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WATER TUBE BOILER.

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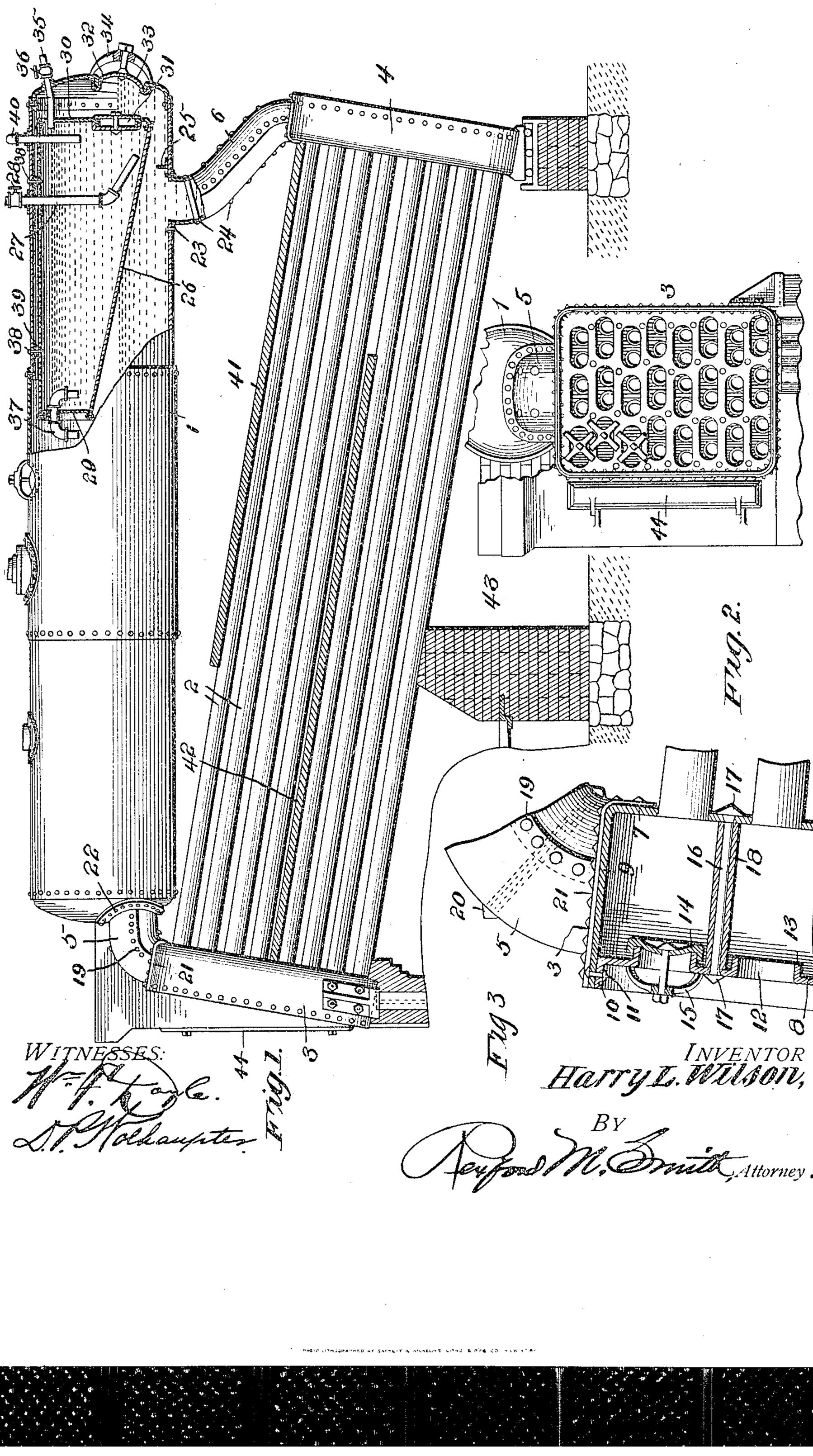

Fig. 2.

Fig. 3.

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UNITED STATES PATENT OFFICE.

HARRY LAMBERT WILSON, OF ERIE, PENNSYLVANIA.

WATER-TUBE BOILER.

SPECIFICATION forming part of Letters Patent No. 787,249, dated April 11, 1905.

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To all whom it may concern:

Be it known that I, HARRY LAMBERT WILSON, a citizen of the United States of America, residing at Erie, in the county of Erie and State of Pennsylvania, have invented a certain new and useful Water-Tube Boiler, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to water-tube boilers, the object in view being to provide a construction in which all parts of the boiler may be formed of wrought metal, thus obtaining the highest efficiency, the maximum strength, and lowest shop cost, together with economy of maintenance.

One object of the invention is to provide for a free and rapid flow and uninterrupted circulation of water through the tubes, headers, and drum and incidentally the ready passage of the water to and from the headers and drum, the connections between the headers and drum being of such construction as to give an easy turn to the water as it flows into and through the drum; also, to provide increased strength in the headers and tubular connections leading therefrom to the drum, at the same time preventing all movement or vibration.

The invention consists in the novel construction, combination, and arrangement of parts hereinafter fully described, illustrated, and claimed.

In the accompanying drawings, Figure 1 is a side elevation, partly in section, of a water-tube boiler constructed in accordance with the present invention. Fig. 2 is an enlarged detail section through the upper portion of the front header, showing a portion of the tubular elbow. Fig. 3 is a front elevation, partly broken away, showing one of the headers and a sight-door.

Like reference-numerals designate corresponding parts in all figures of the drawings.

Referring to the drawings, the boiler is seen to comprise a steam-drum 1, of cylindrical shape, arranged horizontally, being supported by suitable masonry in any usual or preferred manner. Beneath the drum 1 are arranged water-tubes 2, which are inclined so as to slope from their forward ends downward to their rear ends, the tubes being all connected at their forward ends to the front header 3 and at their rear ends to the rear header 4. The front header 3 is connected with the drum 1 by means of a tubular elbow or front connecting-neck 5, while the rear header 4 is connected with the drum by means of the tubular neck or connection 6. Thus provision is made for a free flow and rapid circulation of water through the drum, headers, tubes, and connecting-necks.

The headers 3 and 4 are the counterpart of each other, being exactly the same in size and shape throughout, so that the parts thereof may be pressed in and by the same dies. Each header, as shown in Fig. 2, consists of an inner plate 7 and an outer plate 8. One of these plates, and preferably the inner one 7, is provided with a wide flange 9, extending entirely around its outer edge, while the remaining plate 8 is provided with a corresponding flange 10, which, however, is quite narrow as compared with the flange 9, but of sufficient width to receive the rivets 11, by means of which the plates 7 and 8 are connected. The flanges 9 and 10 are so formed that the narrower flange 10 will fit snugly within the wider flange 9 and both flanges project in the same direction, which enables the rivets 11 to be inserted through the flanges outside of the water-space between the plates 7 and 8, and in this way the rivets may be applied by suitable machinery for that purpose, thus avoiding expensive hand-labor. The water-tubes 2 are swaged or otherwise fastened securely to the inner plate 7 and are arranged in inclined or zigzag series, as shown in Fig. 3. The outer plate 8 is provided with oblong hand-holes 12, each of which is adapted to give access to a pair of horizontally-alined water-tubes 2, as shown in Fig. 3, while each hand-hole is provided with a hand-hole cover 14, held in place by a bail or crab 15, the prongs of which bear against the outer surface of the plate 8. The bail or crab 15 is pressed by suitable dies out of sheet metal and is provided with four prongs, as shown, thus producing a simple, cheap, and effective retaining device for each hand-hole cover. The headers are substantially rectangular, with rounded corners.

In order to properly brace the plates 7 and

8, stay rivets or bolts 16 are provided at suitable points, said rivets or bolts passing through oppositely-located openings in the plates 7 and 8, as shown in Fig. 3, the rivets being headed, as shown at 17, upon the outer sides of the plates 7 and 8 and each encircled by a spacing-sleeve 18, located within the water-space, with its extremities bearing against the inner surface of the plates 7 and 8. The stay rivets or bolts and spacing-sleeves add greatly to the strength of the header, and any desired number of such bolts or rivets may be employed. By preference each rivet or bolt 16 is provided with a conical shoulder adjacent to each end to compensate for any shrinkage in the plates 7 and 8.

The front header 3 is connected with the drum 1 by means of a tubular elbow or front connecting-neck 5, which may be either rectangular, round, or oval in cross-section and which is composed of two plates bent into semicircular or semi-oval shape and having their side edges overlapped and riveted together, as shown at 19, the plates being braced relatively to each other by means of stay rivets or bolts 20, similar to those, 16, just above described. At one end the elbow 5 is provided with an angular flange 21, which is riveted to the top of the header 3, while said elbow is provided at its opposite end with a flange 22, which is riveted to the adjacent end of the steam-drum. In this way the water rising in the header 3 flows with an easy turn directly into the head of the steam-drum. The tubular neck or downflow connection 6, which is at the opposite end of the boiler, is connected directly to the top of the rear header 4 in the same manner as the neck 5 is connected with the header 3 and extending upward in ogee form is provided at its upper end with a flange 23, which is riveted to the bottom of the drum 1 at a point remote from the rear end of the drum, as shown in Fig. 1. The tubular neck or downflow connection 6 is constructed in the same manner as the elbow 5 and also braced by means of stay rivets or bolts 24. Immediately in rear of the entrance of the neck 6 into the drum 1 there is placed a dam 25, which may consist of an angle-iron extending transversely across the lower portion of the boiler, the dam serving to arrest the flowing water and cause it to pass downward through the connection 6 into the rear header 4.

Within the steam-drum 1 is mounted a settling-tank 26, which is preferably of conico-cylindrical form and so arranged as to bring its upper side in a substantially horizontal plane and parallel with the upper side of the drum, while its lower side is inclined, so that any sediment or solids held in suspension in the feed-water will gravitate to one end, or, in other words, the lowest point in the sediment-tank, at which point is arranged the extremity of a blow-off pipe 27, controlled by a stop-cock 28, enabling the entire contents of the sediment tank or chamber to be blown off without affecting the water-level in the steam-drum. The settling-tank is closed at its opposite ends by the heads 29 and 30, which are of different sizes, the outermost head 30 being provided with a hand-hole 31 and a suitable cover and retaining means therefor. The steam-drum itself is provided with a hand-hole 32 in line with the hand-hole 31 and provided with a suitable cover 33 and fastening bail or crab 34, so that when the boiler is emptied access may be readily had to the settling tank or chamber. Another surface blow-off pipe 35 enters the end of the settling-tank, passing also through the adjacent head of the drum, and is provided with a stop-cock 36. In this way any scum or floating substance may be blown off from the surface of the feed-water contained in the tank 26. At the smaller end of the tank and passing through the head 29 is an inverted-U-shaped feed-water-discharge pipe 37, having one leg extending downward within the tank to a point several inches below the surface of the feed-water, while the other leg extends downward an equal distance on the outside of the tank, so as to discharge the feed-water directly into the steam-drum. In this way scum or floating substances are prevented from being discharged into the steam-drum. The settling tank or chamber is suspended within the steam-drum immediately adjacent to the top thereof, preferably by means of hanger bolts or rivets 38, encircled by washers or spacing-sleeves 39, thus leaving a space entirely surrounding the settling-tank. 40 designates a feed-water-supply pipe which enters the top of the settling-tank and also passes through the upper portion of the steam-drum. The settling-tank is thus suspended in the drum in such manner that the feed-water in the tank, being at a lower temperature than the water in contact with the heating-surface and under the steam temperature in the drum proper, does not come in contact with any of the highly-heated parts of the drum-shell to cause local contraction and expansion and consequent injury to the drum. In this way mud scales and sediment are to a great extent eliminated from the feed-water and retained in the sediment-tank, thus preventing corrosion of the drum. It will be observed that the water is taken neither from the surface nor from the bottom of the sediment-tank and is therefore free from solids when discharged into the steam-drum.

A line of baffle-brick 41 extends along the top of the series of water-tubes 2 from the rear header well forward, as shown in Fig. 1. Another line of baffle-brick, 42, extends from the front header rearward a considerable distance and beneath the upper tier 41 and also midway between the top and bottom of a series of water-tubes. The bridge-wall 43 extends at its top slightly above the bottom of the lower

series of water-tubes, so as to give as much curvature and deflection as possible to the flow of gases and products of combustion before they pass around the rear end of the intermediate baffle-brick 42.

The front and rear headers 3 and 4 are supported upon masonry or other suitable framework, and at each side of the headers 3 and 4 there are arranged vertically-elongated sight-doors 44, one of which is shown in Fig. 2. These doors extend practically the full height of the headers, so that an attendant by opening one of the doors may thoroughly examine the water-tubes and, in fact, all the fire-surface of the boiler and may free the same from soot or dust by a suitable hand implement.

The boiler hereinabove described may be constructed practically throughout of wrought material, thus increasing the efficiency of all parts of the boiler. From eighty-five to ninety per cent. of the labor of construction may be performed by machinery. A free and rapid flow and circulation of water through the drum, water-tubes, headers, and connecting-necks is provided for, and the feed-water discharged into the steam-drum is practically free from the usual solids which have an injurious effect on the drum and other parts of the boiler. The connecting-necks by reason of their shape and arrangement avoid any quick and sudden turns which would greatly hinder circulation. The opposite sides of the headers and connecting-necks are thoroughly braced by means of stay bolts or rivets and vibration and shrinkage are taken care of in a simple and effective manner. The various parts of the boiler are also rendered easily accessible for examination and cleaning. The scum and sediment may be blown off from the settling-tank at any time and without disturbing the water-level in the drum proper. The settling-tank itself is not exposed to the direct action of the products of combustion, being surrounded by the steam-space of the boiler and also partially submerged in the water in the drum. The water is first heated in the settling-tank and is therefore carried off into the steam-drum in a highly-heated condition.

Having thus described the invention, what is claimed as new is—

1. In a water-tube boiler, the combination of a substantially horizontal steam-drum, inclined water-tubes beneath the drum, inclined twin headers and reversely-inclined tubular connections providing continuous circulation between the drum and tubes at both ends, a settling-tank within the drum, feed-water supply and discharge pipes communicating with the settling-tank, and a blow-off pipe also communicating with the settling-tank.

2. In a water-tube boiler, the combination of a steam-drum, a settling-tank having an inclined bottom located within the drum, inclined water-tubes, inclined substantially square or rectangular headers of equal size, inclined tubular connections between the headers and drum providing for a continuous circulation, and a dam extending across the lower portion of the drum beneath the inclined bottom of the settling-tank and at one side of the downflow connection extending to one of the headers.

3. In a water-tube boiler, the combination of a steam-drum, a settling-tank within the drum, inclined water-tubes, inclined substantially square or rectangular headers of equal size, inclined tubular connections between the headers and drum providing for a continuous circulation, and a dam extending across the lower portion of the drum at one side of the downflow connection extending to one of the headers.

4. In a water-tube boiler, the combination of a steam-drum, a settling-tank within the drum, inclined water-tubes, inclined parallel twin headers disposed at right angles to the water-tubes, and reversely-inclined tubular connecting-necks between the headers and drum, each neck being composed of two plates bent into proper form and having their side edges overlapped and riveted together.

5. In a water-tube boiler, the combination of a steam-drum, a settling-tank within the drum, inclined water-tubes, inclined substantially square or rectangular twin headers, and inclined tubular connecting-necks between the headers and drum, the flat front and rear sides of the twin headers and the opposite sections of the connecting-necks being stayed with socket-rivets passing through the plates and provided with conical shoulders, and spacing-sleeves around the rivets within the headers and necks.

In testimony whereof I affix my signature in presence of two witnesses.

HARRY LAMBERT WILSON.

Witnesses:
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JOHN VARLY.