No. 737,026. PATENTED AUG. 25, 1903.

C. F. RUBY.

FEED WATER HEATER.

APPLICATION FILED OCT. 31, 1902.

NO MODEL.

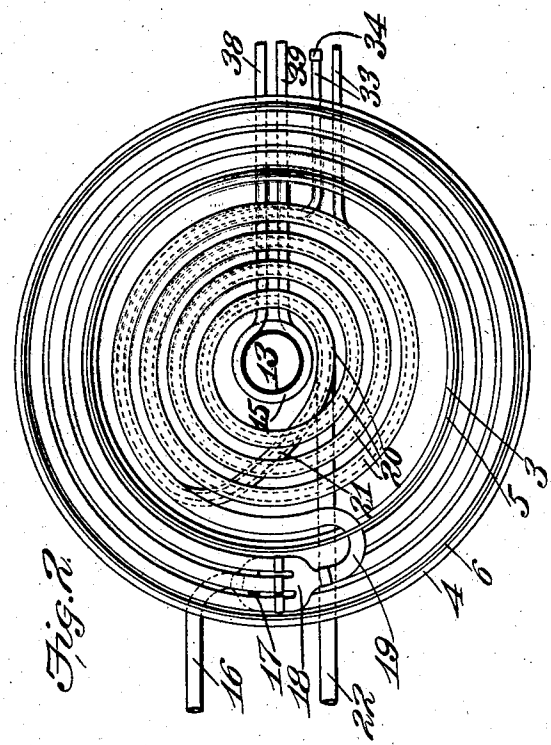


Fig. 2.

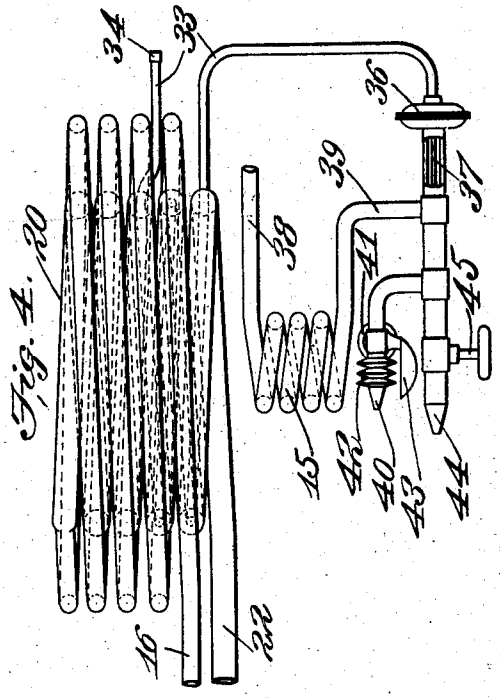


Fig. 4.

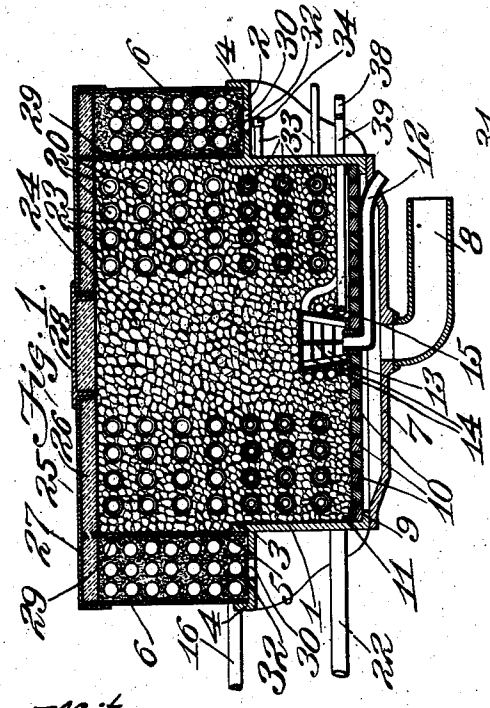


Fig. 1.

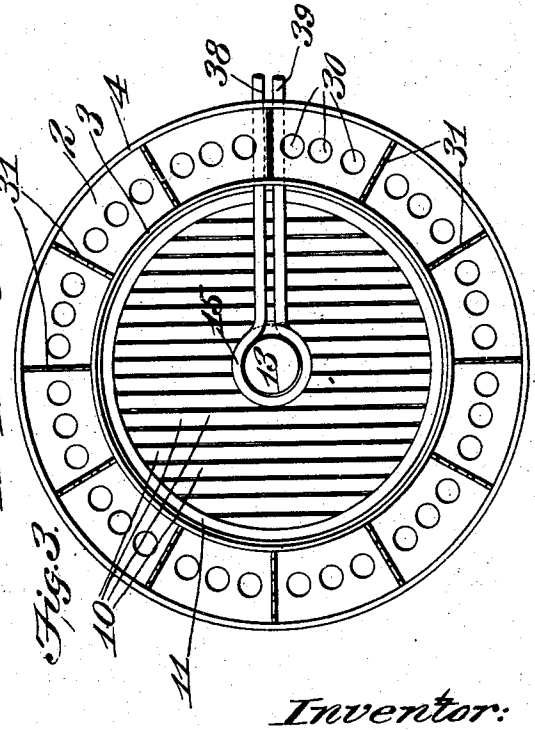


Fig. 3.

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 737,026. Patented August 25, 1903.

UNITED STATES PATENT OFFICE.

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

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 737,026, dated August 25, 1903.

Application filed October 31, 1902. Serial No. 129,578. (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 Feed-Water Heaters, 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 drawings, forming part of this specification, in which—

Figure 1 is a vertical sectional view through a steam-generator with my improved feed-water heater applied thereto. Fig. 2 is a top plan view of the same, the cover being removed to more clearly show the arrangement of the coils inside. Fig. 3 is a similar view with some of the coils removed to more clearly show the construction of the burner, and Fig. 4 is a diagrammatic view showing the arrangement of the coils.

This invention relates to a new and useful improvement in feed-water heaters designed especially for use in connection with steam-generators of the "flash-boiler" type, such as shown and described in applications serially numbered 111,933 and 124,100, filed by me June 16, 1902, and September 19, 1902, respectively.

My invention consists in the construction, arrangement, and combination of the several parts, all as will hereinafter be described and afterward pointed out in the claims.

In the drawings, 1 indicates a shell or housing which is provided with an outwardly-extending perforated flange 2 at its upper end, said flange having concentric ribs or lips 3 and 4, with which coöperate bands 5 and 6, the latter forming an outer inclosing shell.

7 indicates a bottom casting, which is preferably dished, as shown, and to which is connected a pipe 8, said pipe receiving the blast-nozzle which emits the gaseous fuel, as is well understood.

9 indicates an inturned flange on casting 1, which flange supports a series of bars 10. These bars are arranged side by side and parallel to each other with a narrow space between them, said space being preferably produced by nicking the adjacent faces or corners of the bars or otherwise, as by the use of spacers. A ring 11, secured to the inner face of casting 1, serves to hold the burner-bars against displacement.

12 indicates the inleading-duct for the pilot-burner, the inner end of said duct terminating in a burner 13. This burner preferably consists of a series of rings or bands arranged close together and supported by interiorly-arranged ribs 14. The flame from this pilot-burner is intended to burn on the outside thereof, and in starting the device this pilot-burner is first lighted, so as to heat a vaporizing-coil 15, wound about the same. When the liquid fuel is converted into gas in this vaporizing-coil, the main burner is ignited.

The water to be heated is led through a pipe 16 and into a manifold 17, from which manifold leads a series of pipes arranged side by side, three being shown in the drawings, which pipes are coiled in the space between the bands 5 and 6, their upper ends near the top of said space entering a manifold 18, from which leads a connecting-pipe 19 to a spiral coil 20. This spiral coil is the upper one of a series of such coils, which series is formed, preferably, of a single pipe wound about in spiral form until near the center, when said pipe is carried outwardly, as at 21, to the commencement of the large turn of the next coil immediately beneath. In this manner the coils constituting this series are all connected so that the water travels approximately in the same direction, entering each coil at the largest bend thereof. It is obvious, however, that instead of the particular arrangement above described the coils can be so constructed as to cause the water to travel in opposite directions in different coils. Other changes in the arrangement of the coils might also be made, and therefore I do not wish to limit my invention to any particular arrangement, except as such limitations may appear in the claims. The water entering in the heating-coils will pass into the converting-coils 20 practically at the coolest part of the combustion-chamber, the water descending in the converting-coils until it is converted into steam, the steam being led off through a pipe 22, which

is connected to the terminal of the lowest converting-coil. In order to cause the water in the converting-coils to travel in other than a straight path, I insert in said coil a coiled wire 23. The shape of this wire 23 is substantially that of a coiled spring stretched somewhat, so as to increase the pitch thereof, whereby the water in passing through the pipe containing such coiled wire will have imparted to it a swirling motion. I prefer to arrange this coiled wire 23 throughout the length of the converting-coils, said wire being introduced into position before the pipe is bent to form said coils.

To maintain a uniform heat in the generator, I prefer to introduce some refractory material around the converting-coils, which refractory material becomes highly heated. This refractory material is preferably magnesite, which is broken up into small particles, so as to form connected air-spaces throughout the entire chamber. This magnesite is indicated at 24.

25 indicates a cover, which is preferably made up of asbestos 26, having an outer protecting-shell 27.

28 indicates a removable door which enables access to be gained to the interior of the shell. When it is desired to light the pilot-burner, this door is opened when the chamber has become partially filled with gas and the gas ignited, when the flame will ultimately confine itself close to the sides of the burner. When gas is admitted through the main burner, it passes up through the openings between the burner-bars and may be ignited from the pilot-burner or through the door 28. The gas in the main burner is ignited in the bottom part of the chamber and forms practically a solid fire-floor, the products of combustion passing upwardly through the interstices or connected openings formed by particles of refractory material. This refractory material becomes highly heated, retaining the heat for a considerable period of time and imparting a high heat to the converting-coils. The products of combustion pass through openings 29, formed in the upper end of the band 5, thence around the heating-coils and downwardly through escape-openings 30 in the flange 2. The heating-coils referred to after being placed in position have packed around them some heating medium of high conductivity—such, for instance, as brass or copper chips. In this manner the direct escape of the products of combustion from openings 29 to openings 30 is interrupted and the heat is absorbed by the great surface present in the granulated metal or conductive material and is caused to be diffused throughout the chamber containing the heating-coils. To properly space these heating-coils, notched radial ribs 31 may be provided on the upper face of flange 2, as shown in Fig. 3. To prevent the escape of the chips or granulated metal through the openings 30, said openings may be covered by wire-gauze 32.

In order to regulate the temperature of the generator, I introduce a pipe 33 into the converting-coils and preferably inside of the coiled wire 23. This "expansion-pipe," as it might be termed, is closed at one end by a plug 34, the other end of said pipe leading down behind a diaphragm in a casing 36. This diaphragm coöperates with a spring-pressed valve-stem 37, whose valve controls the supply of gas from the coil 15 to nozzles leading to the pilot and main burners. The object of plugging up one end of coil 33 is to enable the introduction of some suitable liquid or gas in said coil which will entirely fill the same, and the expansion of this liquid and its gases are relied upon to operate the diaphragm in the casing 36.

The liquid fuel from any suitable source of supply is led to the vaporizing-coil through a pipe 38, and when converted into vapor the vapor is led from said coil through a pipe 39, the exit from said pipe to the main and pilot burners being controlled by the valve on the diaphragm-operated stem 37.

40 indicates a nozzle leading to the pilot-burner, which nozzle is controlled by a valve 41 and is preferably provided with heating pins or flanges 42 over a fuel-pan 43, into which liquid fuel is placed and ignited in starting the pilot-burner, as is well understood.

44 indicates a nozzle leading to the main burner, which nozzle is controlled by a valve 45.

In the following claims for the sake of distinction I will refer to the chamber in which the water is flashed into steam as the "converting-chamber." The refractory material used provides a series of connected air-spaces in which combustion occurs, the products of combustion passing off through the said air-spaces, and for purposes of distinction these spaces may be termed "interstices."

The comminuted metal referred to is preferably in the form of turnings, as described, in which event the products of combustion escaping from the granulated material may readily pass through the turnings, as the openings between the turnings are of larger size, and the passages for the products of combustion are thus increased. However, the comminuted metal may be in other forms, such as granulated metal, and therefore I do not wish my invention to be limited to the use of said turnings.

It will be observed that the cold water enters at the coolest portion of the generator and when converted into steam leaves the hottest portion of said generator. This I deem an advantage.

In generators of the type shown in Fig. 1 which I have used the products of combustion passing through the openings 30 are practically at atmospheric temperature, which

indicates that all or nearly all of the heat units generated in the combustion-chamber have been absorbed. Furthermore, the openings being arranged as shown are not subject to influences of wind or other external conditions tending to impair or interfere with the normal operation of the generator.

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 combination with a combustion-chamber, of a converter arranged therein, a feed-water heater communicating with said converter, heat-conducting particles of material in said chamber and in thermal contact with each other and with said feed-water heater, and a burner in the combustion-chamber opposite the said feed-water heater; substantially as described.

2. The combination with a combustion-chamber, of a burner arranged at one end thereof, a converter arranged in proximity to said burner, a coiled feed-water pipe arranged in the opposite end of said chamber and communicating with said converter and heat-conducting particles of material in thermal contact with each other and with said feed-water heater; substantially as described.

3. The combination with a combustion-chamber, of a converter arranged therein, a feed-water heater arranged exteriorly to said combustion-chamber and connected to said converter and heat-conducting particles of material in thermal contact with each other and with said feed-water heater; substantially as described.

4. The combination with a combustion-chamber, of a steam-converter arranged therein, and feed-water-heating coils arranged exteriorly to said combustion-chamber, said heating-coils being connected at their ends to manifolds; substantially as described.

5. The combination with a combustion-chamber, of a steam-converter arranged therein, series of feed-water-heating coils arranged exteriorly to the combustion-chamber, manifolds at the ends of said heating-coils, a supply-pipe leading into the manifold at the lower ends of said heating-coils, and a connection between the manifold at the upper ends of said series of heating-coils and the upper portion of the steam-converter in the combustion-chamber; substantially as described.

6. The combination with shells forming the combustion-chamber and an auxiliary chamber encircling said combustion-chamber, of a steam-converter in the combustion-chamber, feed-water-heating coils in the auxiliary chamber for initially heating the water before it is admitted to the converter and heat-conducting particles of material in thermal contact with each other and with said feed-water heater; substantially as described.

7. The combination with a chamber through which pass products of combustion, of a feed-water heater arranged in said chamber, and comminuted material in said chamber around the feed-water heater for absorbing heat from the products of combustion and transmitting it to the feed-water heater; substantially as described.

8. The combination with a combustion-chamber, of a chamber communicating therewith, a feed-water heater in said last-mentioned chamber, and heat-conducting particles of material in said chamber and in thermal contact with each other and with said feed-water heater; substantially as described.

9. The combination with a chamber, of a feed-water-heating coil arranged therein, metallic turnings packed about said heating-coil, and means for forcing the products of combustion through said metallic turnings; substantially as described.

In testimony whereof I hereunto affix my signature, in the presence of two witnesses, this 28th day of October, 1902.

CHARLES F. RUBY.

Witnesses:
GEORGE BAKEWELL,
RALPH KALISH.