

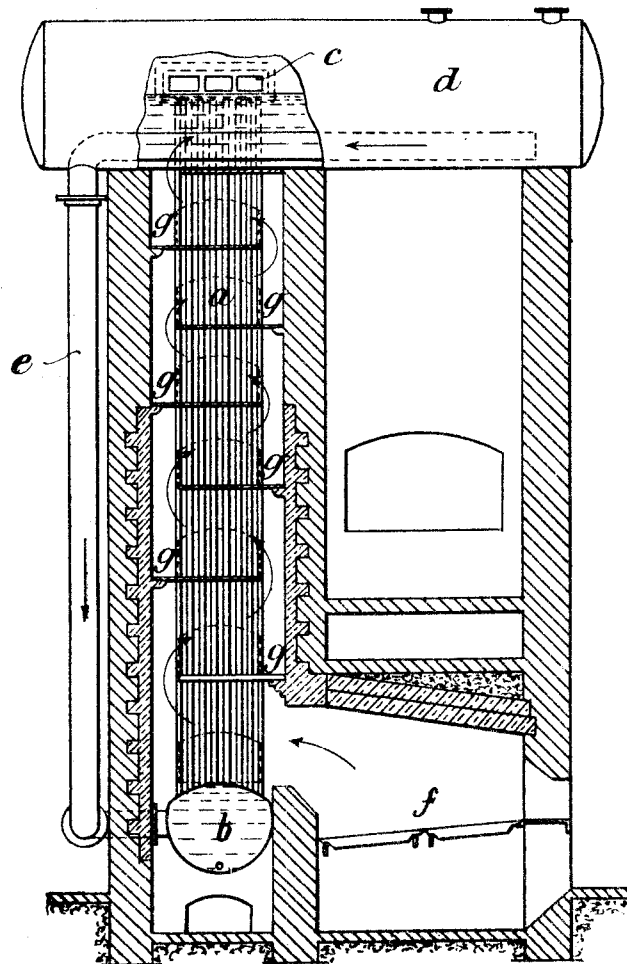
P. KESTNER.
WATER TUBE BOILER.
APPLICATION FILED SEPT. 23, 1909.

1,064,973.

Patented June 17, 1913.

4 SHEETS—SHEET 1.

Fig. 1.



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Willa A. Burrows

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4 SHEETS—SHEET 2.

Fig. 4.

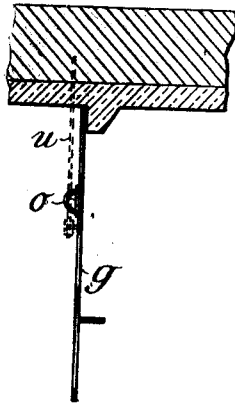


Fig. 3.

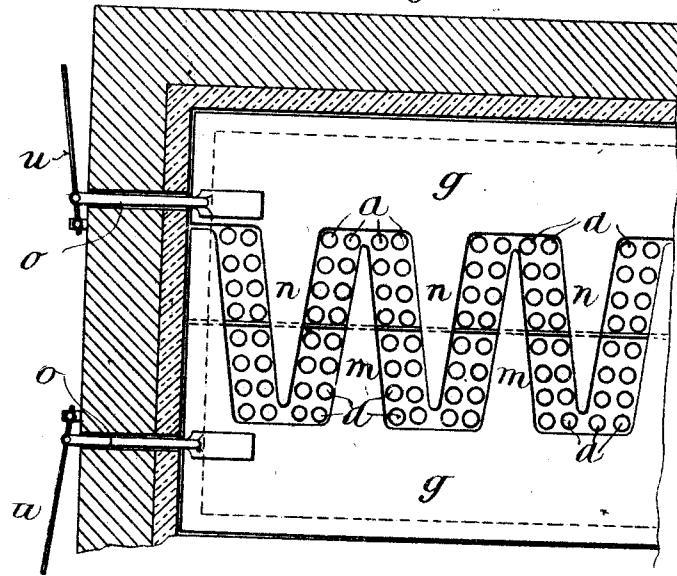


Fig. 6.

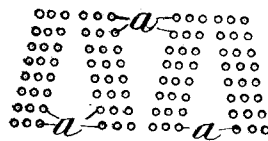


Fig. 2.

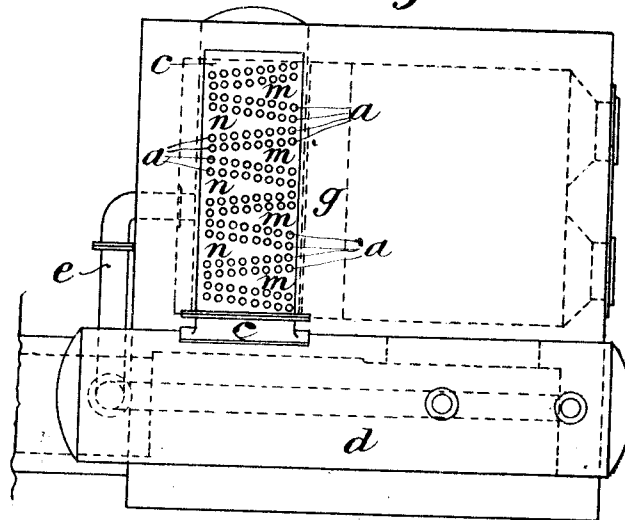
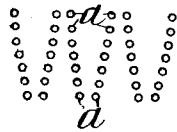


Fig. 5.



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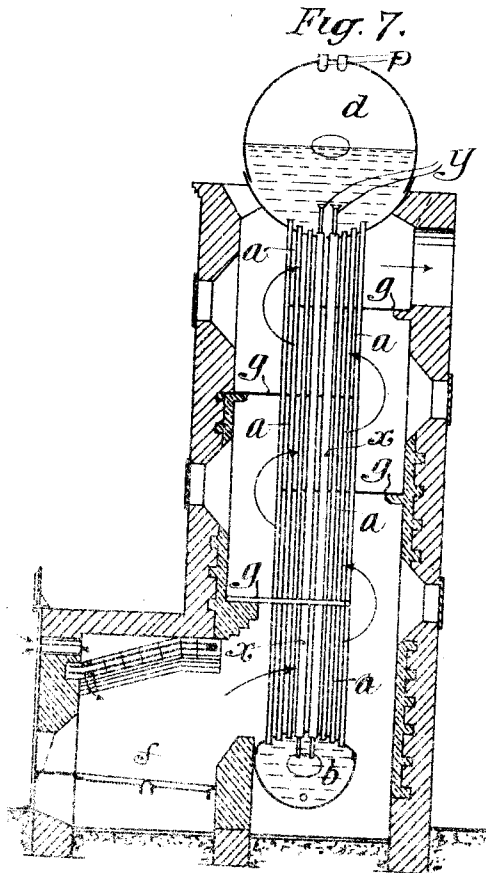
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4 SHEETS-SHEET 3.



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 4 SHEETS—SHEET 4.

Fig. 8.

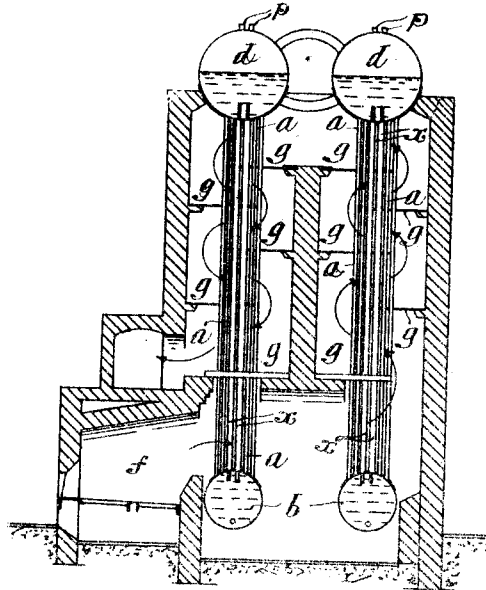


Fig. 9.

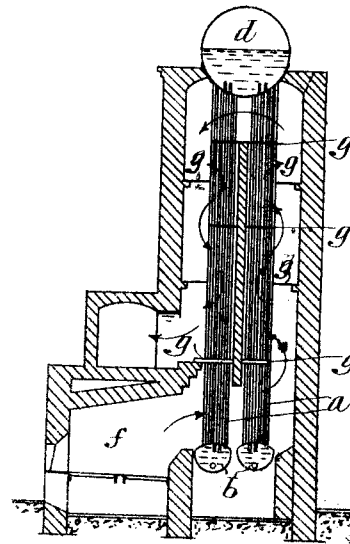


Fig. 11.

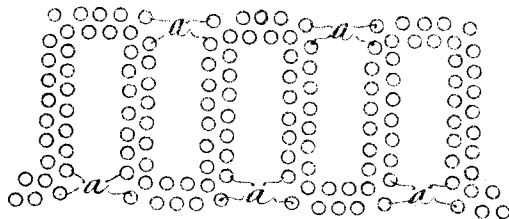
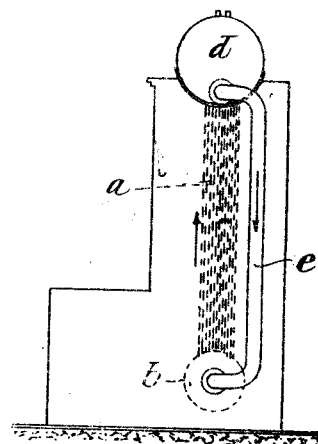


Fig. 10.



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UNITED STATES PATENT OFFICE.

PAUL KESTNER, OF LILLE, FRANCE.

WATER-TUBE BOILER.

1,064,973.

Specification of Letters Patent.

Patented June 17, 1913.

Application filed September 23, 1909. Serial No. 519,146.

To all whom it may concern:

Be it known that I, PAUL KESTNER, a citizen of the French Republic, residing at Lille, Nord, France, have invented a new and useful Improvement in Water-Tube Boilers, of which the following is a specification.

This invention has reference to improvements in water-tube boilers, and its object is to obviate certain defects inherent in such boilers as heretofore usually constructed.

It is well known that in water-tube boilers wherein a large number of tubes are arranged cluster-wise across or between which the furnace gases pass, the first two rows—more or less—of said cluster of tubes, *i. e.* those rows against which the hot furnace gases first impinge act as a quasi screen to the other tubes and absorb an inordinate proportion of the heat units given off by the said gases with the result that the consequent very rapid production of steam in said two rows and comparatively slow production of steam in the rest of the tubes causes violent reaction and a serious interference with the proper and equable circulation of the water in the whole system. Further, the excessive heating of some of the tubes as compared with the rest causes unequal expansion of the parts producing considerable strains and stresses within the complete structure detrimental thereto and causing leakage.

It has been proposed to construct a boiler with a front row of vertical water tubes arranged in zig-zag or serpentine form with the object of exposing as many tubes as possible to the first contact of the products of combustion, and with a rear row of tubes similarly arranged with the spaces between the elbows formed by the serpentine arrangement of the tubes opposite the spaces between the elbows of the front row; and, further, in such a boiler to arrange baffle plates to project into the aforesaid spaces, but such an arrangement of the tubes is still practically a cluster-wise arrangement.

My invention consists in a water-tube boiler wherein the tubes are arranged in a single or double row of tubes in a manner to represent in plan view approximately the letter W. If the individual tubes be spaced comparatively far apart it may be possible to have more than a double row of them but I prefer the double row. At suitable distances apart I provide baffle

plates which are also of approximately W form and which project alternately at one side and the other into the spaces formed by the double (or other) rows of tubes and whereby the hot gases are compelled to traverse and retrace past the rows of tubes on their way to the uptake. The tubes may be arranged to be vertical or at an angle thereto. When arranged vertically I may connect the top ends to a header or collector which is in communication with a cylindrical or other suitably shaped vessel and the bottom ends may be connected to a cylindrical or other vessel. The hot furnace gases are preferably made to impinge against the tubes a short distance above the bottom vessel causing a free and rapid movement upward of the water and steam. The return of the water from the top vessel may be provided for either by a single pipe of comparatively large diameter or I may provide for the return by a series of pipes leading directly from the upper cylindrical vessel to the lower one and passing centrally through the water tubes wherein the steam is generated the latter being made sufficiently large for this purpose. The upper cylindrical vessel may be provided with baffles situated a short distance from the exterior shell thereof and extending about half way up *i. e.* to the normal water level and additional baffles may be provided to project the ascending water toward the surface of the water contained within the former baffle. In this case the "descending" tubes are fixed to the latter baffle and the ascending tubes to the shell and to enable any of the "descending" tubes to be readily replaced I may provide the top of the upper vessel with a series of capped openings. I may also provide a superheater and feed water heater both preferably of tubular construction. The baffle plates whereby the direction of travel of the hot furnace gases is determined may be pivotally carried and adapted to be rocked as required so as not only to shake off any soot and dust that has collected thereon but also, by the vibration set up by such rocking, to shake off soot and dust that may be adhering to the water tubes.

Various forms and modifications of my invention are shown in the accompanying drawings, in which:

Figure 1, is a sectional elevation of one form of water tube boiler embodying my

invention; Fig. 2, is a plan view of the same, partly in section; Fig. 3, is a sectional plan view, on an enlarged scale, of a portion of the structure shown in Fig. 1; Fig. 4, is an end view of one of the baffle plates employed with my improved boiler; Figs. 5 and 6, are diagrammatic views illustrating possible arrangements of the circulating tubes; Fig. 7, is a sectional elevation of another form of water tube boiler embodying my invention; Figs. 8 and 9, are sectional views of other forms of water tube boilers embodying my invention; Fig. 10, illustrates a further modification embodying my invention, and Fig. 11, is a diagrammatic view illustrating another possible arrangement of the circulating tubes.

While I have shown certain forms of water tube boilers embodying my invention, I do not wish to be limited to any special type of boiler.

Referring to the views illustrated on the several sheets of drawing, Figs. 1 and 2, show in sectional side elevation and plan view respectively a water-tube boiler in which vertical tubes *a* are arranged in a double row in a manner as will be seen from Fig. 2—to form approximately the letter W. Fig. 3 is an enlarged view of part of Fig. 2 but showing the baffles *g* which are also formed approximately like the letter W so that they may be made to enter the spaces *m* and *n*. A number of baffles are arranged in the flue at the desired distances apart they being made to project alternately from one side and the other as will be seen from Fig. 1 thus compelling the hot gases to traverse and retrace the vertical tubes. The upper ends of the tubes communicate with a header *c* which in turn communicates with a cylindrical vessel *d* and the lower ends of the tubes are connected to a collector *b* a return pipe *e* also connecting the cylinder *d* with said collector. The length of the tubes is such that the hot gases from the furnace *f* will impinge against the tube some little distance above the collector *b*. The baffles *g* are preferably connected by rods *o* to an operating or vibrating handle *u* so that said baffles may be rocked or vibrated in order to remove soot that may be collected thereon and by causing them to strike against the tubes also shaking off soot that may be adhering to them.

Fig. 4 shows an end view of one of the baffles.

The tubes are not necessarily arranged in a double row, *e. g.* in Fig. 5 they are shown arranged in a single row and in Fig. 6 in a treble row but I do not restrict myself to any particular number of rows always provided that they are arranged in the manner substantially as described and that free access of the hot gases to all said rows may be had.

Instead of connecting the upper ends of the tubes to the header *c* and the latter with the vessel *d* I may connect said tubes directly to the vessel *d* as shown in Fig. 7 and further also I may dispense with the return pipe *e* and cause the return flow of water from *d* to *b* to take place in the known manner.

If desired my improved boiler may comprise two or more systems of tubes arranged as described. As an example Fig. 8 shows a boiler having two such systems the arrangement being such that the hot gases traverse first up one flue in which one system of tubes is located and then down another flue in which the other system of tubes is located each system of tubes being connected to independent vessels *d* and *b* respectively. A very similar arrangement is shown in Fig. 9 the difference being that the two systems of tubes are closer together and both systems connected at their upper ends to a common vessel *d*.

It is not essential that when the vertical tubes are connected at their upper ends directly with the vessel *d* that the return flow tubes shall pass centrally through the tubes *a* and Fig. 10 shows an alternative arrangement where the exterior return flow pipe *e* is shown arranged in place of the centrally located return tubes *y*.

Although I prefer to arrange the tubes as illustrated in Figs. 2, 3, 5 and 6, they might be arranged for example as shown in Fig. 11 without departing from my invention.

Although the tubes *a* are shown in the various figures as vertical I do not restrict myself to such an arrangement.

In the boiler construction herein shown it will be seen that the tubes are arranged as an entirety in a sinuous group, as it may be termed, in a single line or in a plurality of lines, presenting at each side of the group a series of like reentrant angular spaces the sides of which may be parallel or which may diverge outwardly, the spaces of the one series alternating with and being positioned reversely to the spaces of the other series. The depth of such a space is determined by the angularity of the ranks of tubes in the group, by the size, number and spacing of the tubes in a rank, and of course by the distance from one to the other side of the group of tubes as a whole. The free edges of the baffle plates are shaped to conform to the sinuous contour of the group of tubes, that is, said plates have serrated or toothed edges, the teeth or convex portions fitting into the reentrant spaces presented by the group of tubes, and the convex portions of one plate are located opposite the concave portions of the next plate. Thus each baffle plate extends from one side of the group of tubes nearly to the other side

thereof, and thereby the products of combustion are compelled to take such a course that a very uniform heating action upon all the tubes of the group is effected.

5 What I claim as my invention and desire to secure by Letters Patent is:—

1. A water tube boiler having its tubes arranged to form in cross section approximately the letter **W**, and baffles projecting alternately from opposite sides of the tubes and fitting into the spaces formed by said tube arrangement, baffle portions fitting into the spaces on one side of the tubes alternating with and extending at their apices beyond the apices of similar baffle portions fitting into the spaces on the other side of the tubes.

2. A water tube boiler having its tubes arranged to form in cross section approximately the letter **W**, and movable baffles projecting alternately from opposite sides of and fitting into the spaces formed by said arrangement of tubes, baffle portions fitting into the spaces on one side of the tubes alternating with and extending at their apices beyond the apices of similar baffle portions fitting into the spaces on the other side of the tubes.

3. A water tube boiler having its tubes arranged in a flue to form in sectional plan view approximately the letter **W**, movable baffles to fit into the two series of spaces formed by the said arrangement of tubes and projecting alternately from opposite sides of the flue into said spaces, the baffle portions in one series of spaces alternating with and extending at their apices beyond the apices of the baffle portions in the other series of spaces, and means operable from a point outside the flue to move said baffles.

4. A water tube boiler comprising a combined steam and water reservoir, steam generating tubes suspended in a flue in a zig-zag row from and opening into said reservoir, baffles which project alternately from opposite sides of the flue into the two series of oppositely disposed and alternating V-shaped spaces formed by the zig-zag arrangement of the tubes, and a water collecting chamber suspended from said tubes and communicating therethrough with said reservoir, the apices of the baffles in the spaces of one series extending beyond the apices of and alternating with the baffles in the spaces of the other series.

5. A water tube boiler comprising two sets of straight steam generating tubes suspended in a flue in zig-zag rows, a vertical partition disposed between said sets of tubes and dividing said flue, means affording communication between the upper ends of said tubes, a water collecting chamber suspended from each set of tubes, and horizontal baffles projecting alternately from opposite sides of the flue into the two series of oppositely dis-

posed and alternating V-shaped spaces formed by the zig-zag arrangement of the tubes, the extremities of a baffle entering the spaces of one series extending beyond and alternating with the extremities of the baffle entering the spaces of the other series.

6. The combination, in a water tube boiler, of a header, a water collecting chamber, a series of straight tubes extending in groups disposed in zig-zag lines between said header and water collecting chamber with reentrant angular spaces between said groups, and baffle plates fitting said spaces, the portions of the plates within the spaces extending from one side of the groups of tubes substantially to the other side thereof.

7. The combination, in a water tube boiler, of a header, a water collecting chamber, a series of straight tubes arranged approximately in the shape of the letter **W** and extending between said header and the water collecting chamber, and baffle plates fitting the V-shaped spaces formed by the arrangement of said tubes, the portions of the plates within the spaces extending substantially from one to the other side of the series of tubes.

8. The combination of a boiler setting having a flue, a water tube boiler comprising a header, a water collecting chamber, and a plurality of straight steam generating tubes arranged in a zig-zag row and disposed in said flue, and baffle plates projecting alternately from opposite sides of said flue and provided with toothed edges which fit into the two series of V-shaped spaces formed by the zig-zag arrangement of the tubes, the teeth on one baffle plate being located opposite the spaces between the teeth of the next plate.

9. The combination of a boiler setting having a flue, a boiler comprising a combined steam and water reservoir, steam generating tubes suspended in said flue in a zig-zag row from and opening into said reservoir, and a water collecting chamber suspended from said tubes and communicating therethrough with said steam and water reservoir, and baffle plates projecting alternately from opposite sides of said flue and having toothed edges the teeth of which extend into the two series of spaces formed by the zig-zag arrangement of the tubes, the teeth of one plate being located opposite the spaces between the teeth of the next plate.

10. The combination, in a boiler setting, of a vertical partition therein forming a pair of flues, steam generating tubes disposed in said flues and arranged in zig-zag rows to form two series of alternating V-shaped spaces between the same, steam collecting means affording communication between the upper ends of said tubes, a water collecting chamber suspended from each set of tubes, and horizontal baffle plates project-

ing from opposite sides of the flues into the spaces formed between the tubes, each baffle plate extending from one side of a flue nearly to the opposite side thereof.

5 11. A water tube boiler having a header, a water collecting chamber, and vertical tubes arranged between said header and chamber in a zig-zag row with reëntrant V-shaped spaces at one side of said row inter-
10 posed between similarly shaped but reversely positioned reëntrant spaces at the other side, the depth of each space being nearly equal to the distance between the opposite sides of the row of tubes.

15 12. A water tube boiler having its tubes arranged in a sinuous group presenting at each side a series of like reëntrant angular

spaces, the spaces of one series alternating with and being positioned reversely to the spaces of the other series, and baffle 20 plates projecting alternately from opposite sides of the group of tubes and having their edges conforming to the contour of the group of tubes, to enter the reëntrant spaces thereof, the convex portions of one plate being 25 located opposite the concave portions of the next plate.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

PAUL KESTNER.

Witnesses:

HENRI CHARRIER,
LÉON PECKEL.