June 21, 1932. A. LIPETZ 1,864,310

STEAM BOILER

Filed May 2, 1928 3 Sheets-Sheet 1

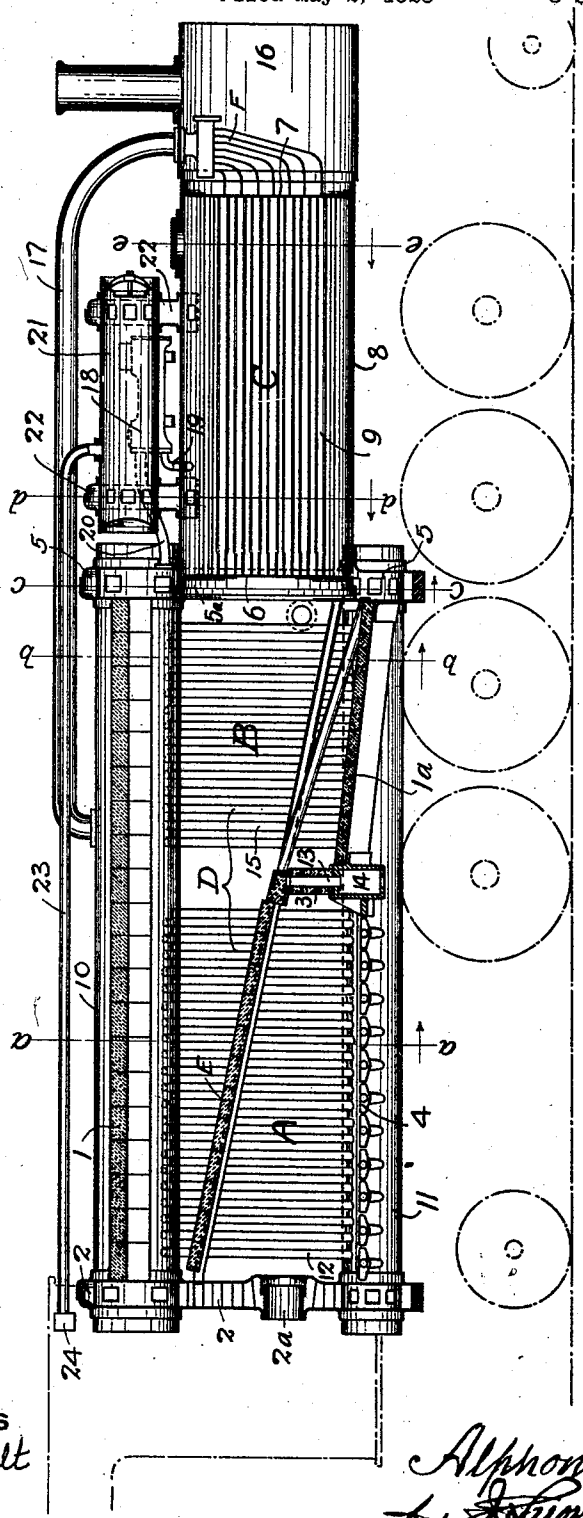



FIG. I

WITNESSES
A. J. Vanderbilt
S. R. Bell

INVENTOR
Alphonse Lipetz
by Thornton Bell
Atty.

June 21, 1932. A. LIPETZ 1,864,310

STEAM BOILER

Filed May 2, 1928 3 Sheets-Sheet 2

FIG. 4

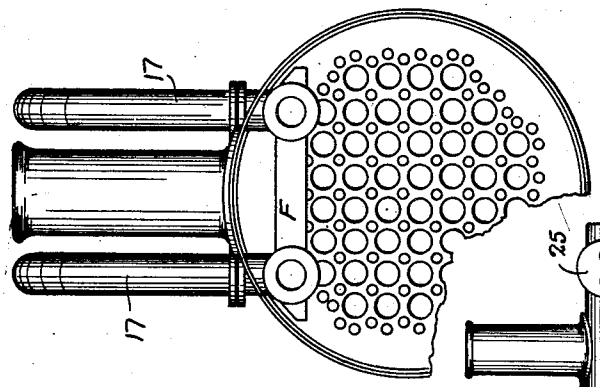



FIG. 9

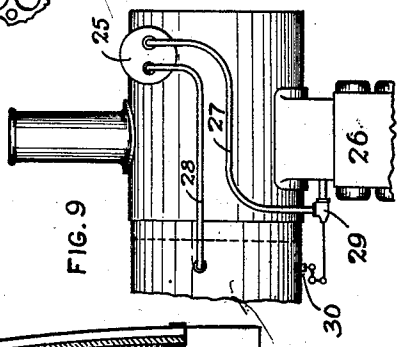



FIG. 3

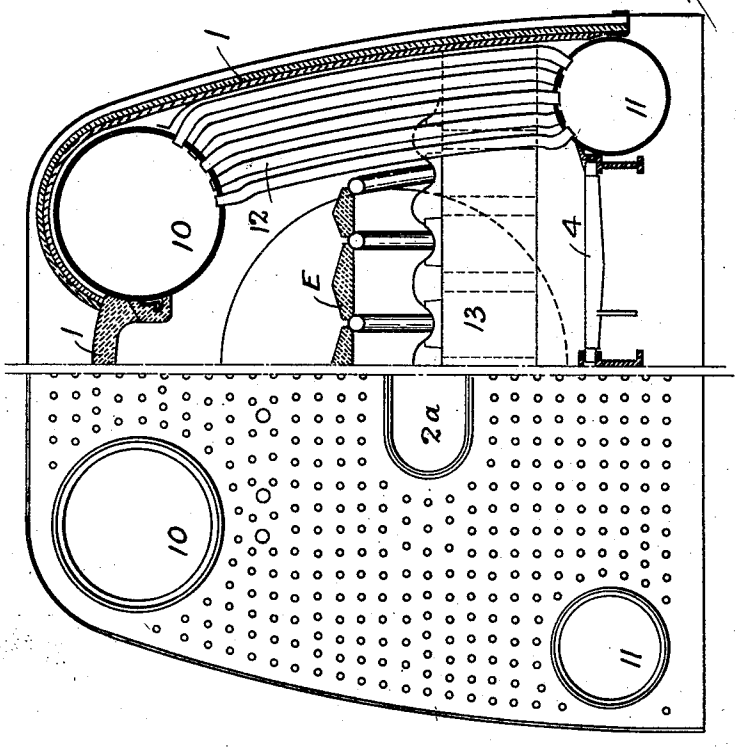



FIG. 2




WITNESSES

A. J. Vanderbilt

S. R. Bell

INVENTOR

Alphonse Lipetz

by Howson & Howson

Attys

June 21, 1932. A. LIPETZ 1,864,310

STEAM BOILER

Filed May 2, 1928 3 Sheets-Sheet 3

FIG. 8

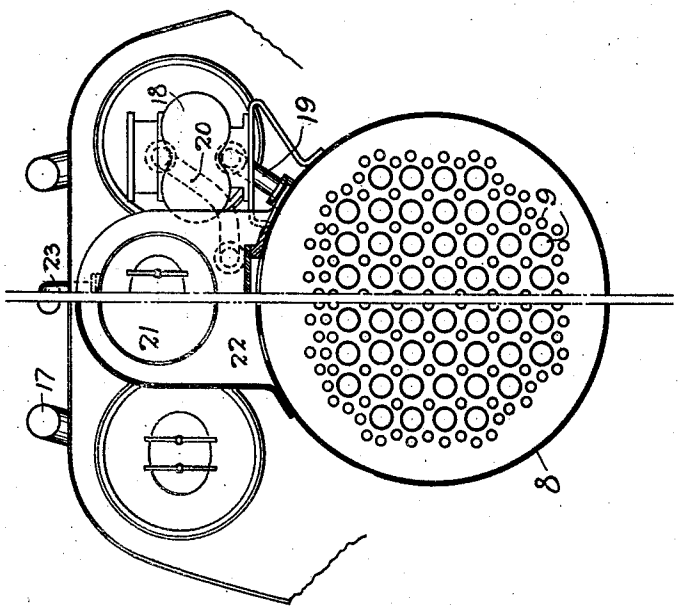



FIG. 7

FIG. 6

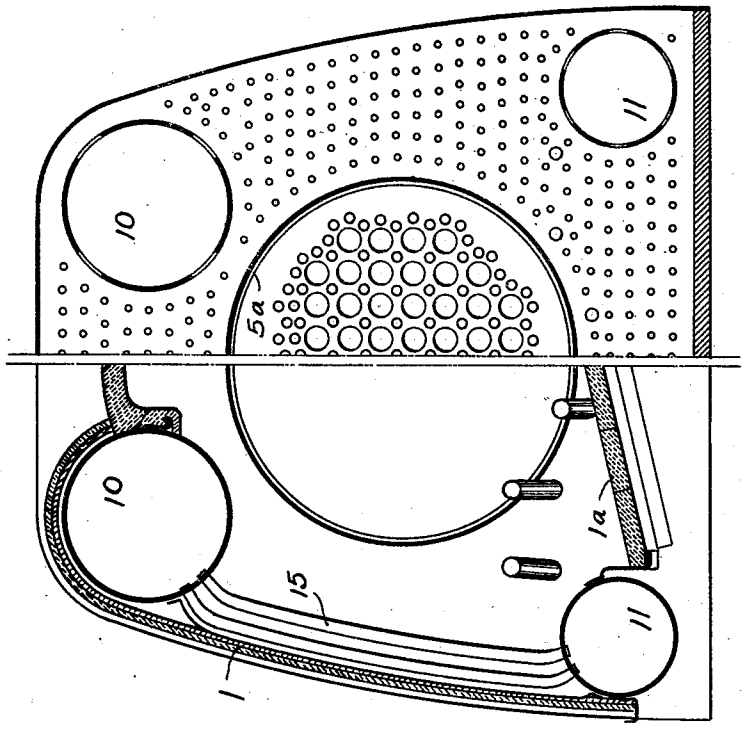



FIG. 5

WITNESSES

A. J. Vanderbilt

S. R. Bell

INVENTOR

Alphonse Lipetz

by J. Arrowdin Bell

Atty.

Patented June 21, 1932 1,864,310

# UNITED STATES PATENT OFFICE

ALPHONSE LIPETZ, OF SARATOGA SPRINGS, NEW YORK

## STEAM BOILER

Application filed May 2, 1928. Serial No. 274,426.

This invention relates generally to steam boilers of the locomotive type, and particularly to those of such type as are designed for operation under comparatively high pressures of steam, and wherein the exhaust gases are utilized for heating the feed water for the boiler, as exemplified in an application filed by me on April 21, 1928, Serial No. 271,666.

The object of the present invention is to provide a steam generator for use in a locomotive boiler, of a construction especially suitable for certain conditions of service, and for certain kinds of fuel.

The improvement claimed is hereinafter fully set forth.

In the accompanying drawings: Figure 1 is a vertical longitudinal section through a locomotive boiler, illustrating an embodiment of the invention; Fig. 2, a half rear view, in elevation, thereof; Fig. 3, a half vertical transverse section, on the line *a a* of Fig. 1; Fig. 4, a front view, in elevation; Figs. 5, 6, 7, and 8, vertical transverse half sections on the lines *b b*, *c c*, *d d*, *e e*, respectively, of Fig. 1, viewed in the directions of the arrows, Figs. 2 to 8 inclusive being on an enlarged scale; and, Fig. 9, a partial side view, in elevation.

In the practice of the invention, referring descriptively to the specific embodiment thereof which is herein exemplified, the essential elements of a locomotive boiler in accordance therewith, comprise a fire chamber, indicated as a unit, by the reference symbol, A; a heating chamber for the gases coming from the fire chamber, indicated by B; an economizer for heating the feed water for the boiler by means of the gases coming from the heating chamber, indicated by C; and a high pressure steam generator, disposed in the fire chamber and heating chamber, indicated by D. The detailed description of the essential elements above stated, which follows, is made with notice that they may be varied as to structural detail, in the discretion of a constructor skilled in the art, without departure from the spirit and operative principle of the invention.

It should be remarked at the outset that, in the embodiment herein set forth, the various features and mode of operation are, in the main, similar to those of the before mentioned application Ser. No. 271,666, and therefore, reference may be made thereto for a more detailed description of the various features and mode of operation.

The main features of difference between the present application and that bearing Serial No. 271,666, relate to the construction of the fire chamber, A, the heating chamber, B, and the steam generator disposed in these chambers.

In the embodiment shown in the present application, the fire chamber, A, comprises the side and top enclosing walls, 1, the rear wall, 2, which serves as a rear header for the generator, as will presently appear, the front wall, 3, which serves a double purpose, as will presently appear and a grate, 4, the rear wall, 2, being provided with an opening, 2*a*, for firing the boiler.

The heating chamber, B, for receiving the gases coming from the fire chamber, is formed by a continuation of the side and top walls, 1, of the chamber, A, the wall, 3, which is common to both chambers, the front wall, 5, which is a header for the forward end of the generator, and the rear wall, 6, of the economizer, which will later be described, and the floor, 1*a*.

The economizer, C, is constructed somewhat similarly to the waist of the conventional locomotive type of boiler, and comprises the end sheets, 6 and 7, a shell, 8, and the tubes or flues, 9, adapted for the passage through them of the gases discharged from the heating chamber.

The high pressure steam generator, D, varies from a structural standpoint, from that shown in the application Ser. No. 271,666. In the present construction two upper drums, 10. 10, are provided, disposed at the top, and adjacent to the sides of the fire chamber, and connected at their rear ends to the header, 2. These drums extend through the two chambers and are connected, at their forward ends, with the header, 5. Likewise, two lower drums, 11, 11, are provided at the bottom of the fire chamber near the sides, with their rear ends connected to the header, 2. These

drums extend through the two chambers, and have their forward ends connected with the header, 5.

A series of water tubes, 12, is provided in the fire chamber, on each side thereof, said tubes being connected, at their opposite ends, to the respective pairs of upper and lower drums, one pair of drums, and the connected series of tubes, being clearly shown in Fig. 3. These water tubes are disposed well out at the sides of the chamber, providing a large central portion of the chamber unobstructed by the tubes for the combustion of the fuel. In this space an arch, E, is shown. This arch is secured to the header, 2, at its rear end, and is supported at its front end by the wall, 3, which is constructed of bricks, 13, and hollow casting, 14. The arch may be of any well known or preferred construction, and a further detailed description is, therefore, not considered essential. It divides the fire chamber into upper and lower parts. This effects a directing of the hot gases in such a way that they most effectively envelope the water tubes, 12.

Other series of water tubes, 15, are disposed in the heating chamber, connected, at their opposite ends, to the respective pairs of upper and lower drums, two rows of such tubes being clearly shown in Fig. 5, but any number may be employed that may be desired. The construction of the steam generator, in so far as it applies to the portion thereof that is confined to the heating chamber, is quite different from that disclosed in the application Ser. No. 271,666. In the present instance, there are two lower drums disposed in the corners, instead of one centrally disposed drum, and the four drums in this chamber are continuations of the four drums in the fire chamber, thereby obviating the necessity for the intermediate header. Also, the heating chamber is not contracted.

Superheaters of any desired type may be applied, and disposed in the boiler at any of the usual points. In the present instance, a superheater, F, is provided in the smoke box, 16, with its units disposed in certain of the flues, 9, which are enlarged to accommodate them in the usual manner. Connections, 17, serve to connect the drums, 10, with the throttle (not shown) and the superheater.

The water from the economizer, which usually will be at a comparatively low pressure, is forced into the high pressure steam generator by means of one or more pumps. In the present embodiment, a pump, 18, is employed, which is in communication with the economizer, through a conduit, 19, and with the steam generator, through a conduit, 20.

While it is desirable that little or no evaporation shall take place in the economizer, provision is, however, made to take care of the relatively small amount of steam that may be generated. To this end, a drum, 21, is connected to the economizer, by means of members, 22, adapting it to receive the steam that may be generated, and a conduit, 23, conveys the steam to the cab turret, 24, of the locomotive, to be used in auxiliaries, or otherwise, as may be desired.

The flues, 9, of the economizer, which are open at both their ends, comunicate at one of their ends with the heating chamber, B, through the opening, 5a, of the header, 5, and with the smoke box at their opposite ends. The flues, in effect, lengthen the heating chamber between the fire chamber, A, and the smoke box, thereby affording a better opportunity for absorbing the heat of the discharged gases, before they reach the chimney. The economizer is preferably maintained at a comparatively low pressure, say between one hundred and two hundred pounds, while the high pressure generator may be, say, between four hundred and five hundred pounds, as an illustration. It is highly desirable that the economizer be maintained at as close a temperature to the saturation temperature as possible, with minimum evaporation of the water therein.

To accomplish this, several factors must be considered. Careful consideration must be given to the relative proportioning of the generator and economizer, to insure the proper division of heat between them. The economizer must, also, be properly positioned relatively to the fire chamber, for if it is too near, there will be excessive evaporation. That is to say, the heating chamber, B, should be of sufficient relative size to prevent excessive evaporation of the water in the economizer, while insuring the desired high temperature. By a proper consideration of these features, the water in the economizer may be raised from a certain temperature to approximately the saturation temperature, at moderate pressure, and the water in the generator raised from this temperature to the saturation temperature, at high pressure, and complete evaporation of all the water thereby effected.

The attainment of the above conditions may be, at times, more or less disturbed by outside factors entering in, or otherwise, as, for instance, by varying the fire ratings. The present invention contemplates the provision of means for correcting this, to a greater or less extent, and is intended to cover this feature broadly, as there are various ways of accomplishing it. For instance, it may be accomplished by varying the pressure in the economizer, between reasonable limits, say, one hundred and two hundred pounds; or by controlling the amount of water fed to the economizer, or when a feed water heater is used for the economizer, by varying the amount of exhaust steam led into the feed water heater, thus affecting the temperature

of the water entering the economizer from the feed water heater. The variation in the amount of exhaust steam fed may be affected manually, or automatically, by using thermostatic or pressure control, to throttle the exhaust steam inlet to the feed water heater.

In the present construction, to better insure the desired high temperature and minimum evaporation of the water in the economizer, a thermostat is employed. To this end, a feed water heater, 25, is provided, communicating with the exhaust passage of the cylinder, 26, through a conduit, 27, to receive the steam therefrom, and also communicating with the water tank (not shown), in the usual manner. The feed water heater is further connected with the economizer, by a conduit, 28, whereby the heated water from the heater is fed thereto. The conduit, 27, is provided with a control valve, 29, which is suitably connected to a thermostat, 30, to be operated thereby in a well known manner. The thermostat is connected to the economizer in a well known manner, whereby it will automatically respond to the change in the temperature of the water in the economizer.

While a direct temperature control has been described by way of illustration, it will be understood that, if desired, the temperature may be controlled by indirect means. For instance, the temperature may be indirectly controlled by the control of the pressure, any suitable or well known device being employed for this purpose. By thus maintaining the pressure control, the temperature will also be controlled.

It will be seen from the foregoing description that the temperature in the economizer may be kept substantially constant, by insuring a proper division of heat between the generator and economizer.

The boiler, as thus described, provides for a very intensive evaporation due to the large direct heating surface, which is enhanced by feeding the generator under pressure by means of a pump. This secures a very high capacity in a limited space. Moreover, the scale precipitation takes place in the economizer, and practically no scale is formed in the generator, thus eliminating the difficult operation of cleaning the inside of the water tubes.

It will be understood, however, that, if desired, an additional scale precipitating device, of suitable or well known construction, may be installed, in the usual manner. Furthermore, the drums of the generator may be provided with the usual plug openings, or man-holes, to facilitate the cleaning of the water tubes of the generator, in the usual manner, when found desirable.

The invention claimed as new and desired to be secured by Letters Patent is:

1. A locomotive boiler comprising a fire chamber; a heating chamber forward of the fire chamber; a high pressure water tubular steam generator disposed in said chambers, having upper drums and lower drums disposed at the opposite sides of the said chambers, and tubes connecting said drums, said drums providing steam and water chambers, and of sufficient length to extend uninterruptedly throughout the entire length of the two members, said tubes being arranged in rows extending from end to end of said drums; a transverse wall disposed between the fire chamber and the heating chamber extending upwardly from the bottom of the same; means for introducing feed water to the steam generator; and a fire tube barrel section in advance of the heating chamber for heating said feed water.

2. A locomotive boiler comprising a fire chamber; a heating chamber forward of the fire chamber; a high pressure water tubular steam generator disposed in said chambers, having upper drums and lower drums disposed at the opposite sides of the said chambers, and tubes connecting said drums, said drums providing steam and water chambers, and of sufficient length to extend uninterruptedly throughout the entire length of the two chambers, said tubes being arranged in rows extending from end to end of said drums; a transverse wall disposed between the fire chamber and the heating chamber extending upwardly from the bottom of the same; means for introducing feed water to the steam generator; and a fire tube barrel section in advance of said heating chamber providing an economizer for heating said feed water.

3. A locomotive boiler comprising a fire chamber; a heating chamber forward of the fire chamber; a high pressure water tubular steam generator disposed in said chambers, having upper drums and lower drums disposed at the opposite sides of the said chambers, and tubes connecting said drums, said drums providing steam and water chambers, and of sufficient length to extend uninterruptedly throughout the entire length of the two chambers, said tubes being arranged in rows extending from end to end of said drums; a transverse wall disposed between the fire chamber and the heating chamber extending upwardly from the bottom of the same; means for introducing feed water, to the steam generator; a fire tube barrel section in advance of the heating chamber providing an economizer for heating said feed water; and a pump disposed between said barrel section and said generator.

4. A locomotive boiler comprising a fire chamber; a heating chamber forward of the fire chamber; a high pressure water tubular steam generator disposed in said chambers, having two sets of upper and lower drums disposed at the opposite sides of the said chambers, and tubes connecting said drums,

said drums providing steam and water chambers, and of sufficient length to extend uninterruptedly throughout the entire length of the two chambers, said tubes being arranged in rows extending from end to end of said drums; a transverse wall disposed between the fire chamber and the heating chamber extending upwardly from the bottom of the same; means for introducing feed water at the forward end of the steam generator; and a fire tube barrel section in advance of the heating chamber for heating said feed water.

5. A locomotive boiler comprising a fire chamber; a heating chamber forward of the fire chamber; a steam generator disposed in said chambers, having upper and lower drums extending in uninterrupted continuity throughout the entire length of the two chambers, series of water tubes connecting the upper and lower drums, and a front header connecting the upper and lower drums and open to the interior of said heating chamber between the drums; a transverse wall disposed between the fire chamber and the heating chamber extending upwardly from the bottom of the same; means for introducing feed water at the front end of the steam generator; and a fire tube barrel section in advance of the heating chamber for heating said feed water.

6. A locomotive boiler comprising a fire chamber; a heating chamber forward of the fire chamber; two upper and two lower drums disposed in said chamber, extending along the sides thereof in uninterrupted continuity throughout the entire length of said chambers; series of water tubes in said chambers connecting the upper drums with their respective lower drums beneath them, said series extending from end to end of said drums; a transverse wall disposed between the fire chamber and the heating chamber extending upwardly from the bottom of the same; a front header connecting the upper and lower drums and open to the interior of the heating chamber between the drums; means for introducing feed water to said header; and a fire tube barrel section in advance of the heating chamber for heating said feed water.

7. A locomotive boiler comprising a fire chamber; a header at the rear end thereof; a heating chamber forward of the fire chamber; a header at the forward end thereof; a transverse wall disposed between the fire chamber and the heating chamber extending upwardly from the bottom of the same; upper and lower drums disposed in said chambers extending in uninterrupted continuity throughout the entire length of said chambers, and connected at their ends to said headers; series of water tubes in said chambers, connected to the drums, said series extending from end to end of said drums, said front header connected to the upper and lower drums and open to the interior of said heating chamber between the drums; means for introducing feed water to the front header; and a fire tube barrel section in advance of the heating chamber for heating said feed water.

8. A locomotive boiler comprising a fire chamber; a heating chamber disposed forwardly of the fire chamber; a steam generator disposed in said chambers, having a plurality of lower water drums, a plurality of upper drums for the collection of steam, said drums extending in uninterrupted continuity throughout the entire length of said fire chamber and said heating chamber, a plurality of tubes connecting the steam and water drums, a header at the forward end of said heating chamber communicating with the upper and lower drums, a header at the rear end of the fire chamber communicating with the upper and lower drums, and arch tubes placing the heating chamber header in communication with the fire chamber header; a transverse wall disposed between the fire chamber and the heating chamber extending upwardly therefrom and supporting said arch tubes; means for introducing feed water to the front header; and a fire tube barrel section in advance of the heating chamber for heating said feed water.

9. A locomotive boiler comprising a fire chamber; a heating chamber disposed forwardly of the fire chamber; a steam generator disposed in said chambers, having a plurality of lower water drums, a plurality of upper drums for the collection of steam, said drums extending in uninterrupted continuity throughout the entire length of said fire chamber and said heating chamber, a plurality of tubes econnecting the steam and water drums, a header at the forward end of said heating chamber communicating with the upper and lower drums, a header at the rear end of the fire chamber communicating with the upper and lower drums, arch tubes placing the heating chamber header in communication with the fire chamber header, and an arch over said arch tubes within said fire chamber dividing said chamber into upper and lower parts; a transverse wall disposed between the fire chamber and the heating chamber extending upwardly therefrom and supporting said arch and arch tubes; means for introducing feed water to the front header; and a fire tube barrel section in advance of the heating chamber for heating said feed water.

10. A locomotive boiler comprising a fire chamber; a heating chamber disposed forwardly of the fire chamber; a steam generator disposed in said chambers, having a plurality of lower water drums, a plurality of upper drums for the collection of steam, said drums extending in uninterrupted con-

tinuity throughout the entire length of said fire chamber and said heating chamber, a plurality of tubes connecting the steam and water drums, a header at the forward end of said heating chamber communicating with the upper and lower drums, a header at the rear end of the fire chamber communicating with the upper and lower drums, arch tubes placing the heating chamber header in communication with the fire chamber header, a transverse wall between the fire chamber and the heating chamber extending upward from the bottom of the same, and an arch supported at its front end by said wall and covering said arch tubes within the fire chamber; means for introducing feed water to the front header; and a fire tube barrel section in advance of the heating chamber for heating said feed water.

11. A locomotive comprising a fire chamber; a heating chamber forward of the fire chamber; a high pressure water tubular steam generator disposed in said chambers, having upper drums and lower drums disposed at the opposite sides of the said chambers, and tubes connecting said drums, said drums providing steam and water chambers, and of sufficient length to extend uninterruptedly throughout the entire length of the two chambers, said tubes being arranged in rows extending from end to end of said drums; means for introducing feed water to the steam generator; a fire tube barrel section in advance of the heating chamber for heating feed water; and a drum disposed above said barrel section for receiving steam therefrom.

12. A locomotive boiler comprising a fire chamber; a heating chamber forward of the fire chamber; a high pressure water tubular steam generator disposed in said chambers, having upper drums and lower drums disposed at the opposite sides of the said chambers, and tubes connecting said drums, said drums providing steam and water chambers, and of sufficient length to extend uninterruptedly throughout the entire length of the two chambers, said tubes being arranged in rows extending from end to end of said drums; a fire tube barrel section in advance of the heating chamber for heating feed water, the interior of said steam generator being separated from the interior of said feed water barrel section whereby the contents of the generator are prevented from passing into the barrel section; and means for forcing the feed water of the barrel section into the generator.

13. A locomotive boiler comprising a fire chamber; a heating chamber forward of the fire chamber; a high pressure water tubular steam generator disposed in said chambers, having upper drums and lower drums disposed within said chambers, and tubes connecting said drums, said drums providing steam and water chambers, and extending substantially throughout the entire length of the two chambers, said tubes being arranged in rows and extending substantially throughout the length of said drums; a fire tube barrel section in advance of the heating chamber for heating feed water, the interior of said steam generator being separated from the interior of said feed water barrel section whereby the contents of the generator are prevented from passing into the barrel section; and means for forcing the feed water of the barrel section into the generator.

14. A locomotive boiler comprising a fire chamber; a heating chamber forward of the fire chamber; a high pressure water tubular steam generator disposed in said chambers, having upper drums and lower drums disposed within said chambers, and tubes connecting said drums, said drums providing steam and water chambers, and extending substantially throughout the entire length of the two chambers, said tubes being arranged in rows and extending substantially throughout the length of said drums; an economizer in advance of the heating chamber for heating feed water, the interior of said steam generator being separated from the interior of said feed water economizer wherby the contents of the generator are prevented from passing into the economizer; and means for forcing the feed water of the economizer into the generator.

ALPHONSE LIPETZ.