A. C. J. HENNIG.

STEAM BOILER.

APPLICATION FILED MAY 12, 1917.

1,296,799.

Patented Mar. 11, 1919.

3 SHEETS—SHEET 1.

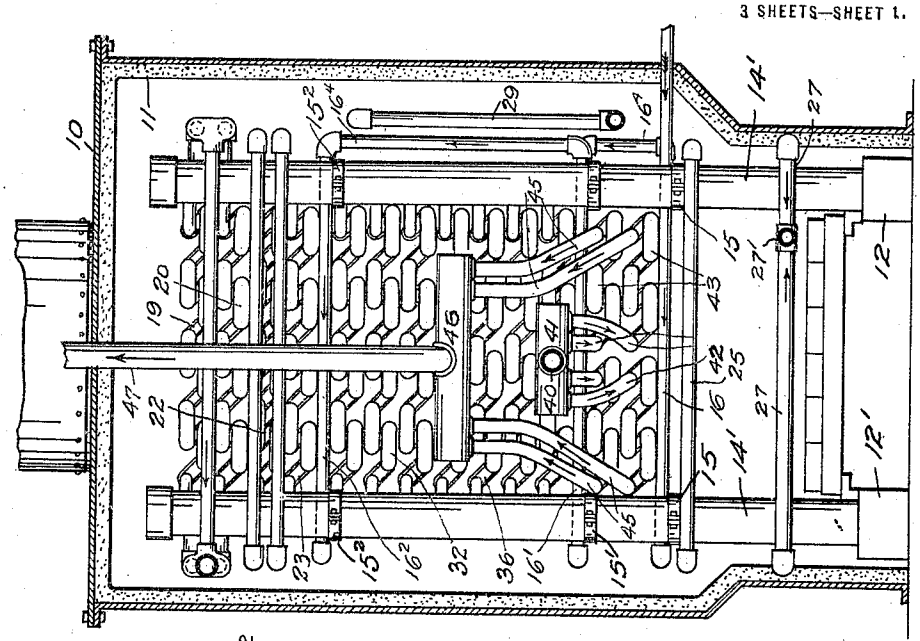


Fig. 2.

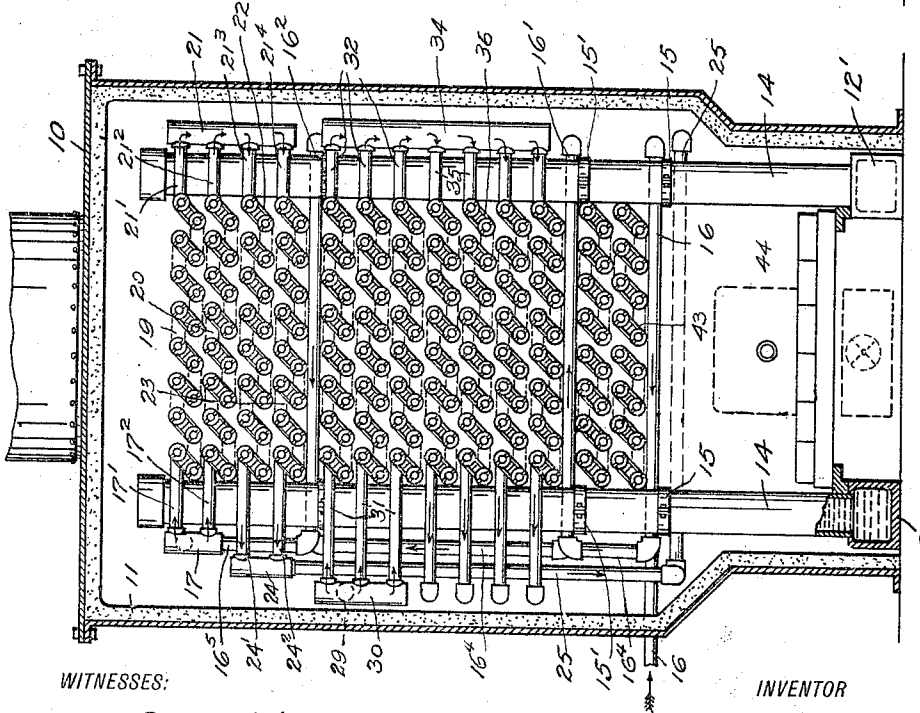


Fig. 1.

WITNESSES:

A. B. Cornelius

E. Peterson

INVENTOR

Adolph C. J. Hennig

BY

Pierre Barnes

ATTORNEY

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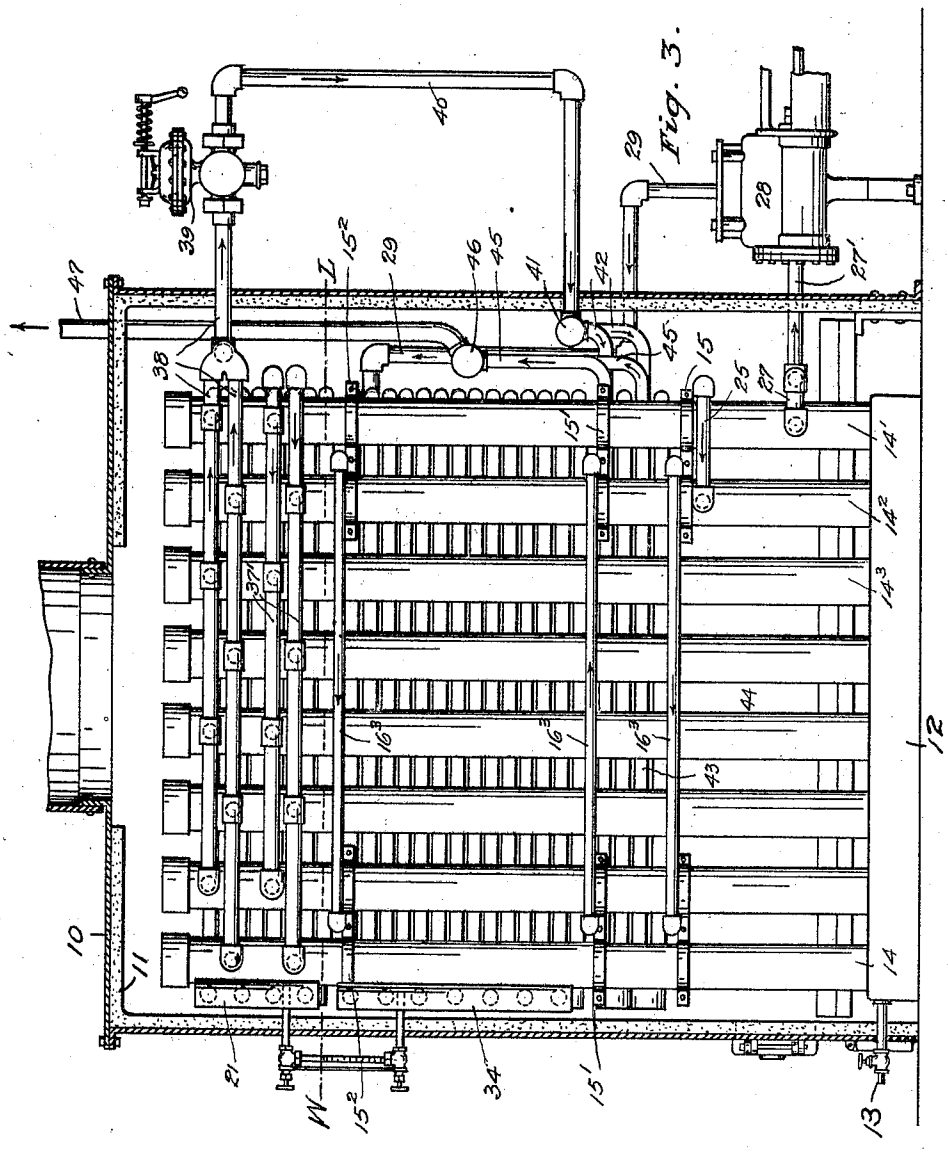
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3 SHEETS—SHEET 2.

Fig. 3.



WITNESSES:

A. B. Cornelius

E. Peterson

INVENTOR

Adolph C. J. Hennig

BY

Pierce Barnes

ATTORNEY

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

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3 SHEETS—SHEET 3.

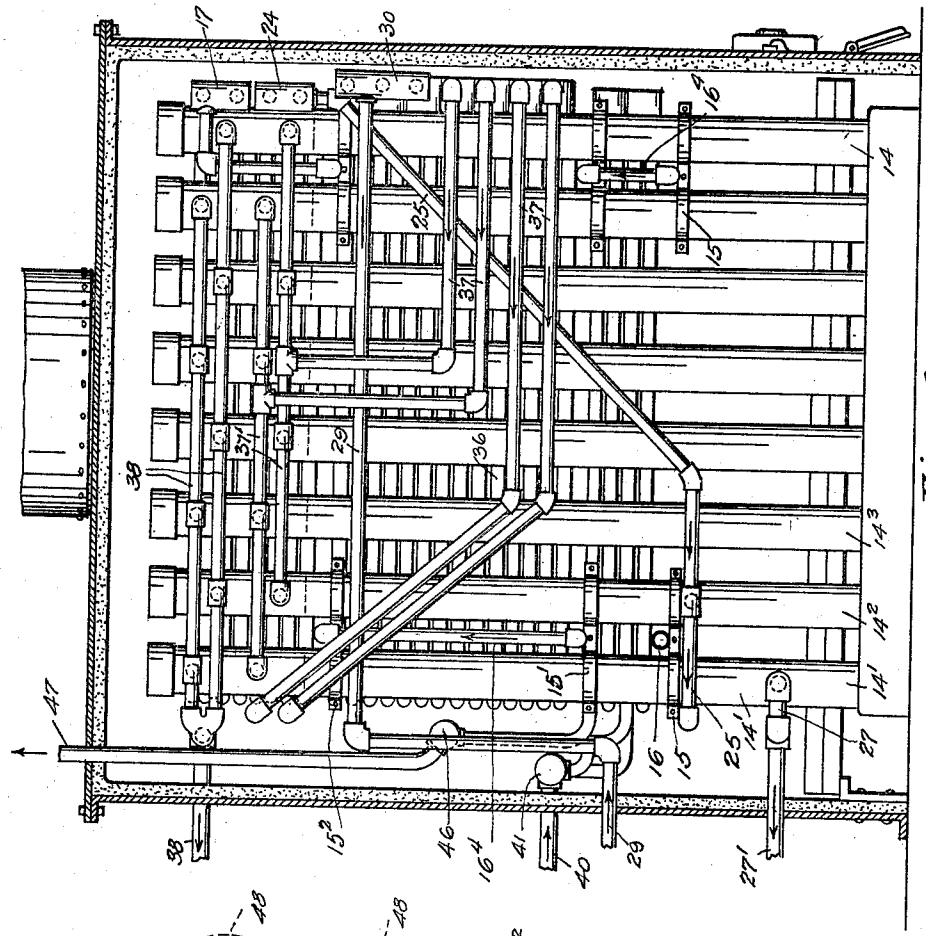


Fig. 4.

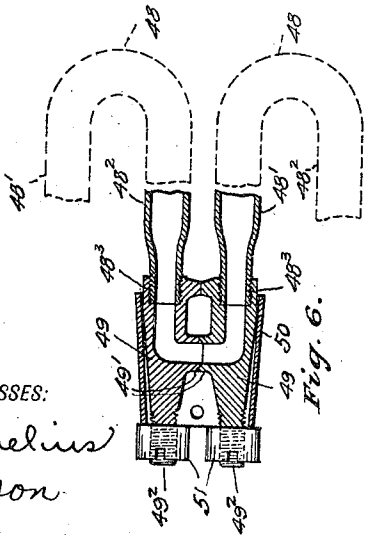


Fig. 6.

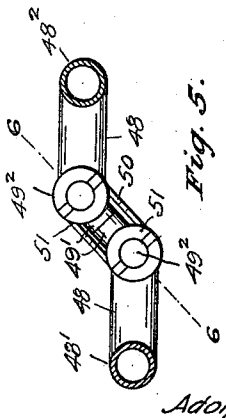


Fig. 5.

WITNESSES:

A. B. Cornelius

E. Peterson

INVENTOR

Adolph C. J. Hennig

BY

Pierre Barnes

ATTORNEY

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

UNITED STATES PATENT OFFICE.

ADOLPH C. J. HENNIG, OF SEATTLE, WASHINGTON.

STEAM-BOILER.

1,296,799. Specification of Letters Patent. Patented Mar. 11, 1919.

Application filed May 12, 1917. Serial No. 168,326.

To all whom it may concern:

Be it known that I, ADOLPH C. J. HENNIG, a citizen of the United States, residing at Seattle, in the county of King and State of Washington, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification.

This invention relates to steam boilers of the water-tube type; and the main object of my improvements is to enable a comparatively small boiler of this class to produce a larger quantity of high pressure steam more economically and rapidly than hitherto.

A further and important object is to provide controlling devices which contribute to the boiler efficiency by regulating the pressures and for effecting a positive circulation of the water and steam within the boiler.

Still another object is to improve the details of the boiler structure so that the same are capable of freely expanding and contracting and arranged to be quickly and conveniently replaced when necessary.

The preferred form of construction is illustrated in the accompanying drawings, wherein Figure 1 is a front elevation of the boiler; Fig. 2 is a rear elevation and Figs. 3 and 4 are elevations from opposite sides, the casing in said views being shown in section; Fig. 5 is a front elevation, to an enlarged scale, of a union for coupling adjacent coil elements of the boiler; and Fig. 6 is a sectional view taken through 6—6 of Fig. 5.

The reference numeral 10 designates the boiler casing which may be constructed of sheet metal plates with an internal lining 11 of a suitable heat insulating material. The boiler proper is provided at opposite sides with longitudinally disposed mud drums or water containing members 12 and 12^1 provided with valved blow-off pipes, such as 13. Opening into and extending upwardly from said members are tubular headers 14, 14^1, 14^2, etc. Clamped to the headers at the front and rear of the boiler are attachments 15, 15^1 and 15^2 disposed at different elevations to support the rack pipes which, in turn, support the various banks of steam-generating and superheating pipe coils. Said rack pipes comprise transversely arranged horizontal pipes 16, 16^1 and 16^2 which are connected by longitudinal and vertical pipes 16^3 and 16^4, as shown.

The feed water for the boiler is supplied from one side into a rack pipe 16, as indicated by feathered arrow in Fig. 1, and after being heated while passing through the above named pipes is led by a pipe 16^5 into the lower end of a manifold 17 located near the front and top of the boiler. This manifold is provided with side outlets for connections 17^1 and 17^2 with the upper coils 19 and 20 of the steam generator system, and from which the water passes through connections 21^1 and 21^2 into a second manifold 21 at the opposite side of the boiler.

The water, together with any steam which may be so far produced, descends in the manifold 21, thence by connections 21^3 and 21^4 into coils 22 and 23, and from the latter by connections 24^1 and 24^2 into a third manifold 24 located subjacent to the manifold 17.

From the latter the steam and water are conducted by pipes 25 into the headers 14^2. The water and steam thus delivered into the headers separate to have the former mingle with the body of water within the headers which is normally maintained to approximately the level indicated by W L in Fig. 3.

From near the lower ends of the headers 14^1 are branches 27 of a draw-off pipe 27^1 which leads to a power-driven force-pump, denoted by 28, provided with a delivery pipe 29 which is connected to a manifold 30. The water thus supplied to manifold 30 is withdrawn through the inlet connections 31 of a series of generating coils 32 having outlet connections 33 with a manifold 34 in which it descends and is led therefrom by connections 35 into generating coils 36.

Through the office of said pump the water and steam within the coils 36 are subjected to a relatively high pressure as, for example, 450 pounds, and in such condition the two fluids are conveyed by pipes 37 into distributing pipes 37^1 and thence into the steam spaces obtaining in the upper ends of the aforesaid headers.

From a higher elevation than said distributing pipes the headers are connected by steam draw-off pipes 38 to a pressure reducing valve, indicated by 39, which is regulated to deliver the steam into the outlet

pipe 40 at a pressure considerably lower, say 50 per cent., than the pressure prevailing in the above explained steam generating coils.

The pipe 40 conducts the steam into a manifold 41, whence it is led by connections 42 into coils 43 which in the present invention, serve in lieu of a steam drum, and by being located immediately above the furnace space 44, as shown, likewise serve as superheating members. In passing through such superheater coils the steam is subjected to a high temperature to render it relatively hot and dry. From the superheater coils the steam is conducted by connections 45 to a manifold 46 wherefrom it is discharged by a pipe 47 to be utilized for power or other purposes.

Each of the steam generating and superheater coils comprises pipe units of substantially U shapes, being bent as at 48 (Fig. 6) at the rear to afford two forwardly extending members 48^1 and 48^2 which terminate in screw-threaded ends 48^3. For coupling such ends of the adjacent units I provide a union fitting consisting of two complementary cap pieces 49 each having a screw-threaded socket at one end into which the end 48^3 of a pipe member is engaged, and with ground interfitting wing elements 49^1 which furnish communicative connection between a pair of cap pieces.

These pieces are further formed to taper toward their outer ends to receive a sleeve 50 which, by being forced inwardly through the offices of nuts 51 engaging screw-threaded projections 49^2 of the respective cap pieces, serve to hold the joint between the wing elements tightly together.

In operation, the water is primarily warmed in the heating pipes which also serve as a rack for supporting the boiler coils and delivered to the upper steam generating coils, and thence into the headers at opposite sides of the boiler. From the lower ends of the headers the water is conducted to a pump and is forced thereby through a second and lower series of steam generating coils to be returned to the headers in the nature of steam.

The steam is thereupon conducted by pipes to the superheater coils which are located between the furnace space and the lower generating coils, said steam being supplied to the superheater coils by means of a regulating valve at a lower pressure than at which it is maintained in the generating coils and headers.

By introducing a pump between the steam generating coils, the circulation within the boiler is such as to not only cause the heated water and steam to take a general downward course, but it also mechanically compresses the fluids with a corresponding increase in temperature. The regulating valve may be of any suitable type which will allow the flow of steam thereby when the pressure at the delivery side falls below the predetermined degree to which the valve is adjusted to operate; hence the steam in the superheater is maintained at a substantially uniform pressure and there is a reserve of steam at a relatively high temperature and pressure which may be drawn upon to compensate for an abnormal demand.

Because of the high pressure steam carried in the generating coils and headers and from the fact that it is expanded upon being delivered to the superheater, it is evident that but little space need be provided in the former to accommodate the equivalent of a large quantity of steam at the pressure as delivered from the boiler.

Having described my invention, what I claim, is—

1. In a steam boiler, the combination with the upright steam and water containing headers, and a feed water pipe connected therewith, of series of superposed steam generating coils connected with the headers at different elevations, a pump for effecting the flow of water and steam produced in said coils downwardly through all of said coils and returning the fluids into the steam spaces provided in the upper ends of the headers, and a series of coils connected with the upper ends of said headers and disposed below the aforesaid coils for superheating the steam subsequent to its delivery thereto from the headers.

2. In a steam boiler, the combination with the mud drums and headers extending upwardly therefrom at opposite sides of the boiler, and a pump, of steam generating coils communicatively connected with each other through the medium of the headers in proximity to the upper and lower ends of the latter, whereby said pump will serve to effect the circulation of water and steam in said headers and the steam generating coils and whereby such fluids are caused to flow from the lower ends of certain of said headers into the upper of the steam generating coils and return the water and steam into the upper ends of all of the headers from the lower of the coils.

3. In a steam boiler, the combination with steam and water-containing headers, water-heating pipes connected thereto, and groups of steam generating coils connected with said headers at different elevations, of a pump arranged to effect the flow of water from the lower ends of headers and thence progressively downward through said groups of coils and return the water and the produced steam into the upper ends of said headers, a second series of coils, communicative connections between said series of coils and the upper ends of said headers, and pressure-reducing means included in the

connection between said headers and the last-named series of coils.

4. In a steam boiler, the combination with steam and water-containing headers, water-heating pipes connected thereto, and groups of steam generating coils connected with said headers at different elevations, of a pump, connections between said groups of coils and arranged to enable said pump to effect the flow of water from the lower ends of said headers and thence progressively downward through said groups of coils and return the water and the produced steam into the upper ends of said headers, a second series of coils positioned below said steam generating coils, connections between said series of coils and the upper ends of the headers, and pressure-reducing means included in the connection between said headers and the said series of coils.

Signed at Seattle, Washington, this 19th day of April 1917.

ADOLPH C. J. HENNIG.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."