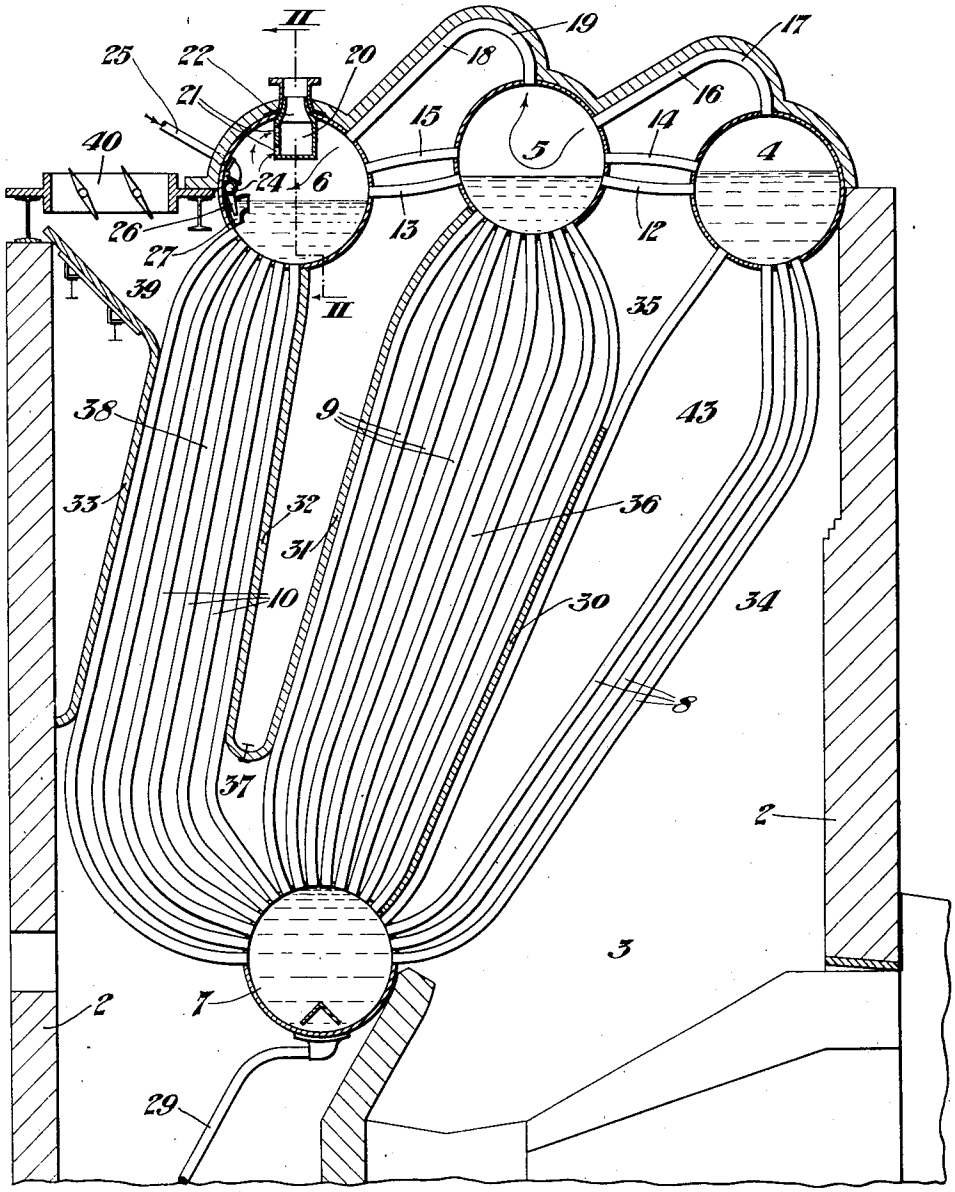
June 11, 1929. D. EDGE 1,717,015

BOILER

Filed Dec. 23, 1925 2 Sheets-Sheet 1

Fig. 1.



Witnesses:

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Inventor:

DEXTER EDGE,

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BOILER

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Fig. 2.

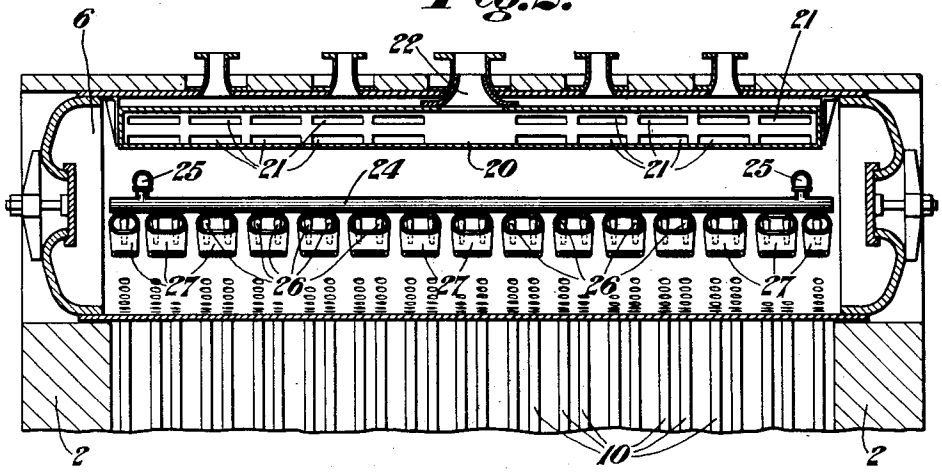
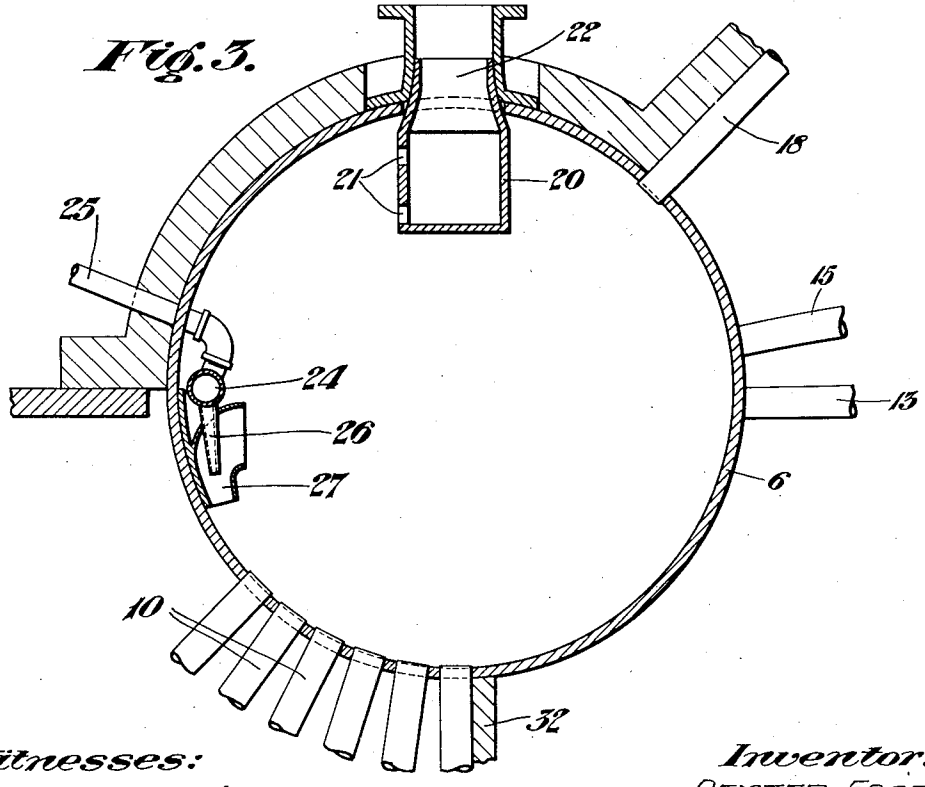


Fig. 3.



Witnesses:

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Patented June 11, 1929. 1,717,015

UNITED STATES PATENT OFFICE.

DEXTER EDGE, OF PITTSBURGH, PENNSYLVANIA.

BOILER.

Application filed December 23, 1925. Serial No. 77,398.

This invention relates to steam boilers and more particularly to water tube steam boilers, and has for one of its objects the provision of a boiler having a greater rate of heat absorption than boilers of this class heretofore constructed.

Another object is to provide a boiler so constructed that there will be a minimum loss of draft due to to the products of combustion passing through the boiler.

Another object is to provide a boiler of the class described, adapted to have a positive circulation of water through the tubes and steam and water drums.

A further object is to provide a boiler adapted to supply steam which is substantially free from entrained water.

A still further object is to provide a water tube boiler having the novel arrangement, construction and combination of parts hereinafter described and illustrated in the accompanying drawings.

In the drawings:

Figure 1 is a transverse sectional elevation through a boiler constructed in accordance with my invention.

Figure 2 is a longitudinal sectional elevation on line II—II, Fig. 1, through the rearmost steam and water drum showing the steam collector and feed water supply mechanism.

Figure 3 is a transverse sectional view through last steam drum.

Referring more particularly to the drawings, the numeral 2 designates the furnace walls which enclose and support the boiler in any usual manner, and the numeral 3 designates the furnace combustion chamber which may be of any desired construction and may be fired with any form of fuel.

The boiler is composed of three steam and water drums 4, 5 and 6 spaced horizontally from the front to rear of the furnace, a single mud drum 7 adjacent the lower end of the furnace, and separate banks of tubes 8, 9 and 10 connecting the steam and water drums 4, 5, and 6, respectively, with the mud drum 7.

The drums 4 and 5 are connected by water circulation tubes 12 and the drums 5 and 6 are connected by water circulation tubes 13. Overflow tubes 14 and 15 are provided between the drums 4 and 5 and 5 and 6, respectively, to prevent the formation of abnormal water levers should a sudden uplift of boiler water occur or the rate of circulation increase above that desired.

The steam generated in the tube banks 8 and 9 rises with the water through said tubes and is liberated at the surface of the water in the drums 4 and 5. Steam collecting pipes 16 extend upwardly from the top of the drum 4 and are curved or arched at 17 and then inclined downwardly so as to enter the drum 5 at a point materially below its top. Steam collecting pipes 18 extend upwardly from the top of the drum 5 and are curved or arched at 19 and then inclined downwardly so as to enter the drum 6 at a point materially below its top. The collecting pipes 16 and 18 collect the steam from the uppermost part of the drums 4 and 5 so that a minimum of water particles, thrown off when the steam is liberated at the surface of the water, are carried through the collecting pipes.

The steam collecting pipes 16 and 18 enter the drums 5 and 6 at such an angle that the steam is caused to pass in a circuitous path which results in any entrained water being thrown out due to centrifugal force, and due to the angle of the pipes the water thrown out of the steam comes into contact with the water surface in drums 5 and 6 at an easy angle which is in the same direction of flow as the circulation flow of the water, thereby eliminating agitation of splash.

The steam and water drum 6 does not receive steam from the bank of tubes 10 due to the circulation of feed water downwardly therethrough. Therefore the water surface is unagitated and the steam collected from this drum will be entirely free from entrained water.

The steam is collected from the steam and water drum 6 by a steam collector 20 in the form of a tube positioned along the top of the drum at its highest point and extending longitudinally of the drum. The collector 20 is provided with a plurality of steam inlet openings 21 along its side farthest from the drum 5, so as to collect the steam across the width of the drum and such openings are so proportioned that steam enters the collector at a velocity sufficiently low to prevent picking up of stray particles of water should they pass in the vicinity of the openings.

A steam outlet tube 22 extends upwardly from the collector tube 20 through the top of the drum 6 for connection to any suitable main or conduit.

A feed water manifold pipe 24 is mounted in the drum 6 and extends substantially the whole length thereof. The pipe 24 is con-

nected at each end with water supply pipes 25 and is provided with nozzles 26 which extend into nozzle sleeve members 27. It will be understood, however, that if desired, only one supply pipe 25 may be used. The feed water upon being discharged into the sleeve members 27 forms an inspirator effect which causes the water in drum 6 to be drawn into said sleeves, and mixed with the feed water, so that the mixture is delivered to the tubes leading from the drum 6 to the mud drum 7.

The hot water in drum 6 is drawn into the sleeves 27 after the water has traveled across the drum 6 from front to rear. This maintains a layer of hot water at the surface of the water in drum 6, which is at the approximate temperature of the steam in this drum, thus preventing absorption by and heating of the incoming boiler feed water by the steam generated in the boiler, as the boiler feed water is delivered under the shielding layer of hot boiler water.

The mixture of the feed water and boiler water after it leaves the sleeves 27 is relatively colder when delivered to the tubes in bank 10 than the water in the remainder of the boiler. This causes a positive down flow of the water in the tubes in bank 10. The water flowing down the tubes in bank 10 is below the temperature of boiling at the steam pressure carried, while the rising boiler water in tube banks 8 and 9 contains steam bubbles due to the heat absorbed. The weight of the water in bank 10, per unit of volume, is considerably heavier than in the banks 8 and 9, due to a mixture of water and steam in banks 8 and 9 occupying a unit volume and the steam portion having a much lighter weight. This condition results in a further unbalancing which, added to the difference in weight per unit volume due to temperature, causes an increased rate of flow down tubes in bank 10.

The water flowing rapidly down tube bank 10 necessarily causes a rapid upflow of water and steam in tube banks 8 and 9, resulting in a positive and rapid circulation of the boiler water.

Attention is called to the layout of all parts of the boiler, except the drum 7, which are so arranged that no depressions exist where scale or foreign matter can collect. The lower half of the drum 7 is positioned below the line of the circulation to form a settling pocket for collecting all foreign matter, which matter can be blown out through the blow down conduit 29 when desired.

A baffle wall 30 is positioned in back of the bank of tubes 8, a second baffle wall 31 is positioned back of the bank of tubes 9, and baffle walls 32 and 33 are positioned in front and back of the bank of tubes 10.

The baffle wall 30 extends upwardly and forwardly and terminates short of the drum 4 forming a passageway 34 along the bank of tubes 8 for the products of combustion and a port 35 leading to the bank of tubes 9. The passageway 34, due to the inclined position of the baffle plate 30, has a gradually reduced cross section upwardly along the bank of tubes, and the port 35 is of less cross-section than the upper end of the passageway along the tubes 8 so as to increase the velocity of the products of combustion as they pass through said port.

The bafflewall 31 extends along the back of the bank of tubes 9 from the drum 5 downwardly to a point a short distance above the mud drum 7 where it joins the baffle wall 32. The wall 31 is inclined downwardly and rearwardly at a less degree than the baffle wall 30 so as to form with the wall 30 a passageway 36 reduced in cross-section from its upper end downwardly toward its lower end. The space between the lower end of the wall 31 and the mud drum 7 forms a port 37 for the products of combustion to pass to the space around the bank of tubes 10. The port 37 is of materially less area than the lower end of the passageway 36 so as to increase the velocity of the products of combustion as they pass through said port.

The baffle walls 32 and 33 extend upwardly and forwardly along the front and back, respectively, of the bank of tubes 10, the rear wall 33 being inclined forwardly at a greater degree than the forward wall 32 so as to form a passageway 38 of reduced cross section from the lower end upwardly. The baffle wall 33 extends rearwardly at a point slightly below the drum 6 to form a port 39 leading to the flue outlet port 40.

The tubes of the banks 9 and 10 are spaced apart to correspond with the cross-section of the passageways 36 and 38, respectively.

The area of the passageways 34, 36 and 38 are constantly decreased in the direction of flow of the products of combustion, so that as the products of combustion are cooled and contract they will be brought into more intimate contact with the banks of tubes.

The ports 35 and 37 are of such area that the velocity of the products of combustion are increased sufficiently to carry them across the width of the banks of tubes in the next passageway, resulting in an even distribution of these gases across the width of the banks of tubes.

The tubes of bank 8 are so arranged that a space 43 is provided for the reception of a steam super-heater if desired. This space provides a novel and efficient location for a super-heater since such heater would be exposed to the radiation from the combustion chamber below, and at the same time the products of combustion will pass over the surface of the super-heater, exposing the super-heater for heat absorption to both radiation and convection.

From the above it will be readily appre-

ciated that I have provided a highly efficient and simple construction of boiler, which will improve the quality of steam generated and lower the cost of production over the ordinary construction of boiler.

While I have shown and described one specific embodiment of my invention, it will be understood that I do not wish to be limited thereto, since various modifications may be made without departing from the scope of my invention as defined in the appended claims.

I claim:

1. In a water tube boiler, the combination of a plurality of elevated steam and water drums, a lower mud drum, banks of tubes connecting each of said steam and water drums with said mud drum, a combustion chamber in front of the tubes leading to the front steam and water drum, a baffle wall back of each of said banks of tubes, said baffle walls being arranged to form a continuous passageway for the products of combustion along said tubes, means including a feed water supply mechanism in the rearmost steam and water drum for causing a circulation of water from the rearmost steam and water drum downwardly through the rearmost bank of tubes to said mud drum and then upwardly through said other banks of tubes to the other steam and water drums and successively from the foremost drum through each next rear drum to said rearmost drum, said feed water supply mechanism comprising water supply pipes, a manifold pipe arranged longitudinally within said rearmost steam and water drum and connected to said water supply pipes, a plurality of downwardly directed open ended distributing sleeves arranged below said manifold and having their upper ends at least partially below the water level in said drum and their lower ends wholly below the water level in said drum, a plurality of nozzle members connected with said manifold and projecting into said distributing sleeves, whereby the feed water upon being delivered into said sleeves by said nozzles forms an inspirator effect which causes the water in the rearmost drum to be drawn through said sleeves and mixed with the cool feed water, and also causing a flow of hot water uniformly across said rearmost drum above the level of the feed water delivery, thus preventing absorption and heating of the boiler feed water by the steam generated in the boiler.

2. In a water tube boiler, the combination of a plurality of elevated steam and water drums, at least one mud drum positioned at a materially lower level than said steam and water drums, banks of tubes connecting each of said steam and water drums with said mud drum, water circulation tubes connecting each of said water and steam drums, steam collecting pipes connecting each of said steam and water drums forward of the rearmost drum with the next rear drum, a feed water supply mechanism in the rearmost steam and water drum, said mechanism comprising at least one water supply pipe, a manifold pipe arranged longitudinally within said rearmost steam and water drum and connected to said water supply pipe, a plurality of downwardly directed open ended distributing sleeves arranged below said manifold and having their upper ends at least partially below the water level in said drum and their lower ends wholly below the water level in said drum, a plurality of nozzle members connected with said manifold and projecting into said distributing sleeves, whereby the feed water upon being delivered into said sleeves by said nozzles forms an inspirator effect which causes the water in the rearmost drum to be drawn through said sleeves and mixed with the cool feed water, and also causing a flow of hot water uniformly across said rearmost drum above the level of the feed water delivery, this preventing absorption and heating of the boiler feed water by the steam generated in the boiler.

3. In a water tube boiler, the combination of a plurality of elevated steam and water drums, at least one mud drum positioned at a materially lower level than said steam and water drums, banks of tubes connecting each of said steam and water drums with said mud drum, water circulation tubes connecting each of said water and steam drums, steam collecting pipes connecting each of said steam and water drums forward of the rearmost drum with the next rear drum, a feed water supply mechanism in the rearmost steam and water drum, said mechanism comprising at least one water supply pipe, a manifold pipe arranged longitudinally within said rearmost steam and water drum and connected to said water supply pipe, a plurality of downwardly directed open ended distributing sleeves arranged below said manifold and having their upper ends at least partially below the water level in said drum and their lower ends wholly below the water level in said drum, a plurality of nozzle members connected with said manifold and projecting into said distributing sleeves, whereby the feed water upon being delivered into said sleeves by said nozzles forms an inspirator effect which causes the water in the rearmost drum to be drawn through said sleeves and mixed with the cool feed water, and also causing a flow of hot water uniformly across said rearmost drum above the level of the feed water delivery, thus preventing absorption and heating of the boiler feed water by the steam generated in the boiler, and a steam collecting tube within and extending longitudinally of said rearmost steam and water drum, said steam collecting tube being provided with a plurality of inlet openings along its rear side so as to collect

the steam across the width of the drum, said openings being so proportioned that the steam will enter said collector at a velocity sufficiently low to prevent the picking up of stray particles of water should they pass in the vicinity of said openings.

4. In a water tube boiler, the combination of a plurality of elevated steam and water drums, at least one mud drum positioned at a materially lower level than said steam and water drums, banks of tubes connecting each of said steam and water drums with said mud drum, water circulation tubes connecting each of said water and steam drums, means for delivering feed water to one of said steam and water drums at a point below the surface of the hot water in said drum, and means cooperating with said feed water delivering means and acting as an inspirator to cause a flow of the hot water in said drum from front to rear so as to maintain a layer of hot water at the surface of the water in said drum, thus preventing absorption by and heating of the incoming boiler feed water by the steam in said drum.

In testimony whereof, I have hereunto set my hand.

DEXTER EDGE.