J. GOOD.

HEATING APPARATUS.

APPLICATION FILED MAY 2, 1916.

1,349,668.

Patented Aug. 17, 1920.

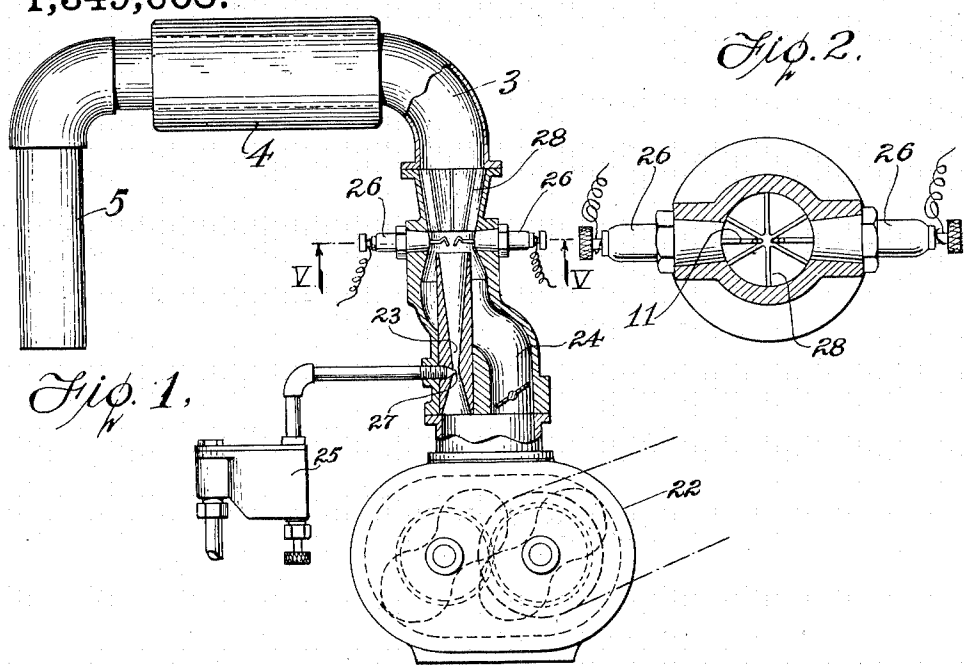

Fig. 1.

Fig. 2.

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[illegible]

UNITED STATES PATENT OFFICE.

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HEATING APPARATUS.

1,349,668. Specification of Letters Patent. Patented Aug. 17, 1920.

Application filed May 2, 1916. Serial No. 94,865.

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 is an improvement in forced draft burner mechanism capable of using kerosene or heavier oil or liquid fuel, and provides means of high efficiency and extreme simplicity and quietness of operation, whereby high temperature can be directly and quickly obtained in closed passages of narrow compass, from the combustion of such heavy fuels and particularly whereby such fuels can be reliably and instantly spark-ignited in their initial cold condition and by means of electric sparking current of low amperage, and whereby also various other advantages and economies are available over existing means for burning liquid fuel, as will be made apparent in the description below. The invention is in the nature of an improvement upon the inclosed flame combustion device shown in my Patent No. 1,207,897 dated December 12, 1916, the particular improvements thereon residing in the arrangement of the air passages whereby a source of air at a single pressure supplies both the fuel atomizing means and the combustion-supporting air in the predetermined relation which permits instant spark ignition without explosion.

In the drawings:

Figure 1 represents one form of the invention in side elevation with parts broken out in vertical central section; and

Fig. 2 is a cross-section on line V—V, on enlarged scale.

The closed combustion passage is represented by the tube or pipe 3 connected to the exhaust pipe or outlet 5 at one end and to the burner mechanism proper at the other. The part 4 indicated as surrounding the flame-passage 3, in the present case, may be assumed to be anything to be heated, it being understood that it may be brought into heat-transferring relationship to the flame-passage in various, obvious ways.

The single source of air pressure is represented as a so-called geared blower marked 22 but equivalent to any suitable means of creating a low-pressure supply of air, a suitable pressure being from one quarter of a pound to two pounds per square inch depending upon the resistance to flow offered by the burner mechanism and the flame-passage. This source of air is connected by a short passage to the burner mechanism proper, a part flowing to a Venturi tube 23 and part flowing into the combustion-supporting air-passage 24. A butterfly valve in the latter passage serves to adjust the proportions of flow as will be evident. The Venturi tube 23 is connected at its throat or point of narrowest construction to a liquid fuel nozzle 27 adjustably threaded in its side wall and in communication with a constant-level liquid supply receptacle 25 of ordinary type. The liquid nozzle projects slightly into the Venturi throat and the flow of air through the latter creates a sharp local depression in the region of the nozzle thereby causing the fuel to flow from the receptacle 25 and producing a finely atomized spray of liquid fuel emerging from the delivery end of the tube. According to the law of the Venturi tube the fuel thus supplied is in substantially constant proportion to the velocity of air flow. As will be seen in the drawing, the nozzle 27 projects into the throat of the Venturi tube far enough to bring its orifice at or near the central axis of the tube and the liquid is thereby conducted to such axis in unbroken form and is thus atomized at a central point within the tube. In such position a spray is produced which is readily ignitible by spark and with the least tendency to smell or smoke after ignition. The atomized liquid spray is discharged into the burner mechanism substantially in alinement with the flame-passage and centrally with respect to the flow of air from the passage 24, which surrounds the delivery end of the Venturi tube. The electric igniter mechanism 26 is permanently mounted in the burner with its spark-gap directly intersecting and surrounded by the liquid spray from the Venturi tube, where it is not yet mixed with the combustion-supporting air from passage 24, and the terminal portions of the electrodes 11 are bent convergently toward the Venturi tube so that drops of impinging liquid fuel will be blown forwardly and away from the spark-gap, thus keeping the same free from short-circuit by the liquid fuel and permitting a short gap.

In this relation, spark ignition of heavy fuel such as kerosene, fuel oil of commerce, and similar oils can be accomplished by current of a few milliamperes, without requiring the pre-heating of the apparatus or the air or fuel. Such a source of current may be assumed to be connected to the plugs 26 although current of any suitable or higher value may of course be employed. The combustion-supporting air flows to the ignited spray uniformly on all sides therefrom through the annular passageway between the end of the Venturi tube and the surrounding wall of the burner casing. The wall of this casing is shown as also formed as a Venturi tube, having its throat approximately coincident with the delivery outlet of the spray-producing Venturi, but this shape is not essential and whether it has such form or is constituted merely of a straight tube the spark-gap is nevertheless disposed centrally in the liquid spray. Immediately beyond the point of ignition the burner mechanism contains a cellular partitioning member 28, about as long as the diameter of the flame-passage and having its thin wall members arranged edgewise to the direction of flow. In the present case this partitioning member is formed as a separate, one-piece, metallic, star-shaped body fitted into the chamber at the upper part of the burner casing. Its function is partly to increase the rate of liquid evaporation and partly, as I believe, to maintain a proper distribution of the combustion-supporting air around the spray.

With the ignition accomplished in the manner stated, the two air streams, through the spraying venturi 23 and the passage 24 respectively, bear a predetermined and constant relation to each other, determined by an original setting of the valve in the latter passage, and which permits ignition without explosion, producing substantially complete and continuous combustion in the flame-passage 3. The proportions of fuel and air delivery are those of an explosive mixture but actual mixture of them in such proportions is avoided by the manner of their introduction and the location of the spark-gap, that is to say, the venturi-spray is too rich in fuel to explode although capable of ignition, and beyond the igniter explosion is avoided by the progressive mixing contact of the air with the ignited spray. The proportions of fuel and air will be understood to be subject to adjustment by manipulation of the needle valve shown at the bottom of the float chamber 25. The apparatus gives automatic ignition and immediate intense combustion by the mere act of setting the blower 22 in operation which can be done either automatically or manually, and at the same time as starting the electric current for ignition and varying intensities of combustion may be had by varying the blower speed, as well as by the control of the fuel delivery after the apparatus has been started in action. The igniting current may be continuously applied to the igniter if desired and may be derived from a magneto-generator (not shown) permanently geared to the main shaft of the blower or otherwise.

It will be observed that the apparatus above described can be variously constructed in accommodation to the particular form of apparatus or material which it is to heat and without departing from the principle of the invention as set forth in the appended claims.

Claims:

1. Heating apparatus comprising a single source of air pressure, a Venturi tube receiving a portion of the air flow therefrom and provided with a liquid fuel nozzle and adapted to produce an atomized spray of the liquid and air, said nozzle being organized in the apparatus to supply a liquid delivery to the Venturi tube which is automatically maintained in constant proportion to the air flow therethrough and suited for ignition by a spark of moderate value, an electric igniter to provide such spark intercepting said spray and stationed therein to ignite the same, and a passage for delivering the remaining portion of the air flow from said source adjacent the outlet of said Venturi tube and spark gap and for mixture with the spray from said tube, whereby, on ignition, the combustion proceeds non-explosively.

2. Heating apparatus comprising in combination a closed flame casing, burner mechanism connected thereto and supplied with all the air requisite for its operation from a single air blower and including two passages for delivering air from said blower to the casing, one of said passages being a Venturi tube and having a liquid fuel orifice therein and the other being arranged to conduct the remainder of the air flow into surrounding contact with the spray from the outlet of said Venturi tube, the said air passages being mutually correlated and organized to conduct relatively constant proportions of air to said casing and the amount conducted by both passages being constantly related to the amount of fuel in the proportions of an explosive mixture, and an electric igniter having a spark gap disposed in the spray from said tube and adapted to produce ignition and non-explosive combustion thereof.

3. Heating apparatus comprising in combination a closed flame casing, a burner mechanism connected thereto and operated by a single source of air pressure and comprising two passages for delivering air from said source to said casing, one of said pas-

sages being a Venturi tube having a liquid fuel nozzle supplied with liquid from a constant-level receptacle and delivering the same into the throat portion of said tube, and the other passage being arranged to conduct the remainder of the air flow from said source to a point around the outlet of said Venturi tube, and an electric igniter having its spark-gap intercepting the air and fuel spray from said Venturi tube at a point where it is not diluted by the air from said other passage.

4. Heating apparatus comprising a closed combustion passage, a Venturi tube delivering a spray mixture of air and liquid fuel in non-explosive proportions into said passage, an electric igniter located beyond the throat of the tube having electrode terminals pointed, one or both, convergently toward said throat and their spark-gap intercepting the path of the spray mixture issuing therefrom, and means for delivering combustion-supporting air under pressure into said combustion passage at a point adjacent the outlet from said tube and removed from the location of said spark-gap.

5. Heating apparatus comprising a closed combustion passage, a Venturi tube adapted to deliver a spray mixture of air and liquid fuel in non-explosive proportions into said passage, an electric igniter having its spark-gap directly in the path of the spray from said tube, a combustion-supporting air passage delivering air into contact with the spray from said tube and a cellular partitioning member in said passage intercepting the flows from said tube and combustion-supporting air passage, in combination with a single source of air pressure supplying said tube and combustion-supporting air passage.

6. Heating apparatus comprising a closed combustion passage, a burner mechanism connected thereto and including a Venturi tube adapted to deliver a spray mixture of air and liquid fuel in non-explosive proportions into said passage, said passage adjacent the outlet from said tube being itself formed as a Venturi tube, an electric igniter having its spark-gap intercepting the spray from the Venturi tube, means for introducing combustion-supporting air into said passage and around the outlet of the Venturi tube therein.

7. In oil burning combustion apparatus, a source of air pressure, a burner supplied with air therefrom and comprising two air passages, one of them being a Venturi tube in communication with a source of liquid fuel and provided with means adapted to deliver liquid therefrom in unbroken form at a point near the axis of said tube whereby it is air-atomized as from the center of said tube and projected therefrom as a fine spray capable of spark ignition, said liquid being moved into the Venturi tube by and in proportion to the air flow by virtue of the venturi-depression therein, the other of said passages serving to conduct air into surrounding contact with the spray issuing from said tube and in proportions adapted to make the total proportions of air and fuel those of an explosive mixture, and an electric igniter intercepting the Venturi spray at substantially the point where it begins to mix with said air but where it does not produce explosive combustion.

8. Heating apparatus comprising a closed flame passage having an open exhaust outlet, a single source of air pressure, a Venturi tube receiving a portion of the air flow therefrom, a liquid fuel nozzle entering said tube with its orifice in spray-producing relation to the air flow therein, a passage conducting the remainder of the air flow into surrounding contact with the spray issuing from the outlet of said Venturi tube and an electric igniter intercepting said spray at a point in advance of its complete mixture with the air from said passage.

9. Heating apparatus comprising a closed flame passage having an open exhaust outlet, a single source of air pressure, a Venturi tube receiving a portion of the air flow therefrom, a liquid fuel nozzle entering said tube with its orifice in spray-producing relation to the air flow therein, a passage conducting the remainder of the air into mixture with the spray issuing from the outlet of said tube, a partitioning member having its wall surfaces disposed edge on to the flow of spray and air and an electric igniter intercepting said spray between said member and the Venturi tube.

In testimony whereof, I have signed this specification.

JOHN GOOD.