

Feb. 12, 1935.

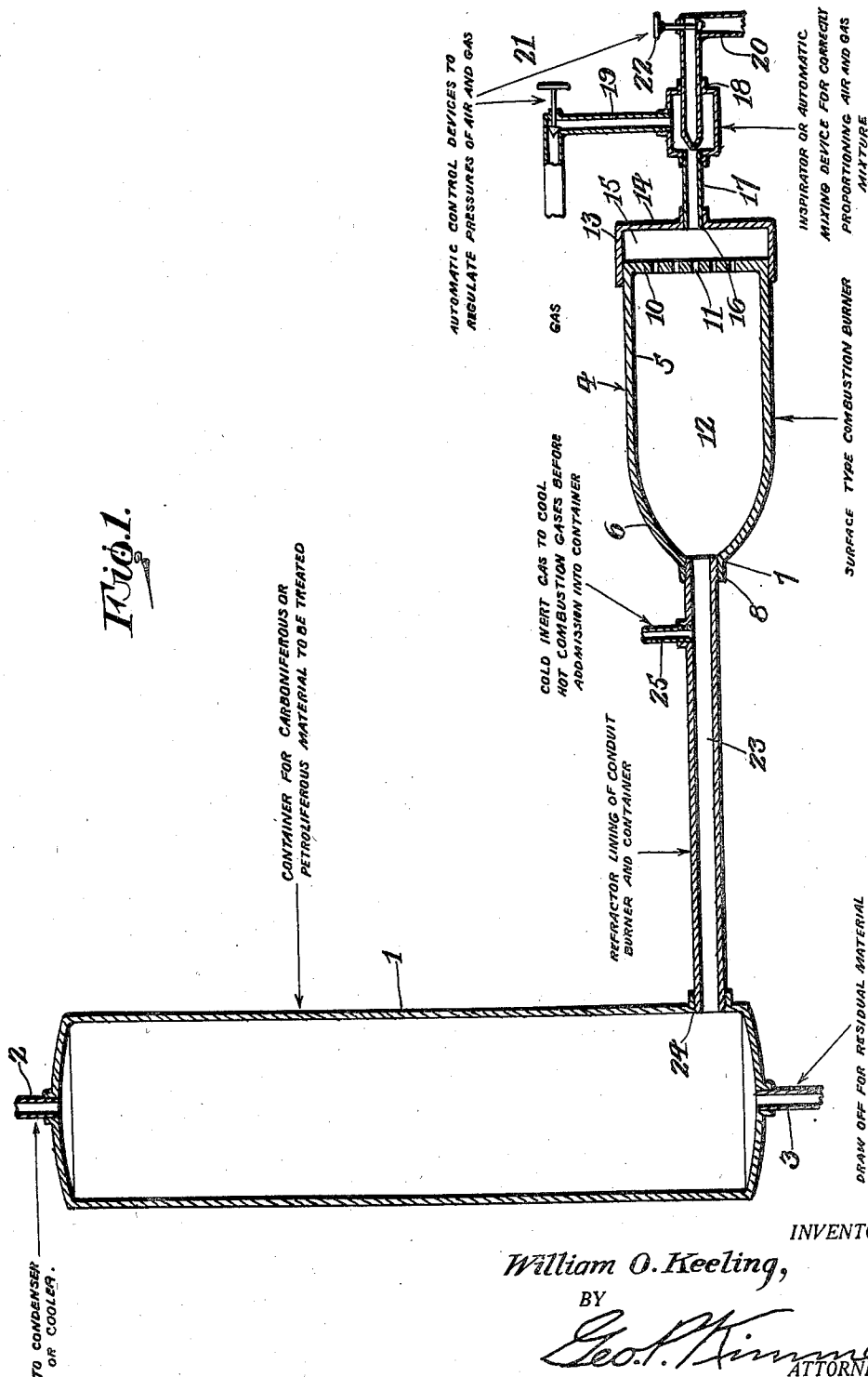
W. O. KEELING

1,990,697

APPARATUS FOR THE PYROLYTIC PROCESSING OF HYDROCARBONS

Filed June 7, 1929

2 Sheets-Sheet 1



Feb. 12, 1935.

W. O. KEELING

1,990,697

APPARATUS FOR THE PYROLYTIC PROCESSING OF HYDROCARBONS

Filed June 7, 1929.

2 Sheets-Sheet 2

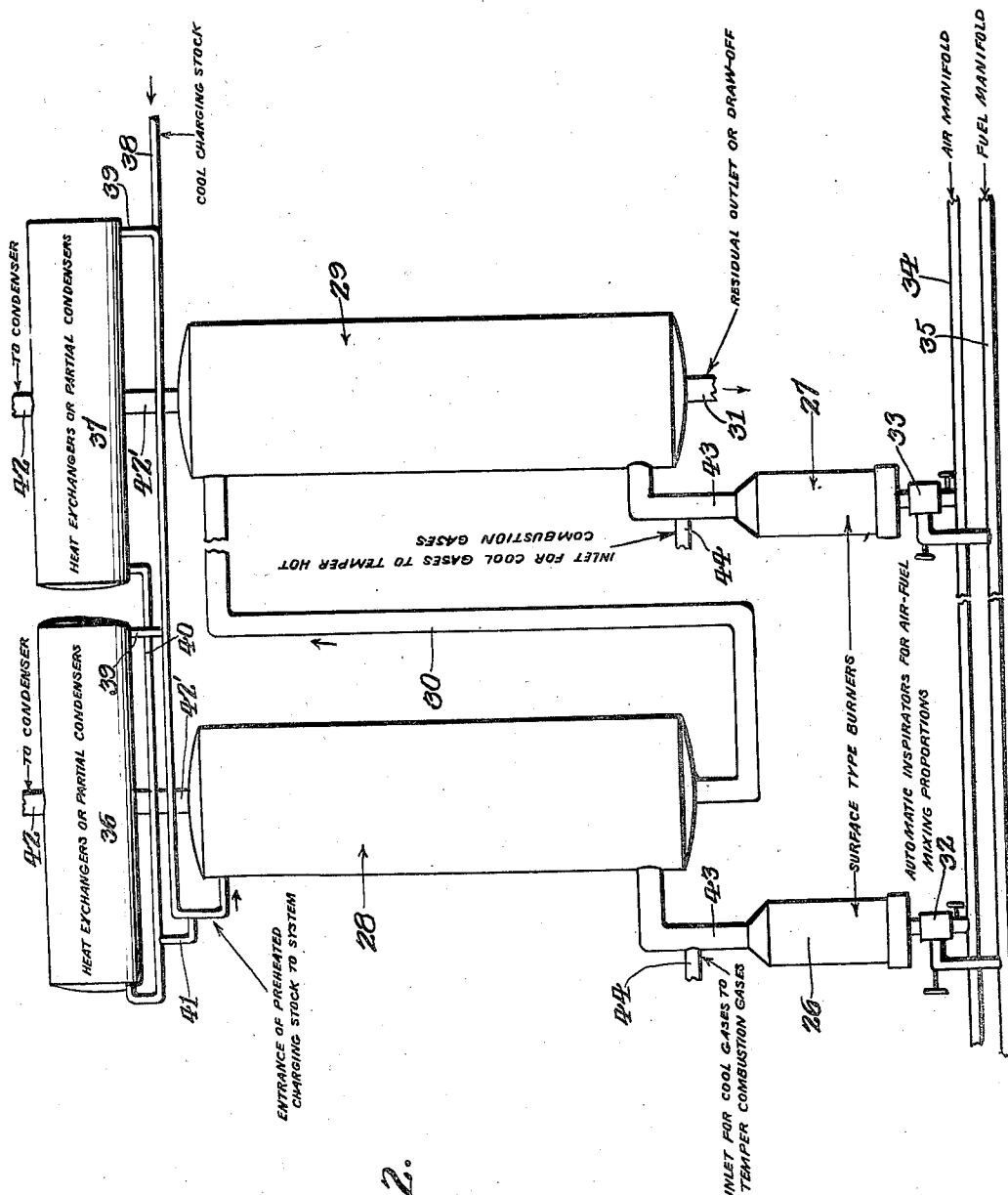


Fig. 2.

INVENTOR.

William O. Keeling,

BY

Geo. P. Kimmel,
ATTORNEY.

UNITED STATES PATENT OFFICE

1,990,697

APPARATUS FOR THE PYROLYTIC PROCESSING OF HYDROCARBONS

William O. Keeling, Independence, Mo.

Application June 7, 1929, Serial No. 369,174

2 Claims. (Cl. 196—106)

This invention relates to a means for the formation and utilization of hot combustion gases in connection with hydrocarbon cracking processes of the vapor phase type and for heating, distilling or cracking carboniferous and petroliferous material and the invention has for its object to provide, in a manner as hereinafter set forth, a surface type combustion burner device for positioning adjacent to and for communicating with the heating, distilling or cracking apparatus or system and so constructed and arranged whereby all the fuel is completely burned before any of the combustion gases are introduced into the apparatus or system; combustion takes place outside of the apparatus or system; no flame can ever come in contact with the material to be heated; no partially burned fuel or partly burned products of the fuel can come in contact with the material to be heated; and further whereby the products of combustion to be introduced into the system are carbon dioxide, water vapor, free nitrogen and which contains substantially zero percentage of free oxygen and carbon monoxide.

A further object of the invention is to provide, in a manner as hereinafter set forth, a surface type combustion burner device making available approximately one hundred percent of the heat content of the fuel.

A further object of the invention is to provide, in a manner as hereinafter set forth, a surface type combustion burner device arranged relative to the system whereby the products of combustion, discharged therefrom are directly co-mingled and contacted with the material to be heated thereby utilizing approximately one hundred percent of the heat energy of the fuel, resulting in a large saving in fuel cost.

A further object of the invention is to provide, in a manner as hereinafter set forth, a surface type combustion burner device whereby the hot gases therefrom may be used for heating only or for distillation, cracking, as well as any or all combinations of heating, distilling and cracking.

A further object of the invention is to provide, in a manner as hereinafter set forth, a new and novel means for heat application of hot combustion gases and with these latter diluted with cool inert gases before the hot combustion gases are introduced into the apparatus or system, under such conditions any temperature of the hot combustion gases up to approximately 3500° F., can be maintained, depending on the fuel used.

A further object of the invention is to provide, in a manner as hereinafter set forth, a surface type combustion burner device whereby the amount of air and fuel mixture admitted thereto is subject to instant and automatic control under such conditions that the quantity of heat introduced into the apparatus or system is also subject to instant and automatic control.

A further object of the invention is to provide, in a manner as hereinafter set forth, whereby the heat application to the material in the apparatus or system can be operated with the pressure in that part of the latter carrying the material above, below or at atmospheric pressure.

With the foregoing and other objects in view the invention consists of the novel construction and arrangement of surface type combustion burner device as hereinafter more specifically described and illustrated in the accompanying drawings, wherein is shown an embodiment of the invention, but it is to be understood that changes, variations and modifications can be resorted to which fall within the scope of the claims hereunto appended.

Figure 1 is a longitudinal sectional view of a surface type combustion burner device in accordance with this invention and showing the adaptation thereof in connection with a container carrying carboniferous or petroliferous material to be treated.

Figure 2 is a diagrammatical view illustrating the adaptation of a pair of surface type burner devices in accordance with this invention with respect to a system or apparatus employed for cracking, heating and distilling hydrocarbons and any combination of cracking, heating and distilling.

Referring to Figure 1 of the drawings 1 indicates a column, container or receptacle for carboniferous or petroliferous material to be treated. The upper end of the container 1 is provided with an outlet pipe 2 leading to a condenser or cooler not shown. The bottom of the container 1 is provided with a draw off pipe 3 for residual material, such as coke or the like.

The surface type burner is indicated generally at 4 and which includes an annular part 5 of uniform diameter and a tapered part 6 extended from one end of the part 5. The tapered part 6 at its free end is formed with an opening 7 and a collar 8 forming a continuation of opening 7. The inner face of collar 8 and the wall of the opening 7 is threaded. The other end of the part 4 merges into a head member 10 provided with a series of spaced ports 11. The parts 5, 6 and head member 10 provide a combustion chamber 12.

Mounted on the outer periphery of the part 5 and projecting rearwardly therefrom is an annular cap member 13 having its rear end 14 spaced from the head piece 10 to provide a fuel receiving chamber 15. The rear end 14 of the receptacle 13 has a central opening 16 to the wall of which is connected a fuel supply pipe 17 leading from an inspirator or automatic mixing device 18. Communicating with the device 18 is a gas feed pipe 19 and an air supply pipe 20 and said pipes have automatic control devices 21, 22 respectively to regulate the pressure of gas and air respective-

ly. The inspirator or automatic mixing device 18 is for correctly proportioning the air and gas mixture which when combined provides the fuel discharging into the receiving chamber 15 and from there it passes through ports 11 into the combustion chamber 12 and burned. The hot combustion gases pass from the chamber 12 through a conducting pipe 23 secured to the wall of opening 7 and collar 8 and opening into combustion chamber 12. The pipe 23 is connected to the container 1, as at 24 and opens into the lower portion of container 1. The burner element 4 and conducting pipe 23 are provided with a lining of refractory material.

Opening into the conducting pipe 23, in advance of the part 6 of the burner element 4 is a supply line 25 which is employed for conducting cold inert gas to the pipe 23 to cool the hot combustion gases before the admission thereof to the container 1.

There is illustrated in Figure 2 an apparatus or system for cracking, heating or distilling hydrocarbons and utilizing therewith a plurality of surface type combustion burner devices in accordance with this invention. The burner devices are indicated generally at 26, 27 and each is constructed in the same manner as the burner device shown in Figure 1. In Figure 2 the burner devices are disposed vertically whereas in Figure 1 the burner device is arranged horizontally.

In Figure 2 a pair of containers or columns for the material being treated are indicated at 28 and 29 in communication with each other by a conducting pipe 30 which leads from the lower end of container 28 and opens into the top of container 29. Burner devices 26, 27 open respectively in the lower portions of containers 28, 29. Container 29 has a residual material outlet 31. Automatic inspirators 32, 33 for air and fuel communicate respectively with burner devices 26, 27. Air and fuel feed lines or manifolds 34, 35 respectively are common to the inspirators.

Communicating heat exchangers or partial condensers 36, 37 are arranged above the containers. A charging line for cool oil stock to be treated is indicated at 38 and has branches 39 opening into the heat exchangers. The line 38 opens into container 28. A conducting pipe 40 establishes communication between the heat exchangers and has a branch 41 leading to line 38. Extending from the heat exchangers to condensers not shown are conducting pipes 42, and extending from containers 28, 29 to the heat exchangers are vapor conductor pipes 42'.

The burner devices 26, 27 are constructed the same as the burner device shown in Figure 1, therefore each includes a conducting pipe 43 corresponding to pipe 23 and a supply line 44 for cool inert gas corresponding to line 25.

In order to regulate the temperature of the hot combustion gases to be introduced to the system or apparatus, it will be necessary to commingle the hot combustion gases direct from the burner with some cold inert gas, because the temperature of the hot combustion gases direct from the burner may reach a temperature of approximately 3500° F., depending on the nature of the fuel. The direct contact of the hot combustion gases at this temperature with carboniferous or petroliferous material would result in complete decomposition of the latter, which is a thing to be avoided.

Among the advantages of heat application in accordance with this invention are that all of the fuel is completely burned before any of the

combustion gases are introduced into the apparatus or system; that combustion takes place outside of the apparatus or system proper; that no flame can ever come in contact with material to be heated; that no partly burned fuel or partly burned products of the fuel can ever come in contact with the material to be heated; that the products of combustion to be introduced into the apparatus or system are carbon dioxide, water vapor, free nitrogen and contains substantially zero percentage of free oxygen and carbon monoxide; that approximately theoretical proportions of air and fuel are necessary, resulting in making available approximately one hundred percent of the heat content of the fuel; that since the products of combustion are directly commingled and contacted with the material to be heated approximately one hundred percent of the heat energy of the fuel can be utilized, resulting in a large saving in fuel cost; that since products of combustion may be diluted with relatively cool inert gases before being introduced into the container containing the material to be heated, any temperature up to approximately 3500° F., can be maintained, depending on the fuel used; that since the amount of air-fuel mixture admitted to a surface type combustion burner is subject to instant and automatic control the quantity of heat introduced into a container is also subject to instant and automatic control; that since the temperature of the combustion gases introduced into a container may vary up to 3500° F., these gases may be used then for heating only, distillation, cracking, as well as any or all combinations of heating, distillation and cracking and by this method of heating can be operated with the pressure in the container either above or below atmospheric pressure.

It is thought the many advantages of a surface type combustion burner device in accordance with this invention can be readily understood, and although the preferred embodiment thereof is as illustrated and described, yet it is to be understood that changes in the details of construction can be had which fall within the scope of the invention as claimed.

What I claim is:

1. An apparatus of the character described comprising in combination a plurality of surface combustion burners, having mixing chambers, air supply pipes entering said chambers, fuel supply pipes adapted to deliver fuel to said chambers whereby to form an explosive fuel and air mixture in the respective chambers, pressure control means interposed in said respective air and fuel pipes, pipes for delivering said mixtures to the respective burners for combustion to form incandescent gas substantially devoid of free oxygen, a plurality of containers, conduits for delivering said incandescent gases into respective containers, an inlet to one of said containers for the material to be processed, ducts for conducting the non-volatile material processed in one container to the adjoining container whereby the material to be processed is adapted to pass through said containers in succession and is subjected to pyrolytic treatment by said gases in the successive containers.

2. An apparatus as in claim 1 wherein said conduits are provided with respective communicating pipes for the introduction of a cooler inert gas thereinto to govern the temperature of said incandescent gases.

WILLIAM O. KEELING.