

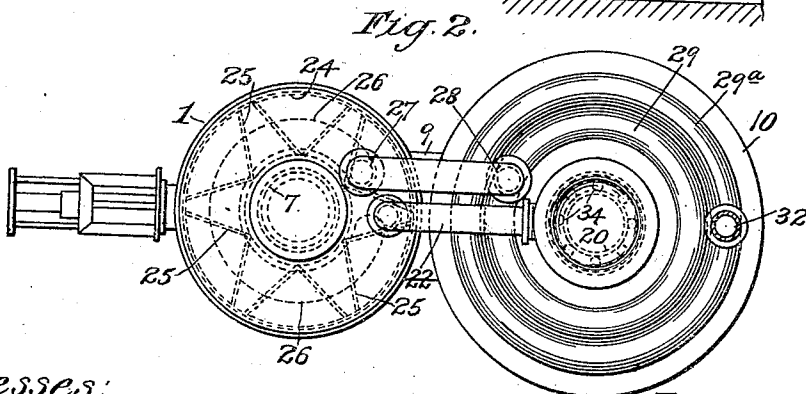
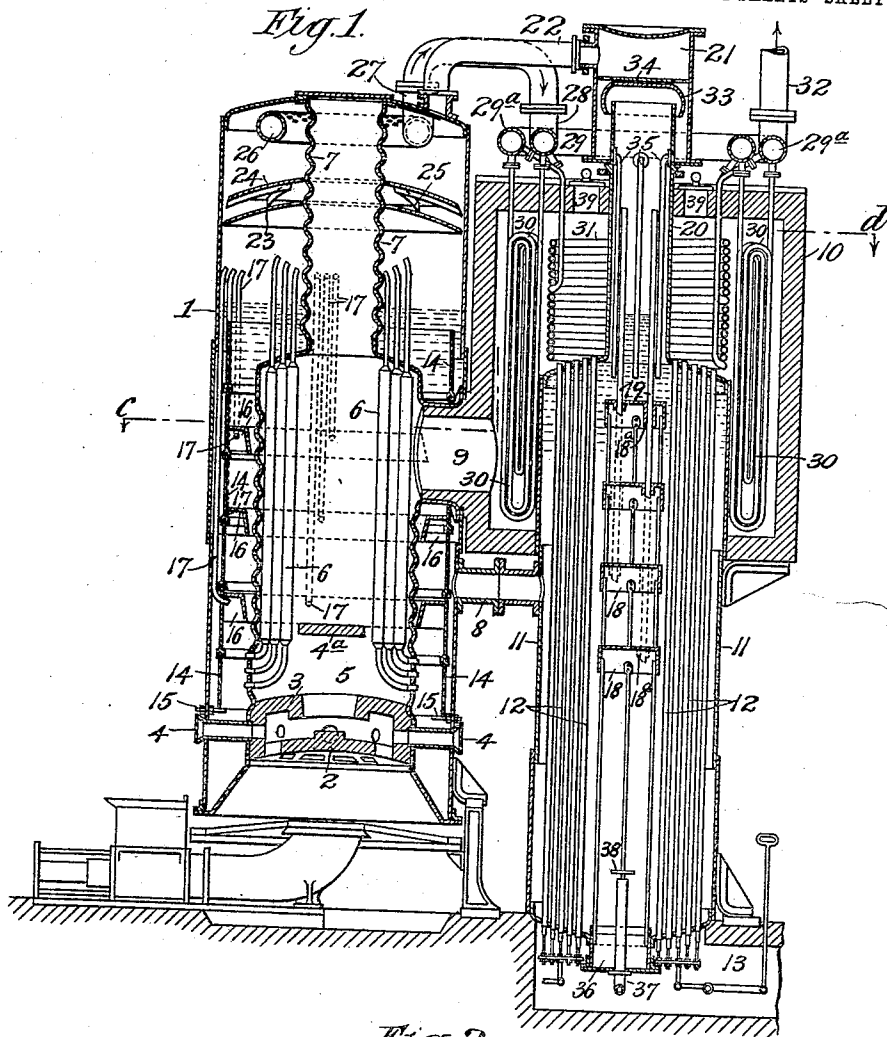
C. WEGENER.
BOILER.

APPLICATION FILED NOV. 30, 1906.

931,907.

Patented Aug. 24, 1909.

2 SHEETS—SHEET 1.



Witnesses:
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O. F. Kehoe

Inventor:
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By his Attys:
Philip Sanger Rice Kennedy

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2 SHEETS—SHEET 2.

Fig. 3.

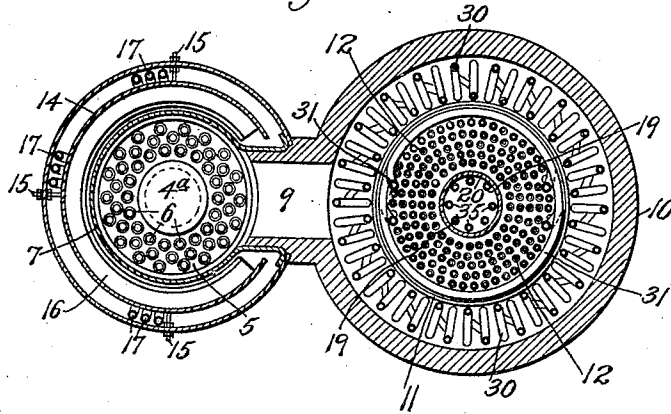


Fig. 4.

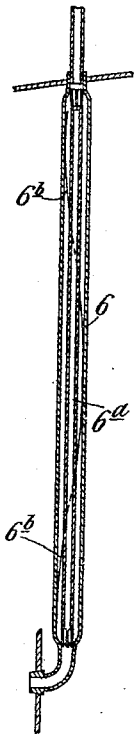


Fig. 5.

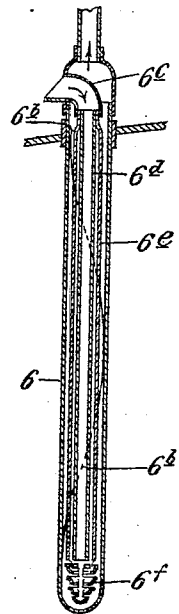


Fig. 6.



Fig. 8.

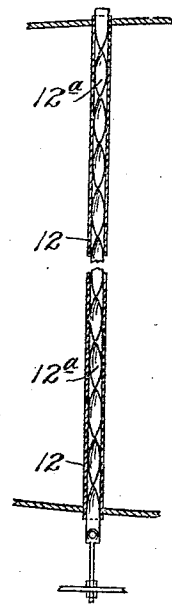


Fig. 7.



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UNITED STATES PATENT OFFICE.

CARL WEGENER, OF CHARLOTTENBURG, GERMANY.

BOILER.

931,907.

Specification of Letters Patent. Patented Aug. 24, 1909.

Application filed November 30, 1906. Serial No. 345,756.

To all whom it may concern:

Be it known that I, CARL WEGENER, of Charlottenburg, a subject of the King of Prussia, and whose post-office address is No. 54 Charlottenburger Ufer, Charlottenburg, near Berlin, Prussia, German Empire, have invented new and useful Improvements in Boilers, of which the following is a specification.

10 The present invention relates to a new boiler plant in which two or more vertical boilers are combined in such a way that one or more primary boilers arranged side by side are fired, and the products of combustion or smoke gases are conducted from these 15 boilers to one or more main or secondary boilers. The one or more secondary boilers which are not directly fired are arranged in such a way that the gas or smoke-tubes go through the entire boiler.

20 While only one primary boiler and one secondary boiler has been shown and described, it will be understood that two or more such primary and secondary boilers arranged side by side may be employed and that the invention is not therefore limited to an arrangement comprising a single primary and a single secondary boiler.

25 Not only a great utilization of heat results from the new plant, but also a great heating surface is obtained with a relatively small space. A number of members placed in the water-space serve for increasing the surface, accelerate the evaporation, and are arranged in such a way that the steam which 30 forms in them is conducted into the steam-space directly without having to pass through columns of water. Water-separators are preferably provided in all the boilers of the plant, which separators prevent the 35 water from being carried up into the steam-space. The arrangement of those boilers in which the smoke-tubes reach from the upper to the lower end permits the arrangement of a superheater in a casing formed over the boiler, so that the products of combustion going from the one into the next boiler are 40 able to be utilized simultaneously for the superheating of the steam generated in the plant. Thus a plant is produced which gives dry and superheated steam and complies with the heavy economic demands placed upon it.

45 In order that the invention may be more clearly understood reference is made to the accompanying drawings in which one em-

bodiment consisting of two boilers is represented.

In said drawings: Figure 1 is a vertical section through two vertical boilers situated side by side; Fig. 2 is a plan view of the construction shown in Fig. 1; Fig. 3 is a horizontal section on the line *c-d* of Fig. 1; Figs. 4 and 5 are vertical sections of two 60 constructional forms of water-tubes; Fig. 6 is a vertical elevation of a detail; Fig. 7 is a plan of the same; Fig. 8 is a vertical section of a detail.

The primary boiler 1 is provided with a firing device of known arrangement and has two bottoms 2 and 3. Lateral openings are provided in the bottom 2, whereas one central opening is provided in the bottom 3. The secondary air is introduced through channels 4. The products of combustion then pass from here into a furnace or fire-box 5, hit against the crown 4^a and are distributed here among the tubes. The boiler tubes 6 may be arranged in any suitable 75 manner.

80 The water-tube according to Fig. 4 consists of an outer tube 6 which incloses a so-called displacer 6^a. The latter consists of a pipe concentric to the tube 6, the inner pipe being closed above and open below. A number of bridges or the like holds the pipe 6^a in its correct position. The tube 6 is fastened in the fire-box in any suitable manner. A continuation of the tube 6 projects at its upper end over the highest water-level. As 85 the displacer 6^a is closed above and open below, air collects in it so that the water entering from below rises upward in a ring-shaped column in the tube 6. The steam which forms then escapes through the continuation of the tube into the steam space. Helically shaped ribs 6^b, which are situated between the displacer 6^a and the tube 6, compel the water to rise upward in a long 90 course. On account of the tube just described, the circulation of the water is more energetic and more uniform than is the case in other arrangements. Namely the speed of the rising water is considerably greater at the circumference than in the middle in 95 a water-tube, as the quantity of water situated immediately at the side of the tube is heated to a considerably higher temperature. The water which comes into contact with the hot side of the tube is therefore lighter 100 than that in the center. The moving water would have different speeds and would be 105

drawn toward the center as a result of this. This disadvantage is avoided by the arrangement of the displacer just described, as the water rises up in the form of a hollow column, and the water in the center is done away with. The central tube or displacer 6^a is open below so that air can enter into it. In this manner the displacer may be made very thin.

10 In Fig. 5 another tube, namely a so-called field-tube, is represented which consists of three tubes 6, 6^e, 6^d which are concentric one to another. An elbow 6^c is provided in an upper continuation of the tube 6, into
15 which the most central tube 6^d opens. A jacketing pipe 6^e is arranged round this tube, the latter having a conical stopper below which is provided with openings 6^f. The latter are alternately bent toward the out-
20 side and toward the inside, whereby guiding surfaces are produced for the water. The pipe 6^e may be provided with helical ribs 6^b in suitable manner just as the tube according to Fig. 4. The water enters
25 through the elbow 6^c and goes downward through the tube 6^d. It then goes through the openings 6^f into the tube 6 in which it is evaporated. The steam then goes
30 through an upper continuation into the steam space, the continuation likewise projecting over the highest water-level, as in the case of the tube previously described. A layer of air is between the tubes 6^d and 6^e
35 which serves for separating the stream of water and steam and thus acts favorably on the circulation and on the formation of steam.

A pipe 7 goes from the fire-box to the uppermost part of the shell of the boiler; a
40 cover closes the pipe tightly during working. The water-space of the boiler 1 is connected with that of the secondary boiler 11 through pipes 8. A channel 9 connects the fire-box 5 with a casing 10 which is formed on the
45 upper part of the boiler 11. Smoke-tubes or gas-tubes 12 are provided in the latter which reach from the upper cover to the bottom of the boiler. The exhaust channel is joined to the latter. A helically twisted strip of
50 iron 12^a (Fig. 8) is provided in each tube 12, the breadth of which corresponds to the internal diameter of the tube. This iron is fastened by a fork-shaped screw-bolt to a ring situated underneath the boiler. A system
55 of levers serves for raising or lowering the strips 12^a for the purpose of cleaning the tubes 12 (Figs. 1 and 8). A jacket 14 is provided in the boiler 1 which rests on pins 15. This jacket, which divides the
60 water-space to a certain extent into two parts, carries a number of receptacles 16 which serve for enlarging the surface and for accelerating the evaporation. Tubes 17 lead from the receptacles 16 into the
65 steam-space. Similar receptacles 18 are ar-

ranged in the boiler 11 from which tubes 19 go to the steam-space. Cases or sleeves 18^a are provided in the receptacles 18 through which the tubes 19 pass. Both the tubes 17
70 as well as the tubes 19 project over the highest water level. A pipe 20 is situated on the upper cover of the boiler 11 which opens into a steam collector 21. The steam collector 21 is connected with the steam-space of the boiler 1 through a pipe 22. Two
75 plates 23 and 24 are provided in the boiler 1. The plate 23 does not extend close up to the sides of the boiler and likewise leaves openings around the pipe 7. Ribs 25 are formed in the upper plate 24 which converge
80 together toward the sides of the boiler. (See Fig. 2). These ribs are inclined to the vertical and form channels. A pipe 26 bent into an arc of a circle is situated below the
85 top of the boiler 1 and is provided with holes through which the steam can enter. This pipe opens into a pipe 27 which is connected with a pipe 28 through a connecting
90 piece. The pipe 28 communicates with the pipe 29 which is in the form of an arc of a circle and is connected with the elements 30 and 31 of the superheater. The elements 31 consist of a number of tubes bent into
95 arcs of circles, whereas the elements 30 have the shapes as shown in Figs. 1, 3, 4 and 5. The steam is conveyed from the superheater through the pipe 29^a and the conduit 32 to the place of consumption. Also the steam
100 collector 21 is provided with a water separator. A cap 33 is provided at the upper end of the pipe 20, over which a perforated plate 34 is situated. So much space remains between the lower edge of the cap 33 and the
105 pipe 20 that the steam and any water carried with it can pass between both. The steam rises upward through the holes of the plate 34, whereas the water is led away through pipes 35 which project into the
110 water-space of the boiler. The feeding device 37 is provided in the lower junction-piece of the boiler 11, over which a plate 38 is situated, so that the water which enters the boiler is distributed in the same.

The manner of working the entire plant is as follows:—The products of combustion
115 pass first through the lateral openings of the bottom 2, then through the central opening of the bottom 3 into the fire-box 5 of the boiler 1, where they impinge against the crown 4^a flow around the tubes 6 and reach
120 the casing 10 of the second boiler by the tube 9. Here they flow around and play upon the elements 30 of the superheater and rise upward against the outer surfaces of the tubes 31. Then they pass around the
125 surface of the uppermost tube and go through the smoke- or gas-tubes 12 which pass through the entire boiler 11 to the exhaust channel 13. Thus they leave at the
130 coldest part of the boiler system. In conse-

quence of the iron strips 12^a the hot gases must traverse a longer path than otherwise and, moreover, the neutral zone of the stream of gas is broken up. In this way both parts of the stream of gas give off more heat. The tubes can be cleaned during working by raising and lowering the iron strips 12^a by means of a suitable system of levers. By this arrangement the heat is able to be turned to the best account. The steam which forms in the boiler tubes 6 is conducted directly into the steam-space. The jacket 14 divides the water space, as it were, into two parts. Inside the jacket the hot water rises upward, whereas outside the cold water falls down. The vessels 16 serve for enlarging the superficial area. The tubes 17 are so fastened in the vessels 16 that sufficiently great intermediate space remains between the opening of the tubes and the cover of the vessels, so that the inclosed air cannot escape. Hereby a surface and a space are formed in each vessel 16, the space serving for receiving the steam which is formed. As soon as the steam has reached the opening of the pipe 17, it enters the same and rising upward escapes into the steam chamber. The receptacles 16 thus serve for enlarging the surface, whereas the tubes 17 permit the steam to rise up without the necessity of its making its way first through the water. Now as it happens that the steam carries water with it, the water separator consisting of the two plates 23 and 25 is provided in the steam-chamber. The steam and the water carried with it hit, in the first place, on the lower plate 23 and rise upward along the pipe 7. Then they strike against the plate 24. The water thus carried away by the steam goes along the slanting ribs 25, which approach one another toward the sides of the boiler, and there falls downward through the space between the plate 23 and the boiler-jacket. The steam goes upward through a corresponding intermediate space which is formed between the upper plate 24 and the side of the boiler. An action similar to that which takes place in the receptacles 16 also takes place in the vessels 18 of the boiler 11. The steam which is formed is conducted through the tubes 19 to the upper part of the pipe 20; it goes from here into the steam collector 21. In the first place the cap 33 compels the steam and any water carried with it to go downward. The water collects on the bottom of the collector 21 and is led back through the tubes 35 into the boiler, whereas the steam is conveyed through the perforations of the plate 34 into the upper part of the steam collector, and from here through the pipe 22 into the steam chamber of the boiler 1. An annular pipe 26 is provided in the latter which has a large number of holes at its upper part. The steam then goes through the lat-

ter holes in many small jets on a large surface into the pipe 26; it is then conducted further through the pipe 27 and goes through the pipe 28 into the superheater through which it flows. Thereon the steam goes into an annular pipe 29^a and, lastly, passes through the pipe 32 to the place of consumption. Thus not only as great an evaporation as possible takes place, but the steam is also led away from the boiler dry and superheated, although the whole plant only occupies an exceedingly small space.

While the construction of parts which is preferred has been described in the foregoing specification, it is to be understood that numerous changes of construction and operation may be made without departing from the spirit and scope of the invention, and it is therefore not to be understood as limited by the positive terms employed in connection with the description, excepting such as the state of the art may require.

What I claim, and desire to secure by Letters Patent of the United States, is:—

1. The combination of a primary boiler provided with furnaces, and a secondary boiler provided with gas tubes passing from end to end of each boiler, and a casing formed on the upper part of the secondary boiler into which said gas tubes open, and a channel connecting the fire box of the primary boiler with the casing.

2. In a primary boiler of the type described, the combination of a vertical cylindrical outer shell with a cylindrical jacket (14) in the water space and a plurality of vessels in the water space provided with tubes passing to the point above the highest water level, for the purpose of collecting the steam and conducting the same to the steam space.

3. In a primary boiler of the type described the combination of the pipe (7), two plates (23, 24) surrounding said pipe, the lower plate (23) having an opening in proximity to said pipe, but contacting at its periphery with the boiler shell, and the upper plate 24 contacting with the pipe 7, but not extending as far as the boiler shell.

4. In a primary boiler of the type described, the combination of the pipe (7), two plates (23, 24) surrounding said pipe, the lower plate (23) having an opening in proximity to said pipe, but contacting at its periphery with the boiler shell, and the upper plate (24) contacting with the pipe (7), but not extending as far as the boiler shell, ribs (25) being provided on said upper plate.

5. In a boiler plant of the type described, the combination of a primary boiler provided with a furnace and having independent sets of steam tubes and a steam-chamber common thereto, a secondary boiler, a steam-collector connected therewith, and means

connecting said steam-collector with said steam-chamber of the primary boiler.

6. In a secondary boiler of the type described, the combination of a steam-collector, a water-separator arranged therein, and tubes connected with the latter and extending into the water space of the boiler for the purposes of conducting water back into the boiler.
7. The combination of a primary boiler provided with a furnace and a secondary boiler provided with gas tubes passing from end to end thereof, and a casing formed on the upper part of the secondary boiler into which said gas tubes open, a superheater located in said casing and a channel connecting the fire box of the primary boiler with the casing.

8. The combination of a primary boiler provided with furnaces, and a secondary boiler provided with gas tubes passing from end to end of the boiler, and a casing formed on the upper part of the secondary boiler into which said gas tubes open, a channel connecting the fire box of the primary boiler with the casing, and a channel connecting the water space of the primary boiler with the secondary boiler.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

CARL WEGENER.

Witnesses:

HENRY HASPER,
WOLDEMAR HAUPT.