C. W. TODD.

STEAM BOILER.

APPLICATION FILED JUNE 8, 1910.

986,876.

Patented Mar. 14, 1911.

3 SHEETS—SHEET 1.

Fig. 5.

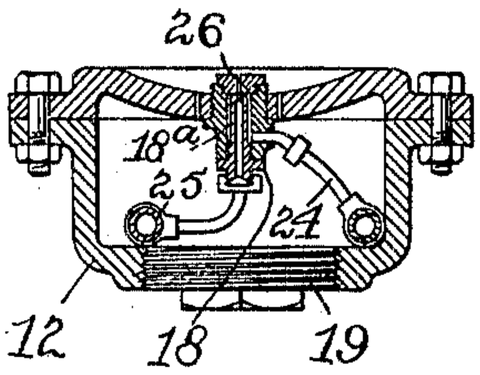


Fig. 1.

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3 SHEETS—SHEET 2.

Fig. 2.

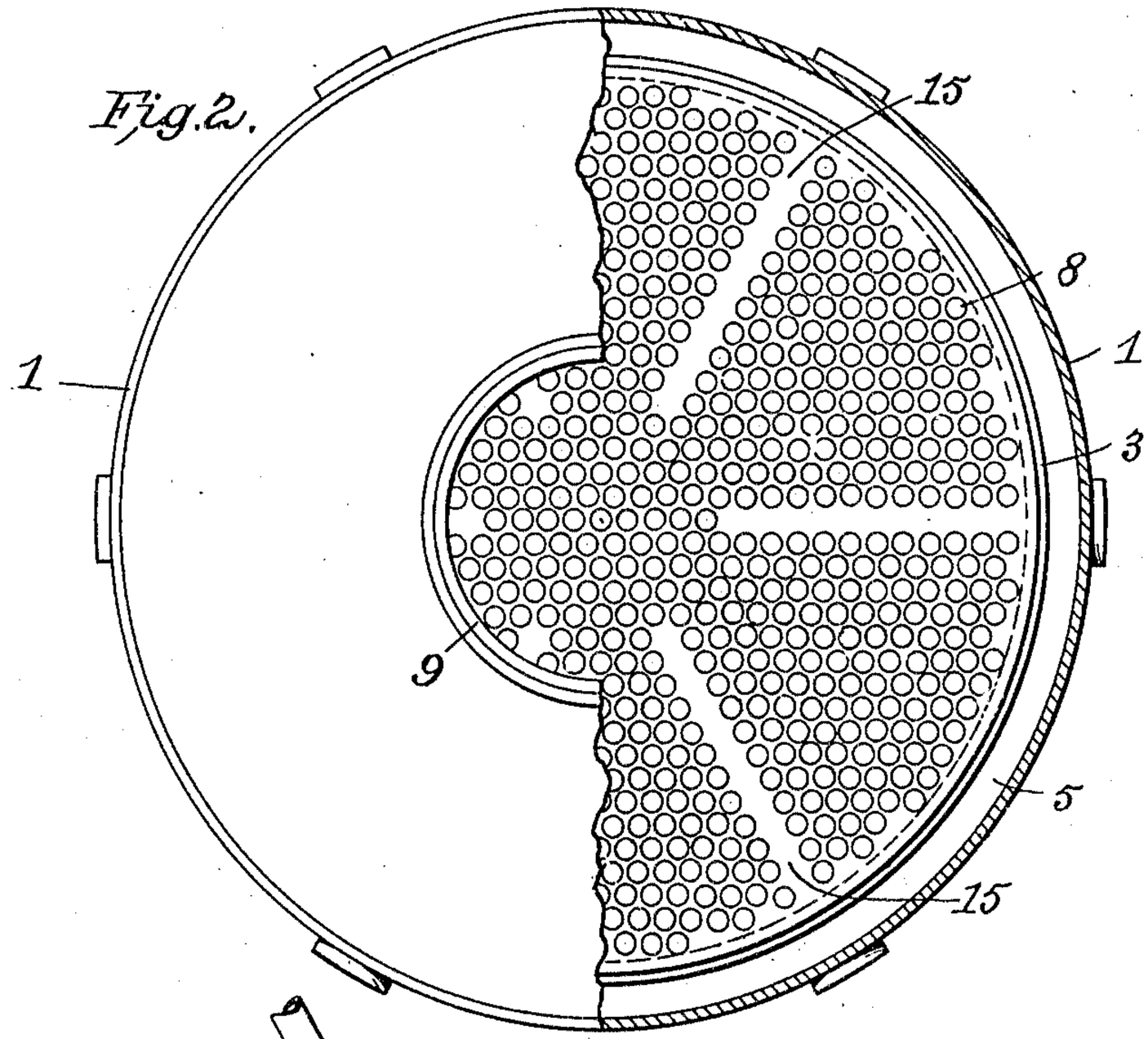
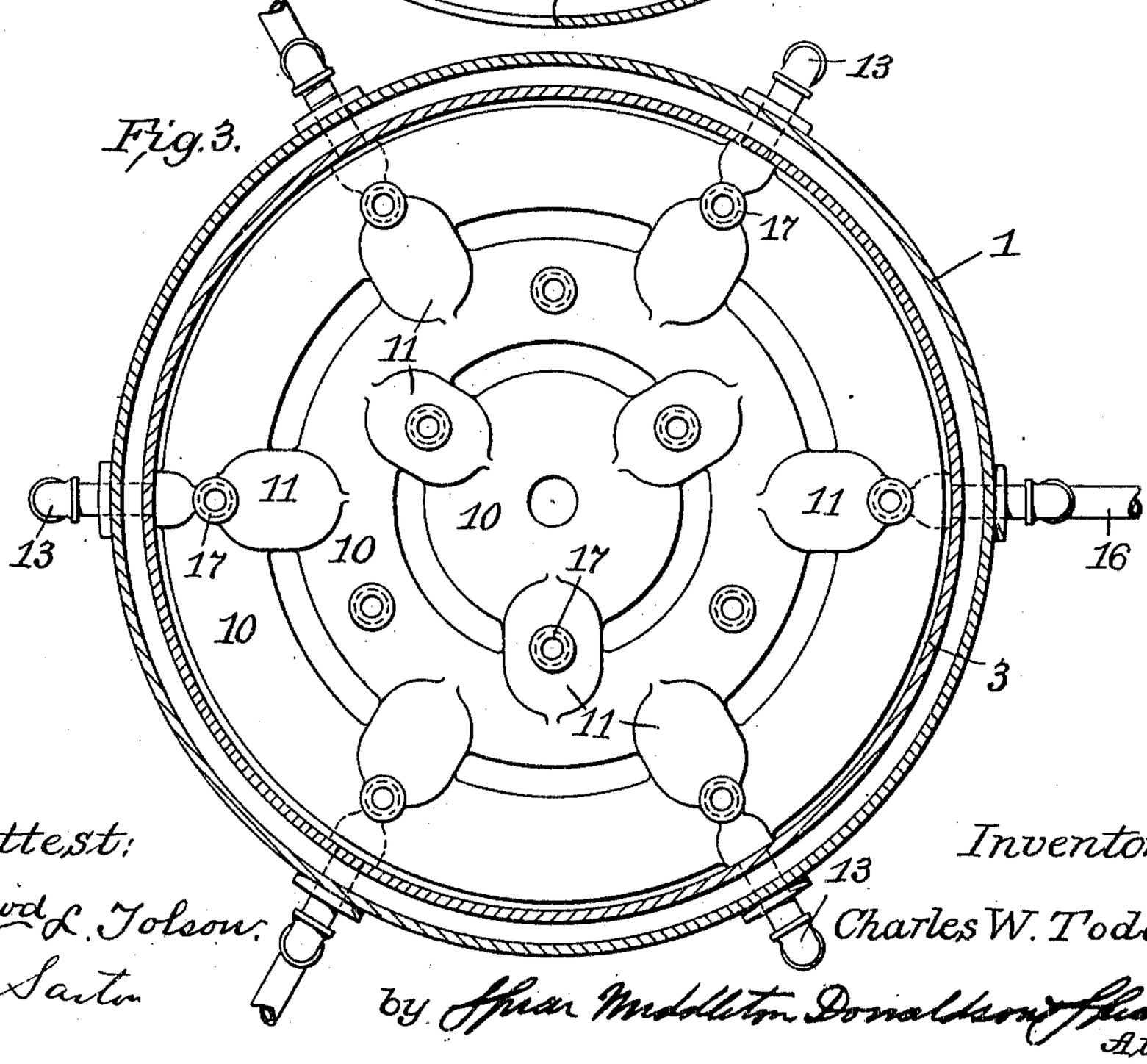



Fig. 3.

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3 SHEETS—SHEET 3.

Fig. 4.

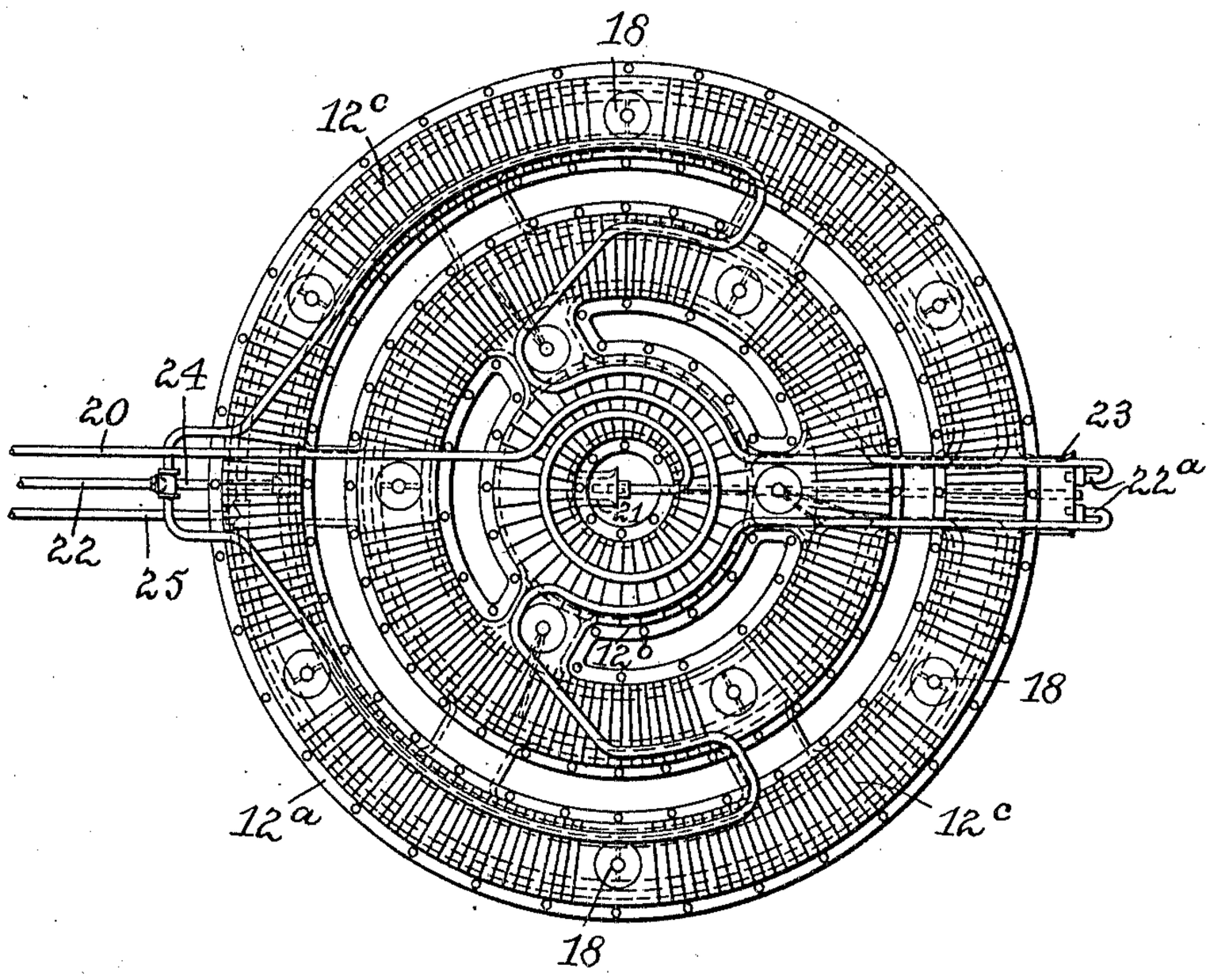
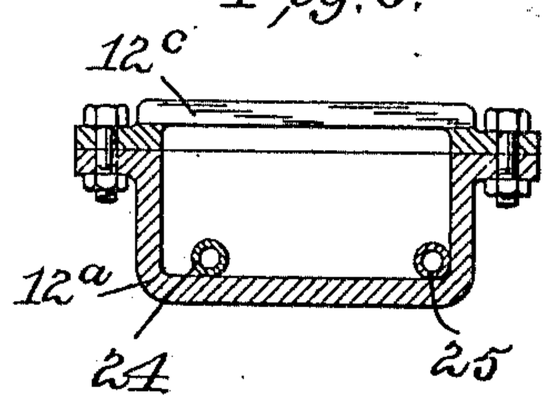



Fig. 6.

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# UNITED STATES PATENT OFFICE.

CHARLES WILLIAM TODD, OF MANCHESTER, NEW HAMPSHIRE, ASSIGNOR OF ONE-THIRD TO LEWIS W. CROCKETT, OF MANCHESTER, NEW HAMPSHIRE, AND ONE-THIRD TO D. ARTHUR BURT, OF BOSTON, MASSACHUSETTS.

## STEAM-BOILER.

986,876. Specification of Letters Patent. **Patented Mar. 14, 1911.**

Application filed June 8, 1910. Serial No. 565,857.

*To all whom it may concern.*

Be it known that I, CHARLES W. TODD, citizen of the United States, residing at Manchester, New Hampshire, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification.

My present invention relates to improvements in steam boilers designed more especially for engines known as automobile fire engines, though not limited in its use to this particular type of motor vehicle, and the invention includes the novel features of construction and arrangement and combination of parts hereinafter described and particularly set forth in the appended claims.

In the accompanying drawings Figure 1 is a view partly in elevation and partly in section. Fig. 2 is a plan view partly broken away to show the arrangement of the tubes. Fig. 3 is a similar section on line 3—3 of Fig. 1; Fig. 4 is a plan of the burner; and Figs. 5 and 6 are enlarged sectional details.

Referring by reference characters to these drawings, the numeral 1 designates the outer shell of the boiler, and 2 and 3 inner shell members, the shell 2 being connected at the upper end to the outer shell by a cap or header 4, while the inner member 3 is connected at the lower end to the outer shell through the spacing ring or member 5. These inner shells 2 and 3 carry headers 6 and 7 which are connected by a plurality of closely spaced fire tubes 8. The space within the lower shell 3 constitutes a combustion space or chamber which communicates through the fire tubes with the space within the upper shell 2, the products of combustion being delivered through the central stack indicated at 9. The combustion chamber is open at its lower end, at which point is located a device adapted for serving a double purpose of maintaining water hot when the engine is not in use, and also as a feed water heater for the fresh water supply. This device is in the shape of a casting comprising essentially a plurality of concentric tubular members 10 connected by radially disposed passages 11, which are designed to be heated by the main vapor burner 12 located below the same and hereinafter more particularly described. This feed water heater is connected to the water space of the boiler by two sets of external pipes or tubes indicated respectively at 13 and 14, the pipes 13 connecting with the water space near the bottom, while the pipes 14 connect with the water space approximately centrally of the height of the fire tubes. It will thus be seen that when the vapor burner is in operation and giving only a minimum amount of heat, this heat is applied directly to the underside of the annular tubes 10, so that the water, as heated, will rise through the tubes 14, and be discharged centrally into the water space on converging lines, while the cooler water in the bottom of the boiler will descend through the pipes 13 to take its place, and thus maintain circulation and keeping up the heat of the water.

In a boiler of this type, and utilizing a burner of the particular construction hereinafter described in detail, it is of vital importance that the fire tubes 8 should be located very closely together, so as to provide the maximum number of tubes. With this arrangement, however, there will be a possibility of an insufficient flow of the water through the central tubes, and in order to obviate this, I omit certain of the tubes on radial lines so as to provide spaces or channels extending from the periphery inward toward the center directly in line with the upper rings of the tubes 14, as indicated at 15 in Fig. 2. The water supply to the boiler connects with this heating member 10 by a pipe 16 leading from any suitable sources of supply, such, for instance, as the usual injector or feed pump, not shown herein. In order to provide for efficiently heating this member 10 in order to keep steam in the boiler when the engine is standing in the station, and also to provide means by which a powerful heat may be suddenly applied to generate a high pressure of steam, when necessary, I provide a special burner arrangement coöperating with this heating member 10 and with the combustion space and fire tubes, which will now be specifically described. At suitable points through the tubes 10 or their radial connecting branches 11, I pass tubes or thimbles 17 through which atomizing burners 18 are adapted to discharge directly into the combustion space. The main vapor burner is composed of concentric hollow members $12^a$ and $12^b$, the inner member $12^b$ being designed to be used as a pilot or starting mem-

ber, and these concentric members being provided in their upper surfaces with radial slots $12^c$ through which the combustible vapor passes, and, being ignited, burns directly in contact with the heating member 10. The atomizing burners 18 are located at suitable intervals in the hollow members 12 in line with the tubes or thimbles 17, being threaded into the top walls of the members 12, as shown in detail in Fig. 5, and screw plugs 19 being provided in the lower surface to permit access to the atomizing burners from below.

Three sets of pipes are used to supply the combustible fluid to the pilot burner, the main vapor burner and the atomizing burners, respectively. The former of these or that supplying the pilot or starting lighter is indicated at 20, and this, it will be seen, passes inward across the face of the vapor burner to the central burner member $12^b$, over the surface of which it is coiled one or more times, as indicated in Fig. 4, whence it passes slightly downward at the center of the ring-shaped member $12^b$, as indicated at $20^c$ in Fig. 1, and discharges into a mixing nozzle 21 communicating with the interior of the pilot burner $12^b$.

The supply pipe for the combustible fluid for the main vapor burner is indicated at 22, and this, it will be seen from Fig. 4, branches toward both sides, and after passing around over the outside ring member $12^a$, is brought inward over the intermediate ring member, and thence inward, and for a certain distance concentrically over the surface of the pilot light member $12^b$, from whence both branches are passed radially outward, and are provided at their outer ends with backwardly turned delivery portions or nozzles $22^a$ which discharge into the mixing nozzle 23, which communicates with both the outer and intermediate ring burners $12^a$. The atomizing burners are supplied with both steam and hydrocarbon, the steam being admitted to an annular space $18^a$ in the burner 18 by a pipe 24, while the hydrocarbon is admitted to a central passage by a pipe 25, both of these passages uniting in an atomizing nozzle or delivery opening, as indicated at 26, which is in the form of an adjustable removable screw plug. The steam pipe 24 and hydrocarbon pipe 25 both pass around inside of the hollow burner members $12^a$, as shown. In order to provide a proper supply of the combustible fluid to these several burners, I have provided the arrangement which will now be described. A steam pipe 27 leads from a suitable connection to the steam space of the boiler, and this has a branch 28 provided with a suitable regulating valve 29 which connects with a reservoir 30 which supplies the hydrocarbon to the pipe 25 for the atomizing burners, this pipe 25 being provided with a suitable regulating valve indicated at $25^a$. The steam pipe 24 is connected to the pipe 28 prior to its point of connection with the reservoir 30, as indicated at 31, and is also provided with a suitable regulating valve $24^a$. Another branch 32 of the steam pipe provided with a pressure reducing valve $32^a$ connects with a reservoir 33 for supplying hydrocarbon for the pilot and main vapor burner, this reservoir 33 connecting with a pipe 35, this pipe 35 being provided with a T-couple 36 which is connected respectively to the pipes 20 and 22, suitable regulating valves being provided, as indicated at $20^a$ and $22^b$. Both reservoirs are provided with pressure gages as indicated at $30^a$ and $34^a$, and the reservoir 30 is provided with a safety valve $30^b$, which is set at the maximum reservoir pressure.

Cut-off valves are provided in the steam and oil supply pipes 24 and 25, respectively, as indicated at $24^b$, $25^b$, so that when the boiler is not in use, the pipes 24 and 25 may be closed without disturbing the adjustment of valves $24^a$ and $25^a$, this being especially desirable when the reservoir is located above the level of the burner.

It will thus be seen two separate and distinct burners are shown, and are controlled and operated by different methods. In the vapor burner, the hydrocarbon is forced into the burner under pressure, and the fire is controlled by the supply valves $20^a$ for the pilot and $22^b$ for the main burner. The regulating valve $32^a$ is used only as a reducing valve to reduce the boiler pressure to the required pressure in reservoir 33. In the atom burner the hydrocarbon is sucked into the burner by a slight vacuum generated by the lifting type of atomizers. The valves $24^a$ and $25^a$ are not disturbed after they have been adjusted and locked, but the fire is here controlled by the regulating valve 29 which reduces the boiler pressure to a low (probably about 10 lb.) reservoir pressure, and, in turn, acts against the valves $24^a$ and $25^a$, and correspondingly increases or diminishes the supply through the atomizers.

While I have described with considerable particularity what I at this time regard as the best construction embodying my invention, it will be understood that I do not limit myself to the specific construction or special design and arrangement shown, as the detailed construction shown may be varied without departing from the spirit of my invention.

Having thus described my invention what I claim is:—

1. In combination a steam boiler having a lower hollow water heating member with a combustion space above the same, a burner member below said water heating member for heating said water heating member, and a plurality of atomizing burners associated

with said burner member and adapted to project heated products through said water heating member into the combustion space, substantially as described.

2. In combination a steam boiler having a horizontally disposed tubular water heating member and combustion space above the same, said water heating member having vertical tubes or flues passing therethrough, a burner member located below said water heating member for heating said water heating member, and atomizing burners associated with said burner member and in line with said tubes or flues for projecting heated products through said tubes or flues, substantially as described.

3. In combination a steam boiler having a horizontally disposed water heating member composed of concentric water tubes having at suitable intervals vertical tubes or flues passing therethrough and a combustion space above the same, a burner member located below said water heating member and composed of concentric burner rings in line with said concentric water tubes for directly heating the latter, and atomizing burners in line with said vertical tubes or flues for projecting heated products through said tubes or flues into said combustion space, substantially as described.

4. In combination a steam boiler having a horizontally disposed water heating member composed of concentric water tubes and radial connecting branches, and having a combustion space above said water heating member, said concentric water tubes and branches having at suitable intervals vertical tubes or thimbles, a burner member composed of concentric burner rings located beneath said concentric water tubes for directly heating the latter, said burner tubes having radial connecting branches, and atomizer burners carried by said burner rings and branches in line with said vertical tubes or thimbles, substantially as described.

In testimony whereof, I affix my signature in presence of two witnesses.

CHARLES WILLIAM TODD.

Witnesses:
WALTER B. MITCHELL,
ARTHUR C. BUNKER.