No. 808,228. PATENTED DEC. 26, 1905.

J. E. BELL.

INDEPENDENTLY FIRED SUPERHEATER.

APPLICATION FILED JUNE 6, 1904.

2 SHEETS—SHEET 1.

Fig. 1.

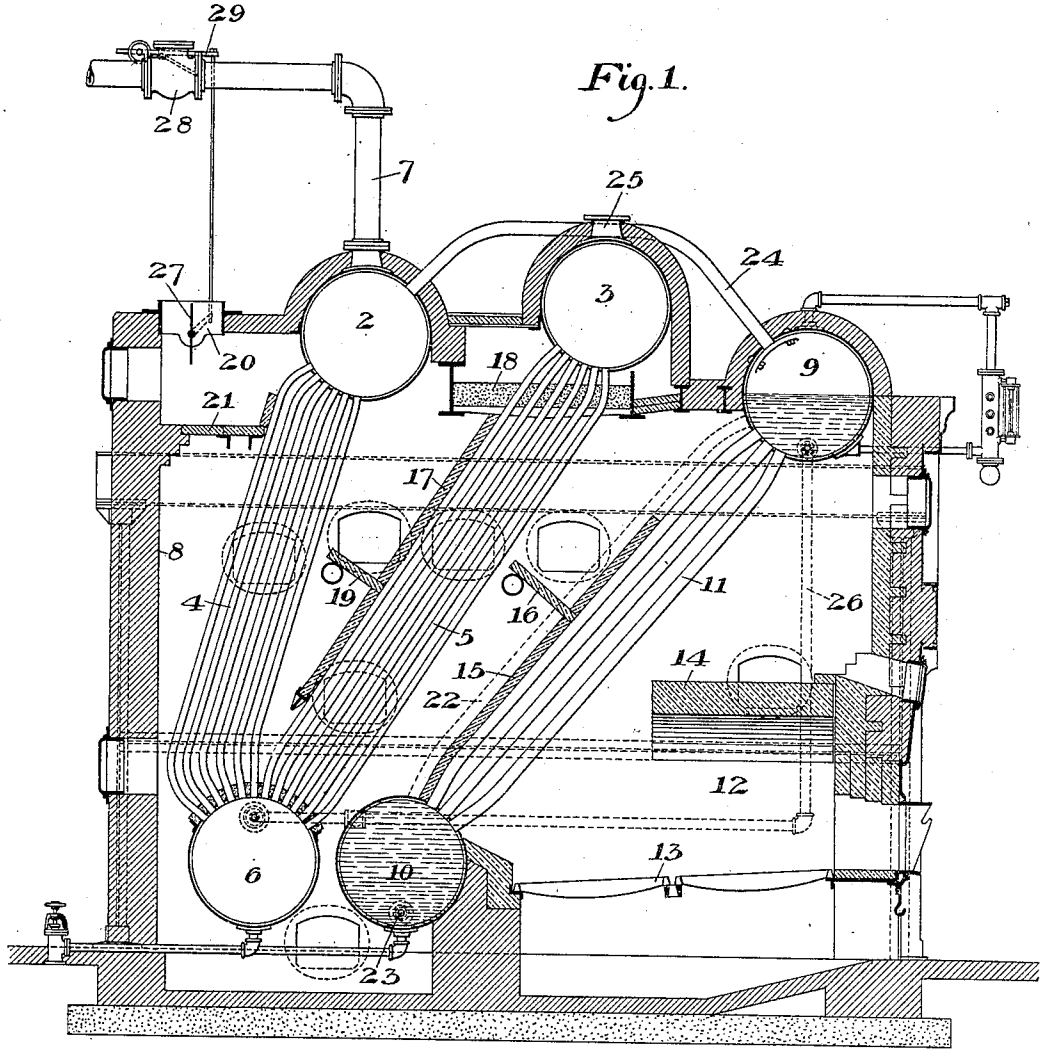
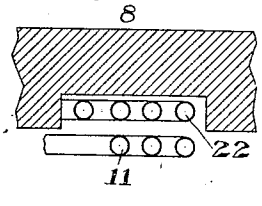


Fig. 3.



WITNESSES

Warren W. Swartz

A. M. Corwin

INVENTOR

J. E. Bell

by Baldwin & Baynes

his attys

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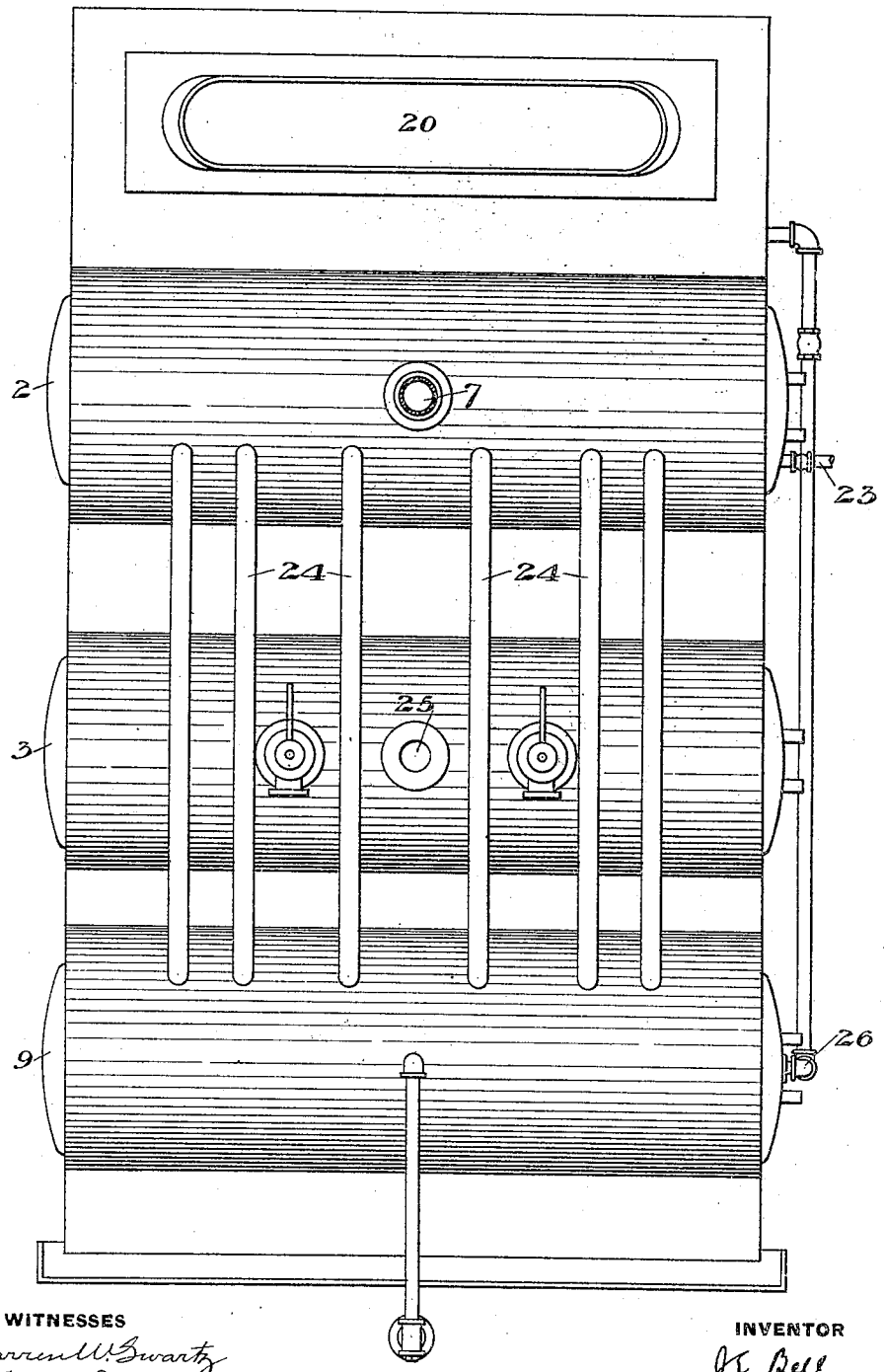
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2 SHEETS—SHEET 2.

Fig. 2.



WITNESSES

Warren W. Swartz

H. M. Corwin

INVENTOR

J. E. Bell

By Baldwin & Peyres

his attys

UNITED STATES PATENT OFFICE.

JOHN E. BELL, OF BARBERTON, OHIO, ASSIGNOR TO THE STIRLING CONSOLIDATED BOILER COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

INDEPENDENTLY-FIRED SUPERHEATER.

No. 808,228. Specification of Letters Patent. Patented Dec. 26, 1905.

Application filed June 6, 1904. Serial No. 211,280.

To all whom it may concern:

Be it known that I, JOHN E. BELL, of Barberton, Summit county, Ohio, have invented a new and useful Independently-Fired Superheater, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a longitudinal vertical section of my improved superheater. Fig. 2 is a top plan view of the structure, showing its connection to a boiler; and Fig. 3 is a detail view of circulating-pipes I prefer to employ.

My invention relates to the class of independently-fired superheaters for steam, and is designed to overcome the difficulties present in the usual types of such superheaters.

Heretofore two main objections have been incident to the use of independently-fired superheaters, the first being that on account of the high temperature of the furnace-gases the life of the superheater is short and the tubes are rapidly blistered and burned up, being cooled only by the steam in the tubes. The second objection is that the efficiency is low, since the furnace-gases leave the superheater at a high temperature. The temperature of the gases has been reduced in some superheaters by admitting cold air to the furnace; but this only partially corrects the burning of the tubes and aggravates the second difficulty of low efficiency. My invention is designed to overcome these objections by placing water-heating surfaces between the superheating-tubes and the furnace, which will reduce the temperature of the gases to a point where the superheater-tubes can be maintained in better condition. I also prefer to use superheating-tubes arranged in two passes of the furnace-gases with the steam admitted to that part of the superheating-surface at which the temperature of the gases is lowest. This reduces the second difficulty and gives better efficiency, since the steam and the gases move in opposite directions.

In the drawings, in which I show my invention as applied to an independently-fired superheater constructed on the general plan of the Stirling boiler, with transverse drums, vertically-extending banks of tubes, and serial up-and-down passes for the gases, 2 and 3 represent upper steam-drums connected by banks of tubes 4 and 5 to a lower steam-drum 6. These drums extend transversely of the setting, and the steam enters the drum 2 through the inlet 7 from another boiler or boilers, alongside which the superheater may be located.

In front of the superheater-tubes 4 and 5 and within the setting 8 I place water-evaporating surface, which in the form shown consists of a steam and water drum 9 and a mud-drum 10, extending transversely of the setting and connected by the bank of water-tubes 11.

12 represents the usual furnace with the grate-bars 13 and upper overhanging arch 14.

The furnace-gases are given serial up-and-down passes over the tubes by suitable baffles. In the form shown the baffle 15 extends upwardly and forwardly from the mud-drum 10 along the back of the bank of tubes 11 and is preferably provided with a projecting shelf 16. On the back of the bank 5 is a baffle 17, extending down from the refractory filling 18 through a portion of the length of the tubes and preferably having a rear projecting shelf 19. I have shown the outlet-flue 20 for the gases as arranged at the upper rear part of the setting, a baffle 21 being preferably used below it and projecting from the rear wall to the upper part of the bank of tubes 4.

In order to provide an efficient circulation for the bank of water-tubes, I preferably provide circulating-tubes 22 at each end of the bank, these tubes, of which I have shown four, being preferably set in a recess in the side wall, so that they are partially protected from the gases and will serve as downcomers for the circulation. These downcomers can also be protected by placing tiling between them and the end steam-generating tubes of the bank, if desired. The means for promoting the circulation may be varied in many ways within the scope of my invention. The water is preferably fed into the mud-drum 10 through a pipe 23, and the steam liberated in drum 9 may be carried from this drum to the drum 2 by means of tubes 24, connecting these drums. This steam will mingle with the steam from the other boilers and pass through the superheating-tubes. The drums 2 and 3 are not connected with each other except through the banks of tubes in the lower drum.

In the operation of the superheater the flame and gases rise through the bank of water-heating tubes 11, thence pass down through the bank of superheating-tubes 5, and then rise from the superheating-tubes 4 and pass to the outlet-flue 20. The steam generated in the front bank passes to the superheater-drum 2 and mingles with the steam from the other boilers. The mingled steam in the drum 2 passes down through the bank of tubes 4 into drum 6 and thence up through the bank of tubes 5 into the drum 3, from which it is taken through outlet 25.

The drums 2 and 3 of the superheater may be connected by reversely-bent long tubes without using the lower drum 6. I prefer the construction shown, however, since the superheater-tubes are nearly straight and can be easily cleaned. It also provides for a convenient flooding without fear of clogging the tubes and being unable to clean them. For flooding the superheater-tubes I have shown a valve-pipe 26 leading from the water-space of the drum 9 exterior to the setting and connecting into the end of the drum 6. This connection can of course be varied; but I prefer the form shown, as it will supply cleaner water to the superheater and cause less deposit in the superheating-tubes.

When flooded, the entire apparatus may be used as a boiler in the ordinary manner, the superheater-tubes acting as water-heating surface and the apparatus then giving saturated steam. In order to further protect these superheating-tubes from overheating, I preferably connect the damper 27 for the outlet-flue with a valve 28 in the steam-pipe leading to the superheater. I have shown this valve as of flap form with link connections 29, the arrangement being such that when the flap-valve is open the damper is completely opened, and as the flap-valve closes the damper moves toward closed position. The draft is thus reduced as the supply of steam to the superheater is reduced, preventing overheating of the tubes. The connection from this regulating-valve may lead to the throttle of the van if forced or induced draft is used.

The advantages of my invention result from the use of water-heating surface in front of the superheating-tubes in an independently-fired superheater. This reduces the liability to burning out of the superheater-tubes and makes this action more economical and efficient. As the steam flows in the opposite direction to the gases in two passes, the temperature of the steam will be higher in those portions of the tubes which are subjected to the higher temperature, thus giving better efficiency in reducing the temperature of the outgoing gases. The water-heating surface adds to the boiler capacity of the plant by the amount of steam generated therein while protecting the superheating-tubes.

The type of the superheater and of the water-heating surface may be varied widely without departing from my invention.

I claim—

1. An independently-fired superheater having a plurality of back-and-forth passes for the heating-gases, water-heating surface forming the entire first pass for the gases, and superheater-tubes in the succeeding pass or passes, the superheater having an inlet arranged to supply steam thereto from a separate boiler.

2. An independently-fired superheater having tubes arranged to give the steam a plurality of passes in a forward direction, baffles arranged to give the furnace-gases back-and-forth passes over the superheater-tubes in an opposite direction to the flow of steam within said tubes, and water-heating surface between the superheater-tubes and the furnace, said superheater having an inlet arranged to supply steam thereto from a separate boiler; substantially as described.

3. An independently-fired superheater having at least two banks of superheater-tubes, a steam-inlet leading into the rear bank from a separate boiler, a steam-outlet from a front bank of the superheater, a baffle arranged to give the furnace-gases serial passes over the superheater-tubes in the opposite direction to the flow of steam therein, water-heating surface forming an entire pass between the superheater and the furnace, a steam and water drum for said water-heating surface, and a steam connection between the steam and water drum and the superheater; substantially as described.

4. A superheater having tubes arranged to give the steam a plurality of passes, a steam-inlet leading from a separate boiler to the rear portion of the rear pass, water-heating surface forming an entire pass between the superheater-tubes and the furnace, and baffles arranged to direct the gases in serial passes over the tubes in the opposite direction to the flow of the steam through the superheater-tubes; substantially as described.

5. An independently-fired superheater having a plurality of back-and-forth passes for the heating-gases, water-heating surface forming substantially the entire first pass for the gases, the superheating-tubes being in the succeeding pass or passes and constituting the major part of the entire heating-surface, the superheater having an inlet arranged to supply steam thereto from a separate boiler, and being arranged to receive water and act itself as water-heating surface; substantially as described.

6. An independently-fired superheater having a plurality of upper steam-drums connected by banks of superheating-tubes to a lower drum or drums, the rear upper drum having a steam-inlet from a separate boiler, and water-heating surface in a separate pass between the superheater-tubes and the furnace, the

major portion of the heating-surface consisting of the superheater-tubes; substantially as described.

7. An independently-fired superheater having a plurality of upper steam-drums connected by banks of superheating-tubes to a lower drum or drums, the rear upper drum having a steam-inlet from a separate boiler, and water-heating surface in a separate pass between the superheating-tubes and the furnace, and having a steam and water drum with its steam-space connected to the superheater proper, the major portion of the heating-surface consisting of the superheating-tubes; substantially as described.

8. An independently-fired superheater having two upper transverse steam-drums connected by banks of tubes to a lower transverse steam drum or drums, water-tubes in front of the superheater-tubes and connecting an upper steam and water drum to a lower mud-drum, and baffles arranged to give the gases serial up-and-down passes over the banks of tubes; substantially as described.

9. An independently-fired superheater having two upper transverse steam-drums connected by banks of tubes to a lower transverse steam drum or drums, water-tubes in front of the superheater-tubes and connecting an upper steam and water drum to a lower mud-drum, baffles arranged to give the gases serial up-and-down passes over the banks of tubes, and water-circulating tubes for the water-heating surface; substantially as described.

10. An independently-fired superheater having a plurality of back-and-forth passes for the heating-gases, the superheating-tubes constituting the major portion of the heating-surface, and having an inlet arranged to supply steam thereto from a separate boiler, and water-heating tubes forming the minor portion of the heating-surface, at least the major portion of the water-heating tubes forming substantially the entire first pass for the gases between the furnace and the superheating-tubes; substantially as described.

11. An independently-fired superheater having a plurality of back-and-forth passes for the heating-gases the superheating-tubes constituting the major portion of the heating-surface, and having an inlet arranged to supply steam thereto from a separate boiler, water-heating tubes forming the minor portion of the heating-surface, at least the major portion of the water-heating tubes forming substantially the entire first pass for the gases between the furnace and the superheating-tubes, and means for flooding the superheating-tubes to convert the device into a boiler; substantially as described.

12. An independently-fired superheater having a plurality of back-and-forth passes for the heating-gases, water-heating surface forming substantially the entire first pass for the gases, and superheating-tubes in the succeeding pass or passes, the superheater having an upper chamber or receptacle arranged to form a steam and water chamber when the superheater is flooded, and having an inlet arranged to supply steam from a separate boiler when used as a superheater, and means for flooding the superheater; substantially as described.

13. An independently-fired superheater having superheating-tubes forming the major portion of its heating-surface, a setting inclosing the superheater, an inlet arranged to supply steam to the superheater from a boiler in a separate setting, said superheater having an upper chamber separated from any steam-boiler chamber and arranged to act as a steam and water chamber for the superheater when flooded, and water connections arranged to flood the superheater and convert it into a boiler; substantially as described.

14. An independently-fired superheater having superheating-tubes, a setting inclosing said tubes, an upper steam drum or drums connected to the tubes, an inlet arranged to supply steam to the superheater from a boiler in a separate setting, and an inlet arranged to flood the superheater and convert its surface into water-heating surface, the superheater drum or drums being separate from any steam-boiler chamber and properly arranged to act as a steam and water drum or drums when the device is flooded; substantially as described.

15. An independently-fired superheater, having superheating-tubes forming the major portion of its heating-surface, water-heating tubes between the superheater and the furnace arranged in a separate pass, said superheater having an inlet arranged to supply steam thereto from a separate boiler, and means for connecting the water-heating surface to the superheater to flood it and convert the entire apparatus into a supplemental boiler; substantially as described.

16. An independently-fired superheater having a front bank of water-tubes connecting an upper transverse steam and water drum with a lower transverse mud-drum, a superheater in the rear of the water-heating surface, and containing an upper transverse steam-drum connected to a lower transverse steam-drum by superheating-tubes, a baffle between the water-heating surface and the superheating-surface, and an inlet arranged to supply steam to the superheater from a separate boiler; substantially as described.

17. An independently-fired superheater having a front bank of water-tubes connecting an upper transverse steam and water drum with a lower transverse mud-drum, a superheater in the rear of the water-heating surface, and containing an upper transverse steam-drum connected to a lower transverse steam-drum by superheating-tubes, a baffle between the water-heating surface and the superheat-

ing-surface, an inlet arranged to supply steam to the superheater from a separate boiler, and means for connecting the water-heating surface to the superheating-surface to flood the superheater; substantially as described.

18. An independently-fired superheater having a front steam and water drum provided with depending water-tubes and a superheater in the rear of the water-tubes and connected to an upper steam-chamber having steam connection with the steam-space of the steam and water drum, and having also an inlet arranged to supply steam to the superheater from an independent boiler and a flooding-inlet, the steam and water drum and the steam-chamber of the superheater being on similar levels to provide steam and water spaces therein when the device is flooded; substantially as described.

19. An independently-fired superheater having water-heating surface constituting substantially the entire first pass for the heating-gases, and a superheater in the rear of the pass and comprising at least two banks of water-tubes connecting upper steam-drums with a lower transverse steam drum or drums, the superheater having an inlet arranged to supply steam thereto from an independent boiler; substantially as described.

20. An independently-fired superheater having water-heating surface constituting substantially the entire first pass for the heating-gases, a superheater in the rear of the pass and comprising at least two banks of water-tubes connecting upper steam-drums with a lower transverse steam drum or drums, the superheater having an inlet arranged to supply steam thereto from an independent boiler, and means for flooding the superheating-surface to convert the apparatus into a boiler; substantially as described.

In testimony whereof I have hereunto set my hand.

JOHN E. BELL.

Witnesses:
MARY E. SAMLIN,
W. T. LUCAS.