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C. F. RUBY.

APPARATUS FOR CONTROLLING TEMPERATURE OF SUBSTANCES TO BE HEATED.

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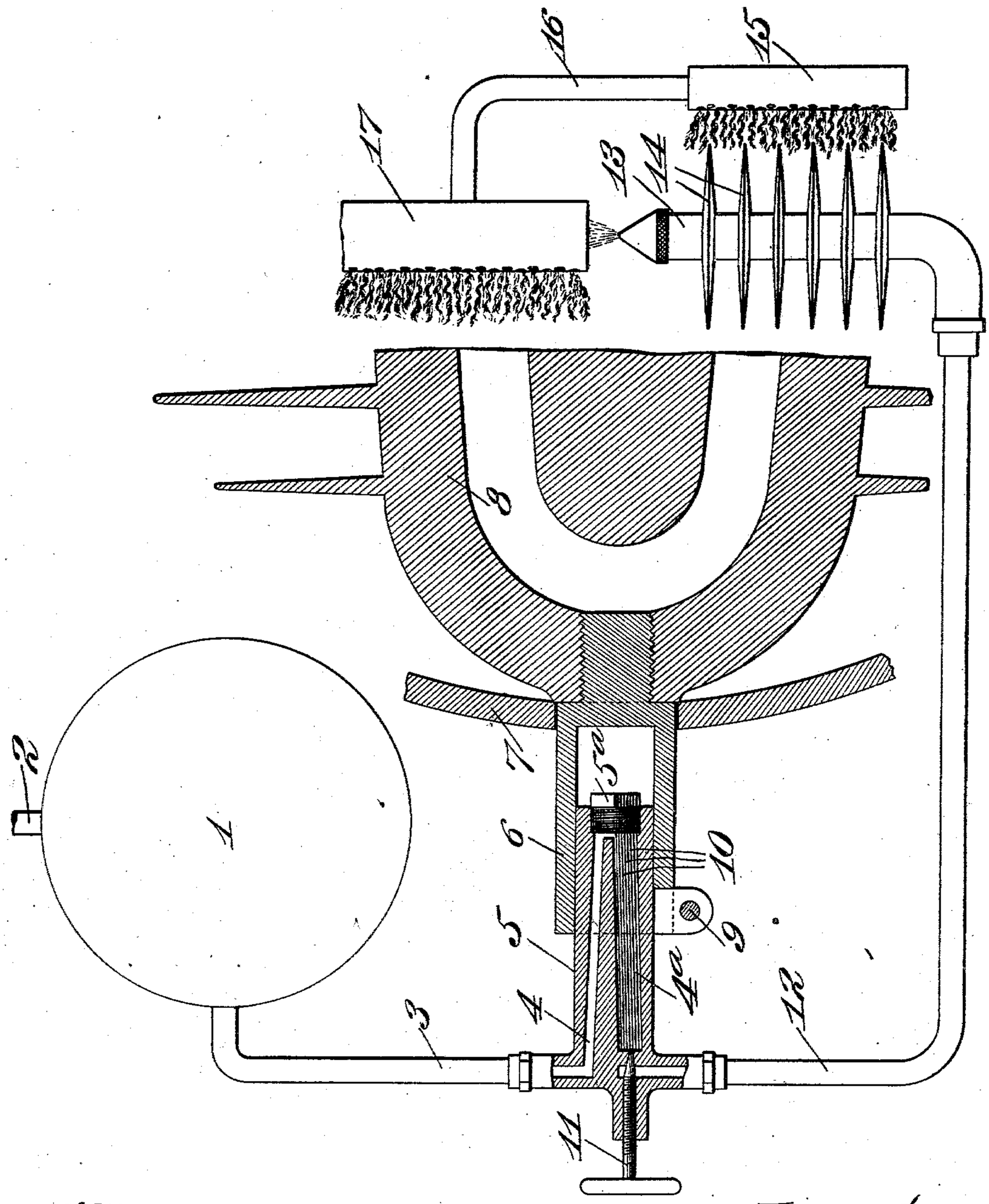
NO MODEL.



Witnesses:
G. A. Pennington
Ralph Kalisch

Inventor:
Chas. F. Ruby,
by Bakewell & Cornwall
Attys.

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UNITED STATES PATENT OFFICE.

CHARLES F. RUBY, OF ST. LOUIS, MISSOURI, ASSIGNOR TO MISSOURI LOCOVOLO COMPANY, OF ST. LOUIS, MISSOURI, A CORPORATION OF MISSOURI.

APPARATUS FOR CONTROLLING TEMPERATURE OF SUBSTANCES TO BE HEATED.

SPECIFICATION forming part of Letters Patent No. 740,472, dated October 6, 1903.

Application filed September 19, 1902. Serial No. 124,101. (No model.)

To all whom it may concern:

Be it known that I, CHARLES F. RUBY, a subject of the Emperor of Austria-Hungary, residing at St. Louis, Missouri, have invented a certain new and useful Improvement in Apparatus for Controlling Temperature of Substances to be Heated, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawing, forming part of this specification.

This invention relates to a new and useful improvement in apparatus for controlling temperature of substances to be heated by liquid-fuel burners, an object being to regulate the supply of fuel to the burner directly by the temperature of the part or mass being heated and in such a manner as to dispense with moving parts, the temperature of the part being heated being allowed to act directly on the liquid fuel.

Another object is to simplify the construction of devices of this character and to so arrange the parts that when the burner is once ignited it will be self-regulating without requiring adjustment or further attention on the part of the operator. Heretofore thermostats have been relied upon to effect such regulation; but by the use of my invention thermostats are entirely dispensed with.

The principles upon which my present invention operates can be briefly described as follows: Liquid fuel under pressure, which may be gravity-pressure, is admitted to a vaporizing-chamber, which chamber, as is obvious, is subject to the action of heat, so as to vaporize the liquid fuel therein when the heat is sufficient for that purpose. This "vaporizing-chamber," as it is termed, is connected by a pipe to the main burner, which is located at some convenient point in the steam-generator for generating the heat to convert water into steam. The nozzle which supplies the main burner with the gaseous fuel is at all times in the operation of the device maintained at such temperature that should the liquid fuel pass the vaporizing-chamber referred to and enter the nozzle in a liquid state the "auxiliary" burner, as it might be termed, will at or near the nozzle convert the liquid fuel into vapor, so that the fuel will be discharged from the nozzle of the main burner in the form of vapor. Thus we have the following cardinal features: first, a source of supply of liquid fuel under pressure; second, a vaporizing-chamber, which may or may not vaporize the liquid fuel therein, depending upon the temperature of said chamber; third, a discharge-opening leading from said chamber, which opening can be regulated manually for the purpose of controlling the flame of the main burner; fourth, a mixing arrangement for directing a combustible mixture into the main burner; fifth, an auxiliary burner for converting any unvaporized fuel into vapor at or near the point of discharge of the nozzle, and, sixth, a connection between the main burner and the auxiliary burner for supplying fuel to the latter.

In the drawing I have shown my invention in diagrammatic form for the purpose of more clearly illustrating the principles of operation thereof, and in which—

1 indicates a tank containing a supply of liquid fuel, into the top of which tank leads a pipe 2, preferably from some suitable source of compressed-air supply, for the purpose of admitting pressure onto the surface of the liquid fuel in tank 1.

3 indicates a pipe for conducting the liquid fuel from tank 1 into what I will term a "vaporizing-chamber" 4. This vaporizing-chamber is a passage formed in a plug 5, which plug preferably projects into a receiving-boss 6, extending exteriorly the wall 7 of the boiler, said receiving-boss having a threaded stem which is screwed or otherwise secured in the wall of a flash-converter 8. This so-called "flash-converter" is arranged in the combustion-chamber and is provided with appropriate passages for the water, which water is converted or flashed into steam in a well-known manner. The plug 5 referred to may be adjusted in and out of the receiving-boss 6 and held in its adjusted position by means of a clamping-screw 9, passing through ears extending from the receiving-boss 6. Plug 5 is formed with receiving-chamber 4 and a discharge-chamber 4^a, in which latter are located

a series of wires 10, preferably composed of metal of high conductivity and whose office is to cause the fuel passing through the chamber 4^a to be broken up or distributed and subjected to the action of heat uniformly, so as to vaporize the liquid fuel, if the fuel is in this state upon entering into the chamber 4^a, into gas. For manufacturing purposes the plug 5 is bored from its inner end to form the chambers 4 and 4^a, after which a screw-plug 5^a is inserted to form the inner end wall of said chambers.

11 indicates a valve, preferably a needle-valve, for controlling the discharge-opening from the chamber 4^a. This discharge-opening from chamber 4^a leads into a pipe 12, located exteriorly the combustion-chamber, which pipe connects with and supplies fuel to a nozzle 13, said nozzle being preferably located near the combustion-chamber of the generator. This nozzle 13 is preferably formed with flanges 14, lying in proximity to the heat of an auxiliary burner 15. Auxiliary burner 15 is supplied with fuel by means of a pipe 16 leading from the main burner 17, which main burner is located in the combustion-chamber of the generator. Both burners 15 and 17 are preferably filled with refractory material, and upon the gaseous fuel being forced from the nozzle 13 into the main burner 17 the oxygen to support combustion is induced to flow into the main burner and become thoroughly mixed with the gaseous fuel, after which the commingled air and gas escape through perforations in the walls of the main burner and burn along the exterior of said walls, as shown. Part of the mixed air and gas in the main burner 17 is conducted, by means of the pipe 16, to the auxiliary burner 15 and upon ignition will burn upon issuing through the openings in the walls of said auxiliary burner.

The operation of my improved regulating device is as follows: The heat from the main burner 17 will generate the steam in the flash-converter 8. Said converter upon becoming heated will by conductivity impart considerable heat to the receiving-boss 6, which is directly connected thereto. Depending upon the extent to which the plug 5 is introduced into the receiving-boss, said plug will become more or less heated from a given temperature of the flash-converter. Assuming that the valve 11 is properly adjusted and that the plug 5 is introduced into the receiving-boss the desired distance, so that the plug 5 will become heated properly from a given heat in the flash-converter, the liquid fuel from the source of fuel-supply will upon its entry into the vaporizing-chamber 4 be converted into vapor. If not converted into vapor in chamber 4, the liquid fuel in passing through the numerous small passages from the chamber 4^a will have a better opportunity to become vaporized. In discharging through the opening controlled by the valve 11 it follows that only a certain amount of vapor can escape through said opening, and consequently that amount only will be supplied to the nozzle 13. The main burner will under these circumstances burn with what might be termed a "small" flame, because but a limited quantity of fuel is supplied thereto. Assuming that this flame is insufficient to heat the flash-converter, the receiving-boss 6, and the plug 5 to such temperature as will convert the liquid fuel into gas in the vaporizing-chamber, it follows that in a short while liquid fuel, partly vaporized, will flow past the valve 11 into a pipe 12 and be delivered to the nozzle 13. At this point the auxiliary burner will be sufficient to vaporize the unconverted liquid fuel before its discharge into the main burner, and consequently the liquid fuel reaching the nozzle 13 will produce an increased quantity of vapor or gas for discharge into the main burner. As the temperature of the flash-converter and the vaporizing-chamber is further reduced, so that no liquid fuel is vaporized in the vaporizing-chamber, it follows that a greater supply of gas or vaporized fuel will be generated in the nozzle 13 and discharged into the main burner. The main burner controls the flame of the auxiliary burner, and consequently the auxiliary burner is sensitive to all changes in the main burner. While it might take considerable time for the main burner to increase the temperature in the vaporizing-chamber to such an extent that the liquid fuel would be vaporized therein, (instead of in the nozzle 13,) during all of this time the main burner is practically running full force—that is, the liquid fuel being vaporized in the nozzle 13 will immediately be discharged into the main burner. As soon as the temperature in the flash-converter reaches or exceeds the desired maximum the vaporizing-chamber will affect the liquid fuel passing therethrough and convert more or less of said fuel into vapor, so that in passing beyond the valve 11, which valve remains in its original position, less fuel in the form of gas will be supplied to the nozzle 13 than was the case where the liquid fuel passed through the opening controlled by valve 11. It is estimated that the volume of liquid fuel as compared to the vapor into which it may be converted is about one to twenty. Consequently under the most efficient method of operating the device if liquid fuel had passed through the opening controlled by valve 11 and had succeeded upon its combustion in raising the temperature of the flash-converter to the desired maximum wherein the liquid fuel was converted into vapor in the vaporizing-chamber such vapor passing through the opening controlled by valve 11 would be equivalent to about one-twentieth of the value of fuel passing through said opening in a liquid state. Thus when the flash-converter is heated to the maximum it will vaporize the fuel before it reaches the small opening controlled by valve 11 and a reduced quantity of fuel will

be supplied to the nozzle 13. Under these conditions it is obvious that the main burner would be immediately reduced to a small flame, which would continue as long as the liquid fuel was vaporized in the vaporizing-chamber. As soon as the temperature in the flash-converter was reduced, so as to permit liquid fuel in whole or in part to pass the opening controlled by valve 11, then the flame of the main burner would build up.

It is obvious from the above that while the two extreme conditions have been referred to—to wit, that wherein vapor alone passed through the opening controlled by valve 11, as when the flash-converter was at a high temperature and it was desired to reduce the heat generated by the main burner, and where liquid fuel alone passed through the opening controlled by valve 11, as when the flash-converter was at a low temperature and it was desired that the main burner operate to its full capacity—it follows that the intermediate stages will control the main burner and render the same extremely sensitive, depending upon the proportion of liquid fuel with relation to the vapor passing conjointly through the opening controlled by the valve 11.

While I have in the drawing shown details of construction embodying the introduction of the receiving-boss into the flash-converter and plug introduced into said receiving-boss, it will be understood that while this construction is desirable in many cases it is not absolutely necessary, as the vaporizing-chamber may be partly or wholly introduced into the flash-converter. The needle-valve may be dispensed with and a passage of suitable capacity substituted.

I do not in this application claim the method of controlling temperature as herein described, as the same forms the subject-matter of a separate application filed by me July 28, 1902, serially numbered 117,301.

I am aware that many minor changes in the construction, arrangement, and combination of the several parts of my device can be made and substituted for those herein shown and described without in the least departing from the nature and principle of my invention.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The herein-described means for controlling the temperature of substances being heated by a liquid-fuel burner comprising the combination, of a fuel-burner, a vaporizing-chamber, a source of fuel-supply leading into the vaporizing-chamber, having a contracted discharge-opening, means for applying heat to the fuel at or near its point of discharge into the burner, and means for heating the vaporizing-chamber from the substance being heated; substantially as described.

2. The combination, of a main fuel-burner, an auxiliary burner, a nozzle for discharging fuel into the main burner, said nozzle being heated by the auxiliary burner, a source of liquid-fuel supply, a vaporizing-chamber into which the liquid fuel is received from said source of supply, said chamber having a contracted discharge-opening, a pipe connecting said contracted discharge-opening to the aforesaid nozzle, and means for heating the vaporizing-chamber from the substance being heated; substantially as described.

3. The combination, of a main burner, an auxiliary burner supplied from the main burner, a nozzle for discharging fuel into the main burner, said nozzle being heated by said auxiliary burner, a source of fuel-supply, a vaporizing-chamber, said vaporizing-chamber having a contracted discharge-opening, a valve for controlling said discharge-opening, and a pipe leading from said discharge-opening to said nozzle; substantially as described.

4. The combination with a burner, of a nozzle discharging fuel into said burner, a source of fuel-supply, a vaporizing-chamber in the form of an adjustable plug 5, having a contracted discharge-opening, means in said chamber for effecting a diffusion of the liquid or gas passing therethrough, a valve for controlling said contracted opening, and a pipe leading from the discharge-opening from the vaporizing-chamber to the nozzle; substantially as described.

In testimony whereof I hereunto affix my signature, in the presence of two witnesses, this 16th day of September, 1902.

CHARLES F. RUBY.

Witnesses:
GEORGE BAKEWELL,
G. A. PENNINGTON.