

951,813.

C. W. HAWKES.
STEAM BOILER.
APPLICATION FILED NOV. 12, 1909.

Patented Mar. 15, 1910.

2 SHEETS—SHEET 1.

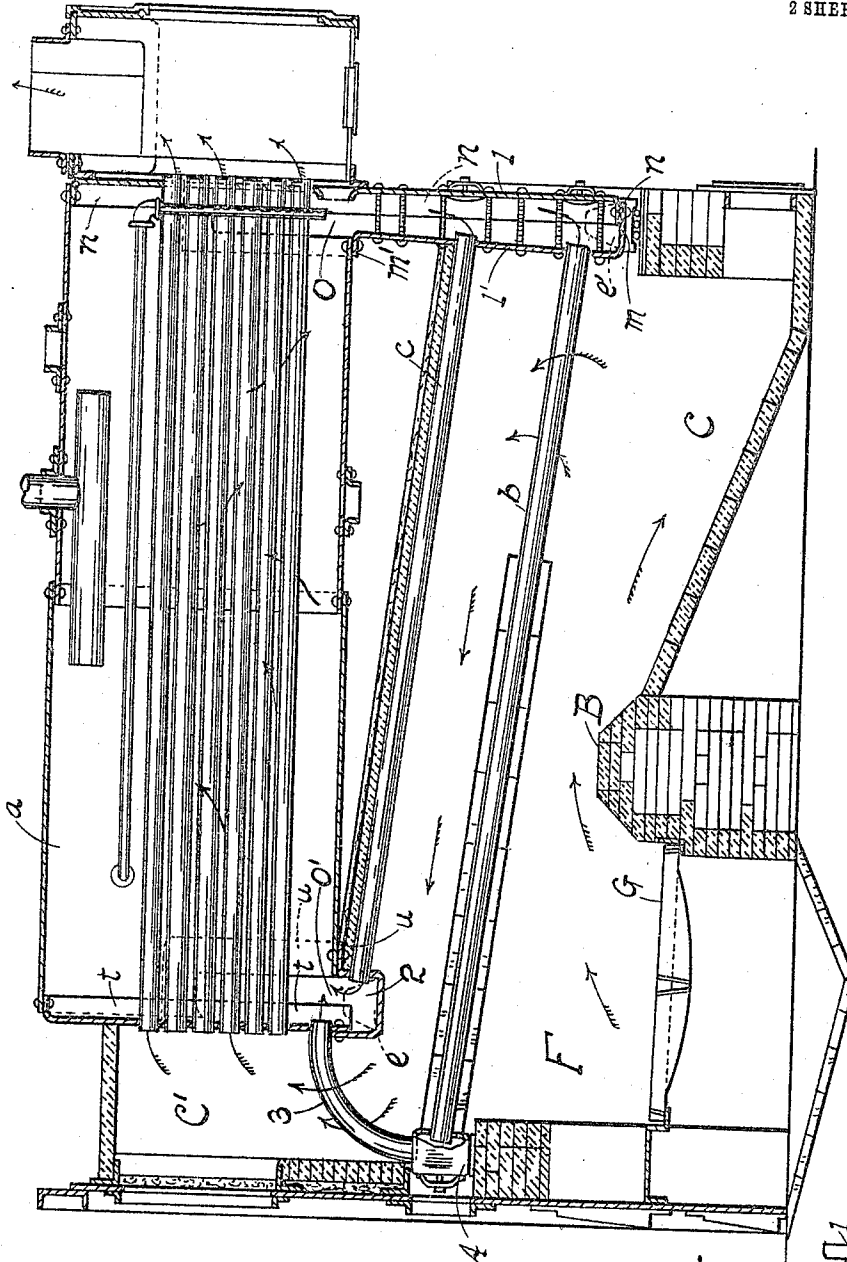


FIG. 1.

FIG. 7.

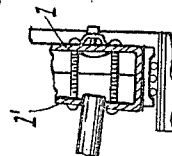
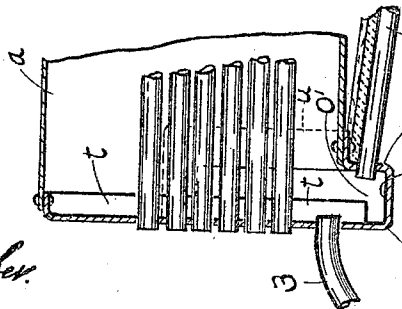


FIG. 6.



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Frank E. Weber.

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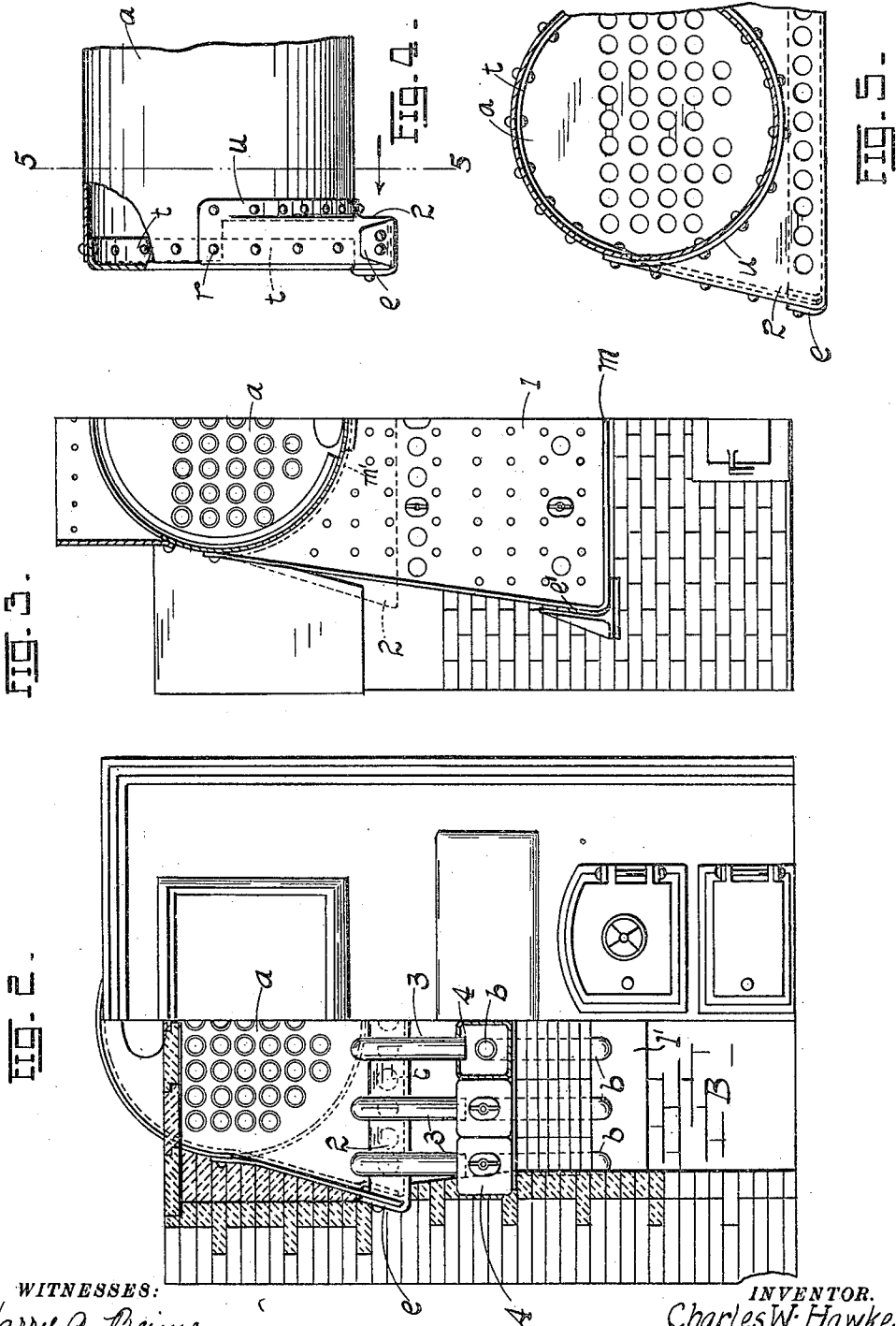
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2 SHEETS—SHEET 2.

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UNITED STATES PATENT OFFICE.

CHARLES W. HAWKES, OF CHICAGO, ILLINOIS.

STEAM-BOILER.

951,813.

Specification of Letters Patent. Patented Mar. 15, 1910.

Application filed November 12, 1909. Serial No. 527,663.

To all whom it may concern:

Be it known that I, CHARLES W. HAWKES, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention has relation to improvements in steam boilers; and it consists in the novel details of construction more fully set forth in the specification and pointed out in the claims.

In the drawings, Figure 1 is a longitudinal middle vertical section of the boiler and furnace; Fig. 2 is a half section and half elevation of the front of the boiler; Fig. 3 is a half rear elevation with smoke-box removed; Fig. 4 is a side elevational detail of the fire-tube or upper section of the boiler, showing the construction of the front water-saddle; Fig. 5 is a cross-section on the line 5—5 of Fig. 4; Fig. 6 is a sectional detail showing the front saddle welded to the front flue-sheet; and Fig. 7 is a sectional detail showing a corresponding construction for the rear water-leg.

The present invention is an improvement on the boiler construction covered by my U. S. patent of January 9, 1906, numbered 809,503 for steam boilers, the special objects of the improvement being to modify the construction and shift the position of the front water-saddle or that immediately adjacent to the flue-sheet, so as to permit its being secured at its front directly to such sheet, the front wall of the saddle being disposed substantially in the same plane with the flue-sheet. This arrangement makes it possible to dispose the rear upper ends of the front curved water-circulating or arch tubes (which connect the fire-tube section with the front header) in substantially the same plane, thereby permitting them to be made of the same length throughout and uniformly distributed and reducing the tendency of unequal and uneven expansion.

A further object is to subdivide the front header into a series of independent boxes, one for each circulating pipe and water-tube leading thereinto, so as to permit each tube

and pipe to expand and contract independently and without affecting or disturbing the behavior of any other tube or pipe while expanding or contracting under its own individual conditions.

The advantages of the improvements will be best apparent from a detailed description of the invention which is as follows:

Referring to the drawings, G represents the grate; F the fire box; B the bridge-wall; C the main or lower combustion chamber of the furnace; and C' the upper or supplemental combustion-chamber.

The boiler is composed of three distinct members or sections, viz., the upper fire-tube section *a* composed of a shell traversed lengthwise by fire-tubes; the lower water-tube section *b* comprising a series of water-tubes; and the intermediate section constituting the upper water-tube section *c* likewise composed of water-tubes, all as in my patent above referred to. The rear flue-sheet is extended downward below the shell forming the outer wall *l* of the rear water leg, the inner wall *l'* being composed of a sheet having an outwardly bent marginal flange *m* riveted to the inwardly formed flange *n* of the flue-sheet and its extension *l*, a rearwardly bent flange *m'* overlapping the opening O cut in the shell (for establishing communication between the interior of the shell and water-leg) the bottom terminating if desired in upturned ends *e'* riveted to the sides, as shown to best advantage in Figs. 1 and 3. The rear water-leg establishes communication with the lower rear ends of the water-tube sections *b*, *c*, the same as in my patent referred to.

In the present improvement, the front water-saddle 2 has its front wall substantially in continuation of the front flue-sheet (Fig. 1) said saddle being formed as seen to best advantage in Figs. 2, 4, and 5, of outwardly and downwardly diverging side walls (the same as in my patent) the side walls being bent or directed forwardly and riveted to the inwardly turned flange *t* of the front flue-sheet, the said sides and rear vertical wall of the saddle being flanged rearwardly at *u*, said flange *u* passing under and around the shell and overlapping the opening O' cut therefrom (to establish communication between the saddle and interior of the shell), the rivet *r* just above the open-

ing O' passing through three thicknesses of metal, namely the flange *t*, boiler shell and the flange *u*. The saddle 2 is wholly below the shell, the front vertical wall of the saddle being turned up and riveted to the front flue-sheet along a line just a trifle below the shell (Figs. 1, 2) the flue-sheet being sufficiently extended if necessary, to secure the proper overlap between the parts so they may be conveniently riveted together. The bottom wall of the saddle has upturned ends *e* which are riveted to the sides, the seams about the rivets being securely calked. As shown in the drawings, the front wall of the saddle is substantially in continuation of the front flue-sheet, this construction affording virtually a common wall along which the upper ends of the front arch-tubes 3 may be uniformly distributed in the same horizontal line and along a common plane, making it possible to have the several tubes of the same length. In the present improvement the lower ends of the arch tubes communicate each with a box or enlargement 4, the rear wall of which is tapped by the front end of one of the tubes *b* which collectively form the lower water-tube section of the boiler, the rear wall of the saddle 2 being tapped by the tubes *c* constituting the upper water-tube section, the same as in my patent referred to. By providing each arch-tube 3 with an individual box 4, it is perfectly apparent that each tube is free to expand or contract independently of any other tube, and hence any unevenness in such expansion or contraction will in no wise strain the tubes, nor will it cause leaks at the joints. Again, by shifting the saddle 2 to the very front of the boiler, the upward circulation therethrough better supplements the corresponding circulation from the arch-tubes 3, and a more vigorous and positive circulation through the shell results.

In Fig. 6 I show the front saddle welded to the flue-sheet along the front and sides, indicated by the reference letters *x*, *x*, in which modification the flue-sheet is preferably extended to meet the horizontal bottom of the saddle, instead of turning up the front wall of the saddle to meet the flue-sheet as shown in the first construction. Either form of construction however, leaves the saddle with a seamless bottom, and without rivets. This is a decided advantage as no leaks can possibly develop under any circumstances. The same principle of welding may be applied to the rear water-leg as shown in the modification in Fig. 7 where the plates *l*, *l'* are welded together. In the welded modifications, the upturned ends *e*, *e'* are eliminated altogether; and in fact, in the original form of the rear water-leg which shows a riveted bottom, the upturned ends *e'* are not necessary and may be dispensed with.

Such features as may be illustrated but to which no specific reference is herein made are either covered by my previous patent or well understood in the art, and hence no description thereof is here attempted.

Having described my invention, what I claim is:—

1. A boiler comprising an upper fire-tube section, a bottom water-tube section, and an upper water-tube section between the first named sections, a rear water-leg communicating with the rear ends of the tubes of the respective sections, a front saddle into which the upper water-tube section discharges, independent boxes for receiving the discharges from the tubes of the bottom water-tube section, and circulating tubes leading from said boxes to the shell of the fire-tube section, said circulating tubes tapping said shell at the same elevation and along a common vertical plane.

2. In combination with a fire-tube boiler terminating in a front saddle the front wall whereof is in substantial continuation of the flue-sheet, a series of circulating tubes leading from the flue-sheet and front wall of the saddle, the upper ends of the tubes being disposed in substantially the same vertical plane and in the same horizontal line, and means for establishing circulation between the bottoms of the tubes and the opposite or rear end of the boiler.

3. In combination with a fire-tube boiler terminating in a front saddle the front wall whereof is in substantial continuation of the flue-sheet, a series of circulating tubes leading from the flue-sheet and front wall of the saddle, the upper ends of the tubes being disposed in substantially the same vertical plane and in the same horizontal line, independent boxes from which the bottoms of the tubes lead, and means for establishing circulation between the boxes and the opposite or rear end of the boiler.

4. A boiler comprising an upper fire-tube section, a bottom water-tube section, and an upper water-tube section between the first named sections, means for establishing communication between the fire-tube section and intermediate water-tube section, means for establishing communication between the fire-tube section and one end of the lower water-tube section, and circulating members between the opposite end of the lower water-tube section and the fire-tube section, said circulating members tapping the fire-tube section substantially along a common vertical plane.

5. A boiler comprising an upper fire-tube section, a bottom water-tube section, and an upper water-tube section between the first named sections, means for establishing communication between the fire-tube section and intermediate water-tube section, means for establishing communication between the fire-

tube section and one end of the lower water-tube section, and circulating members between the opposite end of the lower water-tube section and the fire-tube section, said
5 circulating members tapping the fire-tube section, substantially along a common plane.

6. A boiler comprising an upper fire-tube section, a bottom water-tube section, and an upper water-tube section between the first
10 named sections, a rear water-leg communicating with the rear ends of the tubes of the respective water-tube sections, a front saddle into which the upper water-tube section discharges, suitable means for receiving the
15 discharges from the tubes of the bottom water-tube section, and circulating tubes leading from said discharge-receiving means to the shell of the fire-tube section, said circulating tubes being substantially of the same

length and tapping the fire-tube section 20 along a line disposed in a common plane.

7. In combination with a fire-tube boiler terminating in a front saddle the front wall whereof is in substantial continuation of the
25 flue-sheet, a series of circulating tubes leading from the flue-sheet and front wall of the saddle, the upper ends of the tubes being disposed in substantially the same vertical plane, and means for establishing circulation between the bottoms of the tubes and
30 the opposite or rear end of the boiler, substantially as set forth.

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

CHARLES W. HAWKES.

Witnesses:

C. M. FLYNN,
F. S. HICKOK.