understood to be subject to regulation by any suitable means. The air supply for the air nozzles 9, is also taken from a common source through pipe 9ª from a high pressure air tank 21, a shut-off valve 25 and a reducing valve 20 being interposed in the connection, the latter being of ordinary design for the purpose of delivering the air at a constant pressure.

Immediately in front of the point of ignition of the atomized fuel spray, which point is represented by the spark gap between the electrodes 11, the burner chamber is formed with an annular enlargement 15, constituting the admission means for a source of supplemental air introduced in the present case in a tangential direction with reference to the axis of the fuel spray, and adapted to enter and commingle equally on all sides with said spray. Such supplemental air is of considerably lower pressure that that necessary to produce the fuel spray and is taken, for both burners, from a single fan blower 16, which, however, is driven by an air motor 22, operated by the high pressure air in the tank 21, so that in effect only a single source of air pressure is required to operate the apparatus. The fan blower 16 is shown connected to the end of the rotor shaft of the air motor, and the magneto generator 24, which supplies the current for the spark plugs, is also driven by the same shaft, but it will be understood that these parts are susceptible of different and compact arrangement so as to provide an operating system of small compass. The fan blower and its driving motor are indicated as of ordinary construction, common in the art, and in this case merely represent a means whereby air or fluid at relatively high pressure may be utilized to create an inflow of combustion-supporting air from atmosphere in relatively large volume and at a lower pressure.

In order to improve the mixing action of the supplemental air with the burning fuel spray, a longitudinal partition member 17 in the form of a star or spider, as indicated in Fig. 3, is introduced at the center of the air-admission chamber 15, so that its wings or walls are parallel with the direction of the spray. This member is held in place by the cap 7 on one side and by the fitting 18 on the other, which fitting forms the connection between the burner chamber and the flame casing, the three parts being appropriately secured to each other by screws or bolts, not indicated in the drawing.

By virtue of the introduction of the combustion-supporting air at a point immediately in advance of the spark gap, or where it does not dilute the spray at that point but is yet close to the point of ignition, complete combustion is attained in the confined flame-passage without producing explosions or explosive mixtures at the spark, and ignition can be produced with low current values with reliability and certainty of action. The several burner heads deliver fuel and air into the common combustion passage in explosive proportions in the latter but not in the condition of an explosive mixture, and preferably each burner-head is so operated as to deliver like proportions of fuel and air, so that all of the burner-heads are identical in operation if not in structure.

It will be observed that by opening the valve 25 (the motor valve 23 being open) the compressed air stored in the tank 21 will simultaneously actuate the spray-producing means and start the b. ver 16 and generator 24 in operation, thereby producing a spray in one or more of the burners, which is instantly ignited, even though cold, by the electric spark, while the low pressure air from the fan blower 16 supplies the additional oxygen necessary for the continued combustion of the ignited spray. The resulting flames meet at high velocity in the flame casing, moving with impingement upon the vaporizer plate 4 and thence passing off to the exhaust.

The junction between each burner and the flame-casing is desirably formed by a single part, such as 18, giving a convergently tapered communication to the casing and correspondingly increasing the velocity of the flame gases, which expedites the mixture of the fuel and air in the flame casing.

In the modified form of Fig. 4, the junction fitting 18ª—18ᵇ, corresponding to the part 18 of Fig. 1, is formed as a Venturi tube, or rather as a compound Venturi tube, that is to say the walls of the short converging portions from each burner chamber unite at a point, 16, of least diameter and cross-sectional area, from which point on, the cross-sectional area gradually increases, according to the principle of Venturi tubes, the upper and wider part 18ᵇ of said fitting being connected directly to the heat-transfer space 3 without the intervention of the straight-walled tube 2, shown in Fig. 1. The flame casing in this case is constituted by the Venturi tube and by virtue of the peculiarities of its action a thorough mixing of fuel and air is accomplished in an exceedingly compact space.

The burner chambers in Fig. 4 are shown the same as in Fig. 1, and similarly marked, and will be understood as representing the preferred form of spray-producing device

for use with said Venturi-tube flame mixing chamber.

The construction of the burner heads above described is also shown and claimed in my Patent 1,207,897, December 12, 1916, and the combustion-process thereof is claimed in my copending application Serial No. 312,106, renewed July 19, 1919.

I claim:

1. Inclosed liquid fuel combustion apparatus comprising a flame passage entirely closed to atmosphere at its fuel receiving end and at such end provided with a plurality of closed forced draft burners each comprising a fuel and air mixing space, a connection to each said space for admitting air under pressure in distributed relation to a fuel spray in said space, means for spraying liquid fuel into each of said spaces, one of said burners containing an electric igniter disposed in a part of the fuel spray therein which is relatively undiluted with air, in combination with a single source of air pressure for said air connections and means for simultaneously supplying air therethrough to all said mixing spaces and coincidently actuating said spray means and igniter.

2. Inclosed liquid fuel combustion apparatus, comprising a flame passage entirely closed to atmosphere at its fuel receiving end and at such end connected with a plurality of closed forced draft burners, each comprising a fuel and air mixing space, a connection to each said space for admitting air under pressure, air operated spray nozzles for spraying liquid fuel into each of said spaces to form a mixture of explosive proportions therein, and a common supply chamber for the liquid fuel associated with said spray nozzles, in combination with a single source of air pressure for said air connections and means for simultaneously supplying air to all said connections and said spraying means and coincidently energizing said igniter.

3. Inclosed liquid fuel combustion apparatus comprising a flame passage entirely closed to atmosphere at its fuel receiving end and at such end provided with a plurality of closed forced draft burners symmetrically arranged with respect to said flame passage and each comprising a fuel and air mixing space, a connection to each said space for admitting air under pressure, means for spraying liquid fuel into each said space, one of said burners containing an electric igniter disposed in a part of the fuel spray therein which is relatively undiluted with air from the air connection, in combination with a single source of air pressure for all said air connections, and means for simultaneously supplying air therethrough to all said mixing spaces and coincidently actuating said spray means and igniter.

4. Liquid fuel combustion apparatus comprising a fluid pressure source and means operated thereby for spraying liquid fuel and another means operated thereby for supplying the spray with air in quantity to complete combustion thereof, an igniter for said spray, and electrical means also operated by the fluid pressure from said source, for rendering said igniter active, all of said means being combined and organized for simultaneous operation by said pressure source.

5. Liquid fuel combustion apparatus comprising a fluid pressure source having connection for directly atomizing liquid fuel by said pressure fluid and adapted also to produce a supply of air from the atmosphere and under pressure to support combustion of said atomized fuel, and an igniter for said spray combined and organized to be energized automatically and simultaneously with the discharge of fluid from said source.

6. In inclosed liquid fuel combustion apparatus, the combination of a plurality of burner heads each delivering a mixture in explosive proportions of liquid fuel and air, a flame space formed in part by the object to be heated, and connecting passages converging from each burner head to said flame space.

7. In inclosed liquid fuel combustion apparatus, the combination of a plurality of burner heads, each delivering a mixture in explosive proportions of fuel and air and connected to a flame passage of less cross-sectional area than the combined areas of the outlet from each burner head.

8. Heating apparatus comprising a flame passage containing fluid-pressure means for producing an atomized liquid fuel spray therein, an electric igniter in the path of said spray, means for admitting combustion-supporting air into contact with said spray at a point where such air does not dilute the spray at its point of ignition, a fluid-pressure supply for said atomizing means, and means operated by said fluid pressure for supplying the combustion-supporting air to said spray.

9. Heating apparatus comprising, in combination, a closed flame passage containing fluid-pressure means for producing a fuel spray therein, an igniter in said passage intercepting the spray, means for admitting combustion-supporting air to said spray, a blower for supplying said air, a common source of fluid-pressure operating said spraying means and blower in predetermined relation, and an electrical device adapted to operate said igniter also operated by said source of fluid pressure.

10. Heating apparatus comprising, in combination, a closed flame passage, fluid-pressure means for producing a liquid fuel spray therein, an electric spark igniter intercept-

ing such spray, an electrical device controlling said igniter, and a source of fluid pressure for supplying combustion-supporting air to said passage and adapted also to operate said electrical device to ignite the spray therein.

11. Heating apparatus comprising a plural number of flame-producing devices connected to a common flame-confining Venturi tube and comprising means for projecting air and atomized liquid fuel sprays into said tube.

12. Heating apparatus comprising a plural number of flame-producing devices and a common flame passage therefor consisting of a compound Venturi tube having an individual convergent connection with each device and a single divergent continuation therefrom.

13. Liquid fuel combustion apparatus comprising a closed flame-mixing space a plurality of closed flame-producing burner heads connected thereto, each containing fuel spraying means and provided with an entrance for combustion-supporting air predetermined as to size to produce substantially explosive proportions in said head, means in each head for distributing such air round about the spray, one of said burner heads being provided with an electric igniter located in a position to intercept the spray therein prior to its dilution with the combustion-supporting air, a liquid fuel receptacle for the burner heads and connected with the spraying means thereof, and means for simultaneously supplying air to all said entrances and for operating said igniter.

14. Liquid fuel combustion apparatus comprising a combustion space entirely closed to atmosphere except at its exhaust opening, a plurality of closed burner heads connected to said space and constituting the sole means of entrance thereto of fuel and air, means for spraying liquid fuel into each burner head operated by and delivering fuel in proportion to the air flow therethrough, and in the proportions of an explosive mixture in respect to each head, an air entrance to each burner head arranged to distribute the air round about the fuel spray therein, means for supplying air at the same pressure to all said heads, and an electric igniter in one of said heads.

15. Liquid fuel combustion apparatus comprising a closed combustion space, a plurality of closed burner heads arranged to deliver a plurality of mixtures of fuel and air convergently into said space, each said mixture being in the proportions of an explosive mixture, and means for establishing non-explosive combustion of said convergent mixtures.

16. Liquid fuel combustion apparatus comprising, a closed combustion space a plurality of closed burner heads arranged to deliver a plurality of mixtures of fuel and air convergently into said space, each mixture having the proportions of an explosive mixture, a passage connecting said heads to said space of less cross-sectional area than the aggregate area of the outlets from said heads and means for establishing non-explosive combustion in said space.

17. Liquid fuel combustion apparatus comprising a plurality of closed burner heads each connected to an air source and a liquid fuel source, and operated by the air flow to produce mixtures of fuel and air in the proportions of an explosive mixture, a common closed combustion space for all said burner heads, the latter being arranged to deliver their respective mixtures convergently into said space and means in one or more of said burner heads for establishing non-explosive combustion in said space.

18. Liquid fuel combustion apparatus comprising a flame space provided with fluid pressure means for producing an atomized liquid fuel spray, an entrance for admitting combustion-supporting air in distributed relation to said spray and fluid-pressure means for producing a flow of air from atmosphere through said air entrance in proportion to establish complete combustion of the fuel.

19. Liquid fuel combustion apparatus comprising a flame or combustion space provided with a fluid pressure nozzle for atomizing liquid fuel, an entrance for distributing air to said spray, a fluid pressure means for producing air flow from atmosphere through said entrance to make a mixture of explosive proportions in said space, and an igniter arranged therein to establish non-explosive combustion of said mixture.

In testimony whereof I have signed this specification.

JOHN GOOD.