Apr. 3, 1923. 1,450,338

M. SKLOVSKY

APPARATUS FOR PRODUCING GASEOUS FUEL

Filed Mar. 13, 1917

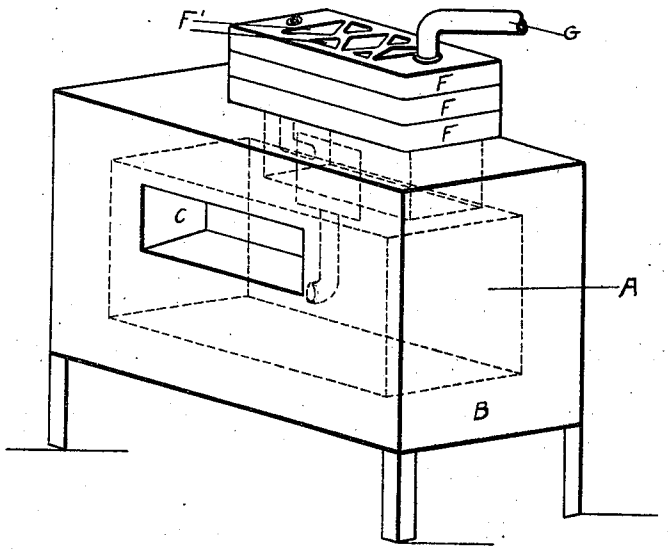


Fig. 1.

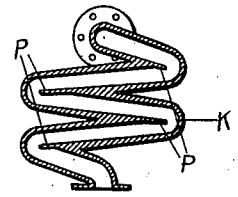
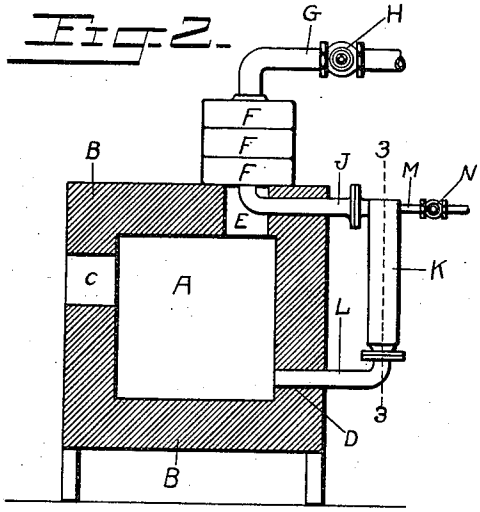


Fig. 3.

Fig. 2.



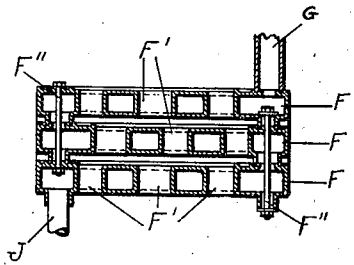


Fig. 4.

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR PRODUCING GASEOUS FUEL.

Application filed March 13, 1917. Serial No. 154,588.

To all whom it may concern:

Be it known that I, MAX SKLOVSKY, a citizen of the United States, and a resident of Moline, in the county of Rock Island and State of Illinois, have invented certain new and useful Improvements in Apparatus for Producing Gaseous Fuel, of which the following is a specification, reference being had to the accompanying drawings.

My invention has to do with the production and consumption of a gaseous fuel made from crude petroleum or similar oils, and has for its object to provide a new and improved apparatus suitable for practicing the process described and claimed in my Patent No. 1,229,338, granted June 12, 1917, for method of producing fuel gas. In high temperature furnaces such as those employed for metallurgical purposes, in which fuel oil is used, it is necessary in order to effectively secure and maintain the requisite high temperature, that the fuel oil be introduced into the combustion chamber not in the form of a spray, but in the form of a gas having already intermixed therewith the proper proportion of air necessary to effect complete combustion, and without excess of air, as distinguished from the introduction of the air and fuel oil separately without previous intermixture. The temperature of the furnace is dependent upon the temperature of combustion of the fuel supplied to it, and with any given fuel the temperature of combustion is dependent upon the initial temperature of the fuel previous to combustion and the exactness of the mixture chemically required to produce complete combustion. If air is admitted in a quantity in excess of that required for complete combustion, such excess air tends to cool or reduce the flame temperature. In the ordinary types of oil-burning furnaces oil as such is introduced in a liquid form directly into the combustion chamber or hearth, either in the form of a stream, as in the case of certain types of large furnaces, or in the form of a fine spray, as in the case of certain smaller furnaces—the vaporization and combustion in either case taking place within the combustion chamber, and in such furnaces the desired high temperature cannot be obtained either because the air supply is in excess of that actually required for perfect combustion, or because of the imperfect mixture of the air and oil and the consequent incomplete combustion of the fuel in the furnace. Moreover, in such furnaces there is no provision for forming a gaseous fuel containing the requisite elements for complete combustion and heating such fuel before its introduction into the furnace to the proper temperature to obtain the desired temperature of combustion.

My improved apparatus avoids the objections above mentioned, and provides for supplying to the combustion chamber a gaseous fuel containing in correct proportions the constituents necessary to effect complete combustion, and introducing such fuel into the furnace at the proper temperature.

In the accompanying drawings, which illustrate an apparatus embodying my invention,—

Fig. 1 is a perspective view of a heating furnace having my improved apparatus applied thereto;

Fig. 2 is a vertical section through the apparatus shown in Fig. 1;

Fig. 3 is a vertical section taken at line 3—3 of Fig. 2;

Fig. 4 is a longitudinal vertical, central section through the series of heating chambers through which the atmospheric air is forced and heated before mixing with the fuel oil.

Referring to the several figures of the drawings,—

A represents the combined combustion and heating chamber of an ordinary heating furnace such as is employed for certain metallurgical operations. B indicates the walls thereof, preferably of brick, as usual. C indicates the usual opening in the front wall of the furnace through which are passed the articles to be heated. D indicates an opening through the rear wall of the furnace into which projects the pipe that supplies the gaseous fuel to the chamber A. E indicates an opening in the upper wall for the escape of the burned gases. Mounted over the opening E is an air preheating device or heating chamber composed of a plurality of chamber sections F, F, F, placed one over another, as shown in Figs. 1, 2 and 4. All of these heating chamber sections are alike in construction, each being provided with a plurality of flues F′ so disposed that by turning adjoining sections end for end in assembling them the flues of adjoining sections will be staggered with relation to each other and the

spaces between the flues of the several sections will form a tortuous passage for the escaping gases, thereby better utilizing the waste heat to effectively heat the walls of the several sections F, as clearly shown in Fig. 4. This provides a very convenient construction, as all the chamber sections are made off the same pattern. The several sections F are secured together so as to be readily removable, thereby permitting any desired number to be used, for it will be understood that while three sections are shown in the construction illustrated, the number will be varied to suit different sizes of furnaces. In the construction shown, the several sections are secured together by bolts F'' shown in Fig. 4. The several sections are each provided with an air inlet and an air outlet, as also shown in Fig. 4, the inlet and outlet passages being at the opposite ends of the section, and the sections are connected in series so that the entering air traverses the several sections successively from end to end and thereby permits all the air that passes through the device to attain a substantially uniform temperature. This is an important consideration as in order that the apparatus may operate to the best advantage, the air must be uniformly heated so that when it comes in contact with the vaporized fuel oil, as hereinafter described, there will be no danger of premature ignition.

G indicates a pipe through which air is admitted to the sections F, it opening, as shown, into the upper one of such series of sections. The air so supplied is forced through the pipe under pressure by any suitable means (not shown), and receives heat by conduction through the walls of the heating chamber, as will be understood. H indicates a valve in the pipe G, by means of which the quantity of air passing through the pipe can be regulated or the supply shut off entirely.

J indicates a pipe connected to and opening into the lower heating chamber section F and passing through a suitable opening in the wall of the furnace where it is so connected to a vaporizing chamber K, as to deliver the heated air from the chamber sections F to the upper part of such vaporizing chamber. Also communicating with such vaporizing chamber K, near the upper end thereof is another pipe, indicated by M, of very considerably less diameter than the air-conducting pipes G and J, which pipe M is for conducting the fuel oil employed to the said vaporizing chamber K. N is a valve for controlling the flow of oil through the pipe. This vaporizing chamber is wholly outside of the furnace proper, and in the construction illustrated it is supported upon and at a short distance from the rear wall of the furnace, but it may be placed in any other suitable location. At its lower end it is in communication with the combustion chamber A through a pipe connection L that passes through a suitable opening D in the wall of the furnace into the combustion chamber.

The vaporizing chamber K, it will be noted, is constructed of approximately uniform area in cross-section from end to end, and is free from any obstacles that would tend to check the velocity of the fuel flowing therethrough. It is preferably tubular in form, and is provided with a series of bends, so that within a comparatively small space is provided a long circuitous passage for the fuel, which is necessary in order that the complete vaporization of the oil may be ensured before it reaches the combustion chamber. It will be observed also that at each of the bends I have provided short ledges or extensions P which are of special value in spreading the oil, particularly during the start of the operation of heating the furnace. At the time of such starting operation a small quantity of fuel oil will be allowed to flow down through the circuitous or winding passage of the vaporizing chamber, and in passing over such ledges or extensions it will be better mixed with the air and sprayed out into the combustion chamber so that it is readily ignited by a torch held in such combustion chamber. After the combustion has been thus started the burned gases rising from the chamber A through the exit opening E and flues F' will quickly heat the chamber sections F and the air that is being forced through such chamber sections F.

While the degree to which the air is preheated may vary, I have found that in practice, with an apparatus such as illustrated, most excellent results are attained by having it, as it leaves the heating chamber, at approximately 800 degrees Fahrenheit, and as it may be assumed that about one hundred degrees of this temperature will be lost or consumed by radiation and in the vaporizing of the oil, it will be seen that the mixture will be discharged from the open or nozzle end of the pipe L into the combustion chamber at approximately 700 degrees and hence is adapted for producing excellent heating effects. When the process is being carried on at the preferred preheated air temperature of 800 degrees above mentioned and with sufficient pressure on the air to give the desired velocity to the gaseous mixture at the nozzle, the heat carried by the air and the agitation created will cause substantially complete vaporization of the fuel oil in approximately one-tenth of a second, and also thoroughly mix the fuel oil vapor with the air. The agitation referred to is well attained by utilizing the pressure or flow of the air in connection with the indirect or

tortuous passage through the vaporizing chamber. The velocity with which the gaseous mixture is forced into the combustion chamber may vary according to the particular characteristics of the oil being used, for, as is well known, the speed of travel of flame propagation varies with different fuels. Using a gaseous mixture made from fuel oil, I have found that with such mixture heated to approximately 700 degrees F. a nozzle velocity of one hundred and fifty feet per second is approximately the minimum that can be used to prevent flame propagation in the direction of the source of supply of the gaseous mixture, but the velocity can be very considerably increased, if desired, without detrimental effects. To increase the velocity more pressure or power would be required to force a given quantity of gaseous fuel mixture through the discharge opening or nozzle-end of the pipe that leads from the mixing chamber to the combustion chamber. It is highly important to pass the air into the vaporizing chamber under such pressure or power as to ensure a sufficiently high velocity for the mixture as it approaches and enters the combustion chamber that it does not have time to absorb sufficient heat from furnace reflection or from the parts in close proximity to the combustion chamber that become heated, to rise in temperature to the temperature of ignition. This will be appreciated when it is borne in mind that with the gaseous mixture containing all the elements necessary for combustion and having approximately a temperature of 700 degrees, and 1050 degrees being approximately the temperature of ignition, it would only require a fraction of a second for the mixture to absorb enough additional heat to ignite when in close proximity to the excessively-heated combustion chamber unless the said high velocity is maintained.

That which I claim as my invention, and desire to secure by Letters Patent, is,—

1. An apparatus of the character described, comprising a furnace having a combustion chamber, a vaporizing chamber arranged to discharge into said combustion chamber, means for supplying said vaporizing chamber with air heated to a temperature high enough to substantially wholly vaporize fuel oil and for causing said air to flow through said vaporizing chamber at high velocity, and a fuel oil supply pipe discharging into said vaporizing chamber at a point remote from the outlet therefrom to the combustion chamber, for introducing fuel oil into the stream of air flowing through said vaporizing chamber, whereby the oil will be thoroughly intermixed with the air by the velocity of the latter, and substantially vaporized by the temperature of the heated air during the time it is associated therewith in the vaporizing chamber before discharge into the combustion chamber.

2. An apparatus of the character described comprising a furnace having a combustion chamber, means for heating air to a temperature high enough to substantially wholly vaporize fuel oil, a vaporizing chamber for vaporizing and thoroughly mixing fuel oil with such heated air before the admission thereof to the combustion chamber, substantially in the proper proportion to effect exact combustion, and means having an unobstructed discharge portion for delivering the mixture at high velocity to the combustion chamber.

3. An apparatus of the character described comprising a furnace having a combustion chamber provided with a discharge passage communicating directly therewith, means located in the path of the gases discharged through said passage for heating air to a temperature high enough to substantially wholly vaporize fuel oil, a vaporizing chamber for vaporizing and thoroughly mixing fuel oil with such heated air before the admission thereof to the combustion chamber, substantially in the proper proportion to effect exact combustion, and means having an unobstructed discharge portion for delivering the mixture at high velocity to the combustion chamber.

4. An apparatus of the character described, comprising a furnace having a combustion chamber, a vaporizing chamber arranged to discharge into said combustion chamber, said vaporizing chamber being in the form of a tortuous passage, means for supplying said vaporizing chamber with air heated to a temperature high enough to substantially wholly vaporize fuel oil and for causing said air to flow through said vaporizing chamber at high velocity, and a fuel oil supply pipe discharging into said vaporizing chamber for introducing fuel oil into the stream of air flowing through said vaporizing chamber.

5. An apparatus of the character described, comprising a furnace having a combustion chamber, a vaporizing chamber arranged to discharge into said combustion chamber, said vaporizing chamber being in the form of a tortuous passage of substantially uniform area in cross-section, means for supplying said vaporizing chamber with air heated to a temperature high enough to substantially wholly vaporize fuel oil and for causing said air to flow through said vaporizing chamber at high velocity, and a fuel oil supply pipe discharging into said vaporizing chamber for introducing fuel oil into the stream of air flowing through said vaporizing chamber.

6. An apparatus of the character described, comprising a furnace having a combustion chamber provided with a discharge

passage communicating directly therewith, means located in the path of the gases discharged through said passage for heating air to a temperature high enough to substantially wholly vaporize fuel oil, a vaporizing chamber through which such heated air passes at high velocity, means for supplying fuel oil to said vaporizing chamber at a point remote from the outlet therefrom to the combustion chamber, whereby the oil may be vaporized by and thoroughly intermixed with the heated air, substantially in the proper proportion to effect exact combustion, before the admission thereof to the combustion chamber, and means for delivering the mixture at high velocity to the combustion chamber.

MAX SKLOVSKY.