No. 850,590. PATENTED APR. 16, 1907.

W. J. & G. LANE.

BOILER.

APPLICATION FILED SEPT. 21, 1904.

2 SHEETS—SHEET 2.

FIG. 2.

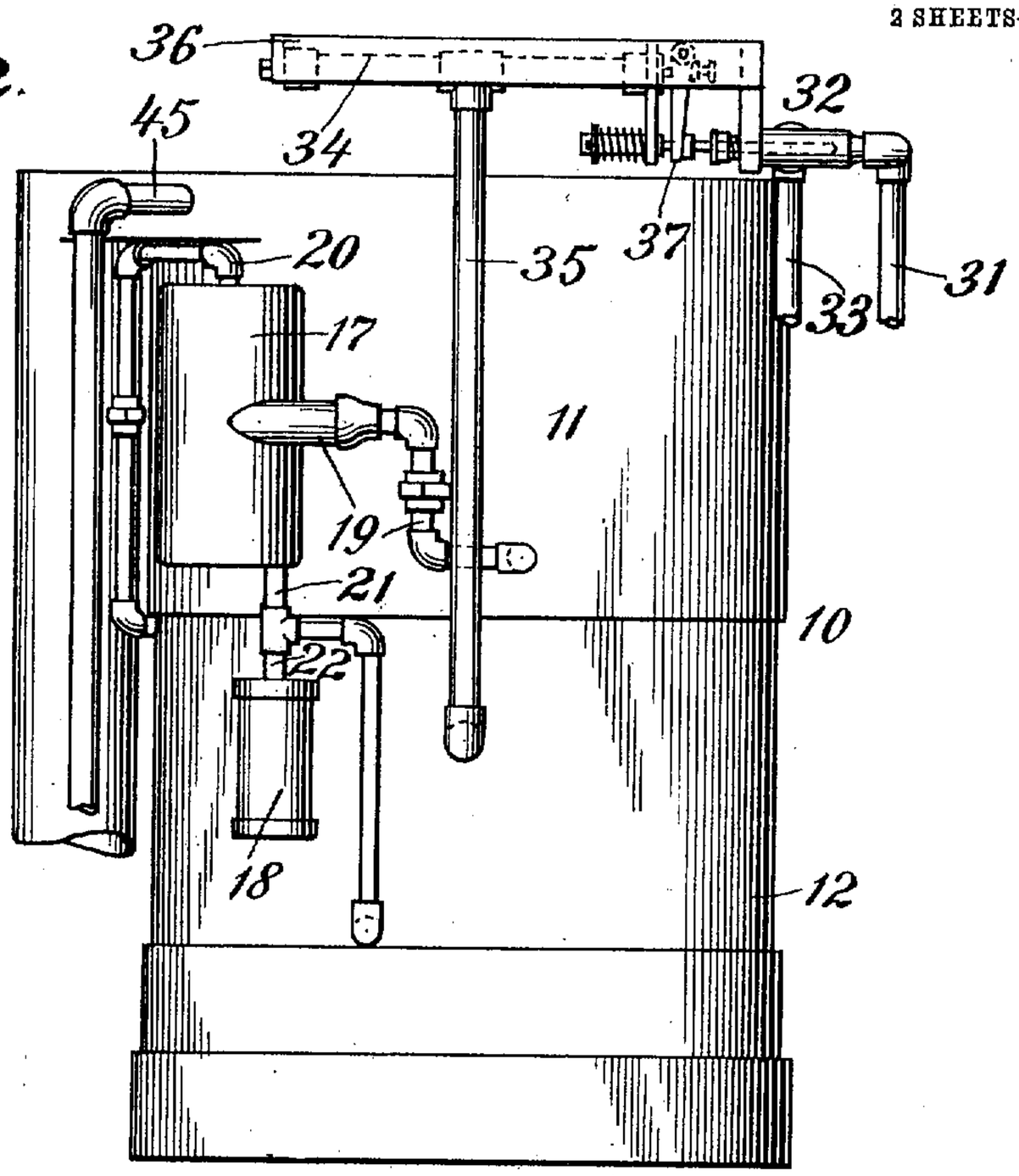


FIG. 3.

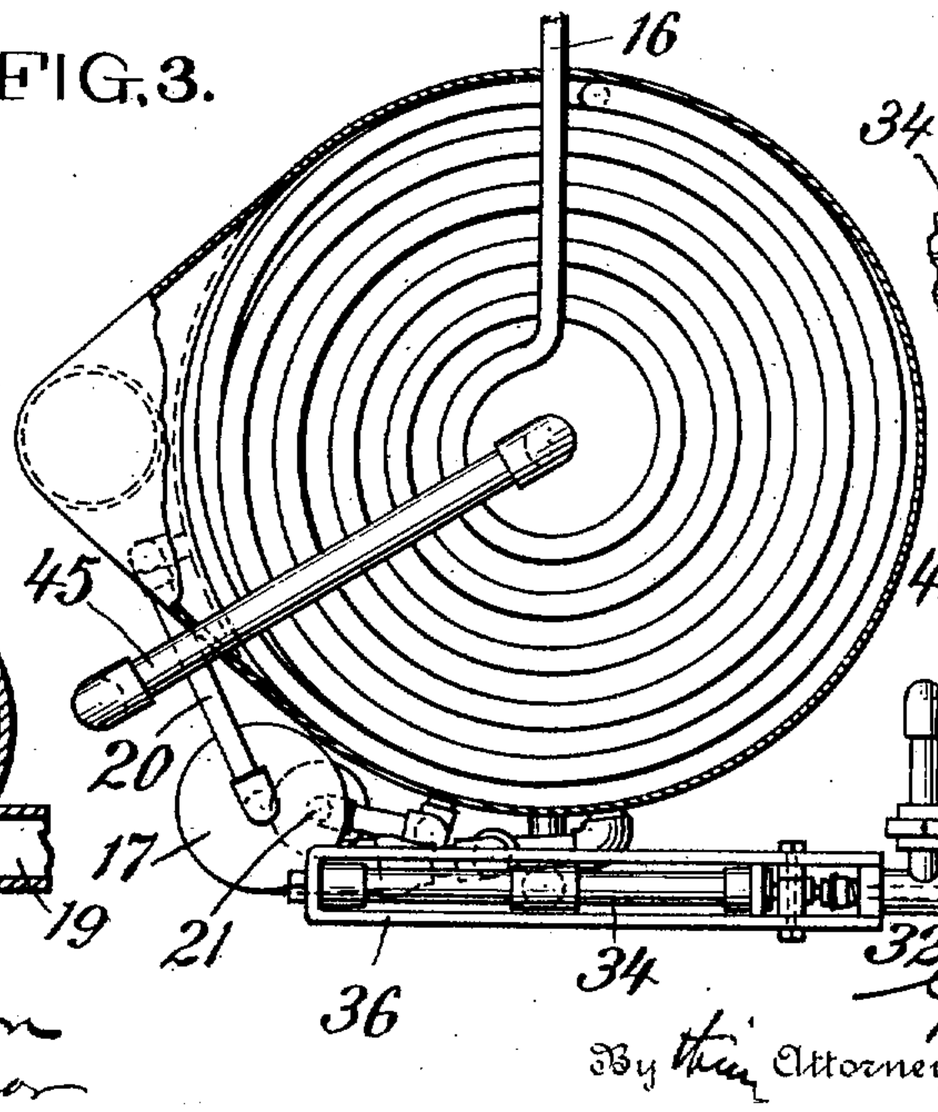


FIG. 4.

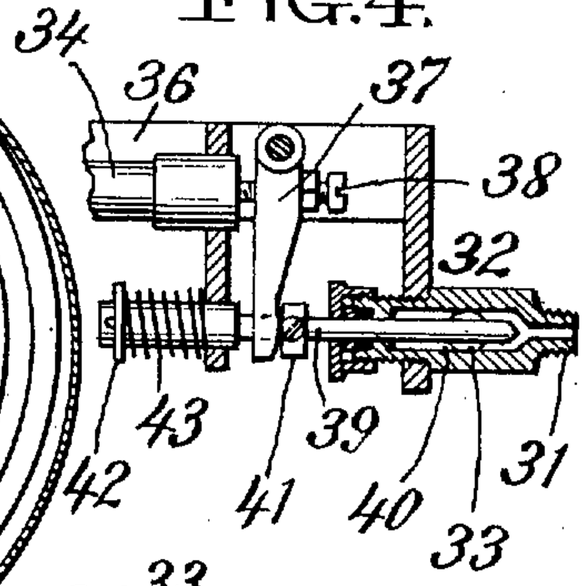
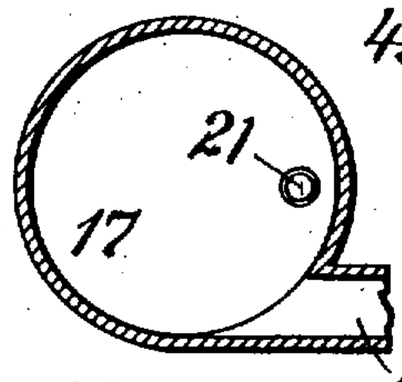


FIG. 5.



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BOILER.

No. 850,590. Specification of Letters Patent. Patented April 16, 1907.

Application filed September 21, 1904. Serial No. 225,351.

To all whom it may concern:

Be it known that we, WILLIAM JAMES LANE and GEORGE LANE, citizens of the United States, residing at Poughkeepsie, county of Dutchess, State of New York, have invented certain new and useful Improvements in Boilers and Attachments to be used in Connection Therewith, of which the following is a specification.

Our invention relates to a steam-boiler and its attachments as designed for use upon a motor-carriage.

Our invention consists, first, in the construction of the boiler, which embodies the characteristics of a vertical fire-tube boiler and a flash-boiler; second, in an attachment designed to separate the steam, the heated feed-water, and the solid matters from the water originally fed to the flash portion of the boiler and to deliver the steam into the steam-space, the heated feed-water into the water-space of the tubular portion of the boiler at the full temperature of the water in such portion of the boiler, and to collect the solid matters—such as mud, scale, &c.—in a suitable mud-drum; third, in an attachment designed to automatically control the water-level in the tubular portion of the boiler.

Vertical fire-tube boilers as heretofore constructed have been found objectionable for the reason that the large number and small size of the fire-tubes employed have acted to cut down the draft through the boiler, and thus prevent free development of flame in the fire-tubes and the free passage of the products of combustion from the burner under the boiler upward through the tubes, with the result that the full heating value of the flame and products of combustion is not obtained, and, further, when a motor-car carrying the burner and boiler is moving rapidly to cause the flame to be driven out from under the burner, and thereby tend to destroy the casing surrounding the boiler and burner and otherwise injure the vehicle. Flash-boilers have also proved objectionable, owing to the rapid destruction of the tubes of such boilers by the direct impact of flame upon them, and, further, because such boilers have no reserve capacity or, in other words, have not proved capable of making steam with sufficient rapidity to supply a sudden heavy demand—as, for instance, when a motor-car is propelled up a steep hill.

Our improved boiler is designed to make use of the advantageous features of both types of boiler in that the steam used for ordinary locomotion is very dry and is generated in and derived from both the flash portion and the tubular portion of the boiler, while the supplemental steam used for heavy work is generated in and derived from the tubular portion of the boiler, such tubular portion acting as a reserve source.

The purpose of the separating attachment introduced between the flash and tubular portions of the boiler is to insure that the feed-water fed to the tubular portion of the boiler shall be at the full temperature of the water in said tubular portion, that any solid matters contained in the water shall be separated therefrom before reaching the tubular portion of the boiler, and that dry steam shall be fed to the engine.

The purpose of the automatic water-level device is to insure that the water-level in the tubular portion of the boiler shall be maintained at a constant level.

The accompanying drawings will serve to illustrate our invention, in which—

Figure 1 is a side elevation of a portion of a motor-car with the shell of the boiler broken away at two places to show the relation of the flash and tubular portions of the boiler and that of the burner to the tubular portion. Fig. 2 is a side elevation of the boiler, separating device, and automatic water-level device looking from the left of Fig. 1. Fig. 3 is a transverse section through the containing-case for the boiler and a plan view of the flash portion of the boiler and water-level device. Fig. 4 is a vertical longitudinal section through the controlling-valve of the water-level device. Fig. 5 is a horizontal section through the center of the upper drum of the separating device.

In the drawings, 10 indicates the boiler. The boiler consists of a containing-shell 11 and is shown as divided into two sections. This, however, is not essential, as the shell may consist of a single section. The interior of the shell is divided into two portions. The bottom portion 12 is constructed in all respects like a vertical fire-tube boiler—that is, it is provided with perforated heads 13 14, between which are introduced and secured the tubes 15. The tubes which we use are approximately one inch in diameter, and such tubes we find to give the best results,

although we do not limit ourselves to tubes of such size. Practically all that is required is that the tubes shall be of such size as to freely permit the upward movement and development of flame within the tubes and the passage of the products of combustion through them and not confine the flame, as is the case with the ordinary construction of fire-tube boilers having a large number of tubes, to the combustion-chamber under the boiler and not retard the free upward movement of the products of combustion.

The upper portion 15 of the boiler is constructed in all respects like a flash-boiler—that is, there is located in such portion a spirally-coiled tube 16. In the drawings the tube is illustrated as having eight superposed layers, each of which is made of three-eighths inch brass pipe. The size of such tube and the disposition of the layers may be different from that stated without departing from the intent of our invention. All that is required is that such tube shall be disposed in the pathway of the products of combustion from the burner after leaving the vertical fire-tubes of the boiler and be sufficiently heated to convert a portion of the water passing through such tube into steam before the water and steam are delivered into the lower portion of the boiler.

In order to carry the steam and heated feed-water derived from the flash portion of the boiler into the tubular portion of the boiler and to separate the steam from the heated feed-water as well as the mud, scale, &c., there is located on the outside of the boiler a separating device, which consists of the separating-drum 17 and mud-drum 18. The interior of the drum 17 is connected to the delivery-orifice of the tube 16 through a pipe 19, which is somewhat larger in diameter and which pipe projects into the side of the drum 17, as shown in Fig. 5, and discharges the steam and heated feed-water from the tube 16 into the drum 17 in a tangential direction and at high velocity. The impact of these bodies against the interior wall of the drum 17 imparts to them a rotary motion, whereby the heated feed-water is thrown against the inner wall of the drum and flows to the bottom of the drum, while the steam flows to the top of the drum. The steam leaves the drum 17 by pipe 20 and is discharged into the steam-space of the tubular portion of the boiler, while the heated feed-water flows from the bottom of the drum through pipe 21 into the water-space of the tubular portion of the boiler. Any solid or precipitable matter—such as scale, mud, &c.—carried by the heated feed-water gravitates into the mud-drum 18 through pipe 22, from whence such bodies may readily be removed by taking off the lower head of the drum.

In practice we have found that some separating device is necessary between the flash portion of the boiler and the tubular portion of the boiler, as otherwise the steam collected in the steam-space of the tubular portion of the boiler contains so much water as to seriously interfere with the action of the engine fed by such steam. The separating device which we have described is the best of which we are aware. We, however, do not wish to limit ourselves to the specific form of separating device shown, as other means for separating the steam and heated feed-water, as also the solid matters, may be employed.

The feed-water for the boiler is fed from water-tank 23 through pipe 24 to a pump, (indicated at 25,) operated by engine 26, and is discharged through pipe 27 into a coiled-pipe heater 28, situated in a steam-space in the upper portion of a condenser 29, and passes thence by pipe 30 into the inlet-orifice of the spirally-coiled tube 16. The feed-water may also pass by pipe 31 to automatic water-regulator 32 and thence by pipe 33 back to pipe 24, these parts forming a by-pass around the pump.

The arrangement of the automatic regulator for controlling the by-pass and maintaining the water-level in the tubular portion of the boiler is best shown in Figs. 2, 3, and 4 and consists of a T portion of pipe 34, made preferably of brass, plugged at both ends, and secured to the upper end of a pipe 35, which pipe is connected at its lower end with the interior of the boiler at the designed water-level. Surrounding the T portion of pipe is a frame 36, Fig. 3, and pivoted in this frame opposite one end of the T portion is an arm 37, carrying an adjusting-screw 38. The lower end of this arm 37, which is forked, surrounds the valve-stem 39 of a valve-chamber 40, with which the pipes 31 33 communicate. This valve-stem 39 is pointed at the end and fits in a seat in the valve-chamber and also moves through a suitable packing-head. Situated on the valve-stem 39 and in front of the arm 37 is an adjustable nut 41, and an end of the stem 39 is enlarged and moves in an opening in the frame 36. Interposed between the frame 36 and a head 42 on the end of the stem 39 is a helical spring 43, which spring by its tension under normal conditions serves to hold the valve-stem in the position shown—that is, with the pipes 31 33 in communication through the valve-chamber 40. The purpose of the adjusting-nuts 38 and 41 is to permit of regulation in accordance with the expansion of the T portion 34. The operation of this portion of the device will be readily understood. When the water in the tubular portion of the boiler is above the orifice of the pipe 35 leading into the boiler, this pipe will be filled with water, and the valve-stem 39 under the action of the helical spring 43 will be moved to the left, thereby permitting communication be-

tween pipes 31 33 in the by-pass chamber 40. When, however, the water is below such orifice, the water will run out of the pipe 35, steam will enter the pipe and through its temperature expand the T portion 34, which, acting upon the lever 36, moves it to the right, which lever in turn acts upon the valve-stem 39 and forces it to its seat, and thus closes the passage in the by-pass chamber 40 between the pipes 31 33. The capacity of the pump for the feed-water is designed to be greater than the evaporating capacity of the boiler. Consequently when the passage in the by-pass chamber 40 is closed water will accumulate in the boiler until it rises above the orifice of the pipe 35, when the by-pass will again be opened.

The device which we have described for controlling the by-pass is one of great simplicity. We do not wish to limit ourselves to the particular feature of such device, as many other devices may be employed operated by variations in temperature of the T portion of the pipe 35.

44 represents a burner situated under the boiler, and 45 steam-pipe from steam-space of tubular portion of the boiler to valve-chest of the engine.

The general operation of the boiler is as follows: The gases and flame from the burner 44 impinge upon the lower head of the boiler and, owing to the large size of the vertical fire-tubes 15, pass upward into said tubes, the gases being developed as flame within the tubes. The products of combustion due to the flame flow out above the tubes and in their passage upward toward the exit-flue from the boiler pass around the tube 16 of the flash portion of the boiler. It will be observed, therefore, that the spirally-coiled tube of the flash portion of the boiler will be exposed to the temperature action both of the flame developed within the tubes and the products of combustion. The temperature action of these bodies, however, is not destructive, as is the case in an ordinary flash-boiler, and owing to the fact that, unlike the tubes of the flash-boiler, which only contain steam, the spirally-coiled tube of the flash portion of our boiler is constantly filled with steam and water flowing to the tubular portion of the boiler. This is a point of great practical importance, as the destruction of the tube 16 is thereby prevented, and, further, the heat value of the flame and outgoing products of combustion, after doing work in the tubular portion of the boiler, is utilized to heat the feed-water to the required temperature to generate steam in the flash portion of the boiler, and the final products of combustion delivered from the exit-flue of the boiler at a very low temperature, thereby obtaining great economy of operation. The steam and heated feed-water from the tube 16 pass to the drum 17 of the separator, are there separated, the steam going to the steam-space of the tubular portion of the boiler, from whence it is drawn, together with steam generated in the tubular portion of the boiler, by pipe 45 to supply the engine, the water going to the water-space of the boiler.

In practice it has been found that under ordinary conditions of running of a motor-car the steam used is derived both from the flash portion of the boiler and the tubular portion of the boiler, the flash portion furnishing about twenty-five per cent. and the tubular portion seventy-five per cent. When, however, an extraordinary demand is made upon the boiler and steam rapidly drawn from the steam-space, the pressure of the steam over the water in such space is decreased, with the result that the extra steam required is rapidly generated in such tubular portion of the boiler. It will be observed that owing to this fact the reserve of water required in the boiler is materially decreased, or, in other words, the amount of water carried in the tubular portion of the boiler may be much less than in tubular boilers as at present constructed.

Among the advantages obtained by the construction described we would enumerate the following: Large space for combustion under and through the boiler, free and unobstructed draft through the boiler, progressive heating through the use of the combined types of boilers, reserve power in water carried, automatic water-level, uniformly-dry-steam delivery, durability of the flash portion and of the tubular portion, the latter due to separation of solid matter and precipitates from the feed-water.

Having thus described our invention, we claim—

1. A boiler comprising a containing-shell, a coil portion through which the feed-water is introduced, a tubular portion situated below the coil portion, and means located between the two for separating the steam and water derived from the coil portion, and introducing these bodies separately into the steam and water space of the tubular portion.

2. A boiler comprising a containing-shell, a coil portion through which the feed-water is introduced, a tubular portion situated under the coil portion, and a structurally independent device situated between the two and adapted to separate the steam and water derived from the coil portion, and deliver these bodies respectively into the steam-space and the water-space of the tubular portion.

3. A boiler comprising a containing-shell, a coil portion through which the feed-water is introduced, a tubular portion situated under the coil portion, a separating device into which the water and steam from the coil portion are collectively delivered, and from which they are separately conveyed, the

steam to the steam-space and the water to the water-space of the tubular portion of the boiler.

4. A boiler comprising a containing-shell, a coil portion through which the feed-water is introduced, a tubular portion situated under the coil portion, a steam-separating device, a pipe connecting the interior of the separating device to the lower end of the coil portion, a pipe connecting the upper end of the separating device to the steam-space of the tubular portion, and a pipe connecting the lower end of the separating device to the water-space of the tubular portion.

5. A boiler comprising a containing-shell, a portion having the characteristics of a flash-boiler located in the upper portion of the shell, and a portion having the characteristics of a different type of boiler located in the lower portion of the shell, together with centrifugally-acting means for separating the steam and heated feed-water derived from said flash portion and for delivering said bodies respectively into the steam-space and water-space of the boiler portion having different characteristics.

6. A boiler having a vertical fire-tube portion and a flash portion, together with centrifugally-acting means for separating the steam and heated feed-water derived from the flash portion, and for delivering said bodies continuously respectively into the steam-space and water-space of the vertical fire-tube boiler.

7. A boiler comprising an inclosing shell, two steam-generating devices situated in such shell, together with means for continuously carrying the steam and water from one generating device to the other, and separating them by centrifugal force in their passage.

8. A boiler comprising an inclosing shell, a steam-generating device in the upper portion of said shell through which the feed-water is introduced, a steam-generating device in the lower portion of said shell into which a portion of the feed-water is finally delivered, and a centrifugally-acting device intermediate of said steam-generating devices, by means of which the steam and water conveyed from the first-mentioned device is separated and delivered continuously, respectively into the steam-space and water-space of the second-named device.

9. A boiler comprising an inclosing shell a coil portion, a tubular portion situated under the coil portion, a steam-separating device arranged external to the shell and communicating with the lower end of the coil portion and respectively with the steam-space and water-space of the tubular portion.

10. In combination, a boiler comprising an inclosing shell two steam-generating devices differing in characteristics situated therein, means for delivering feed-water to one of said generating devices, means for utilizing the difference in momentum of the commingled steam and water derived from one of said generating devices to effect the separation of these bodies, and means for continuously delivering them in the separated state respectively into the steam-space and water-space of the other generating device.

11. In combination, a boiler comprising an inclosing shell, two steam-generating devices differing in characteristics therein, means for supplying feed-water to one of said generating devices, means controlled by the water-level in the other generating device for controlling the supply of feed-water, together with means for separating the commingled steam and water derived from one generating device and separately feeding said bodies respectively to the steam-space and water-space of the other generating device.

12. In combination, a boiler comprising a shell, two steam-generators in said shell, and a device intermediate of said generators, acting through the difference in velocity of impact of the steam and water introduced into it, to separate the steam and water derived from the first generator and constantly deliver said steam into the steam-space and the water into the water-space of the second generator.

13. In combination, a boiler comprising a shell, two steam-generators in said shell having independent and separate water-spaces, and a device introduced between the two, adapted by reason of the difference of velocity of impact and specific gravity of the steam and water introduced into it from the first generator, to separate these bodies and constantly deliver them respectively the steam to the steam-space and the water to the water-space of the second generator.

14. In combination, a boiler comprising a shell, two steam-generators in said shell having independent and separate water-spaces, and means external to the shell, adapted to separate the water and steam derived from one of said generators, and to constantly deliver the steam to the steam-space, and the water to the water-space of the other generator.

15. In combination, a boiler comprising a shell, two steam-generators therein, and a device interposed between said generators cylindrical in form, into which the steam and water from the first generator are delivered tangentially, and which serves by reason of the rotary motion imparted to said bodies to separate them, whereby the steam will be continuously delivered to the steam-space and the water to the water-space of the second generator.

16. In combination, a boiler comprising a shell, two steam-generators, one having the characteristic of a flash-boiler and the other of a tubular boiler, and a steam-separator in-

troduced between the two, adapted to separate the steam and water derived from the first generator through the action of applied centrifugal force due to the movement of the steam and water, and continuously deliver said steam into the steam-space and the water into the water-space of the second generator.

17. In a boiler, means for introducing feed-water at a distance from the source of heat, means for conveying said feed-water together with any steam generated therefrom to a separating device, means for centrifugally separating the commingled steam and water, and means for continuously conveying the separated steam and water respectively to a steam-space and water-space adjacent to the source of heat.

In testimony whereof we affix our signatures in the presence of two witnesses.

WILLIAM JAMES LANE.
GEORGE LANE.

Witnesses:
SILAS LANE,
J. M. JONES.