

(No Model.)

W. B. FOWLER.
BOILER.

No. 482,999.

Patented Sept. 20, 1892.

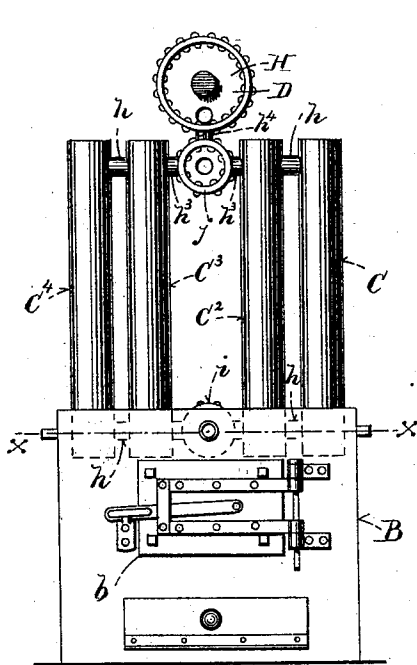


Fig. 3.

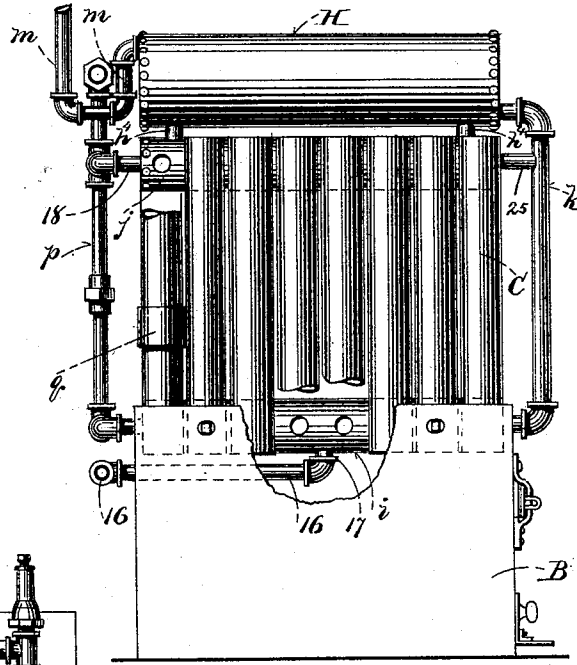


Fig. 2.

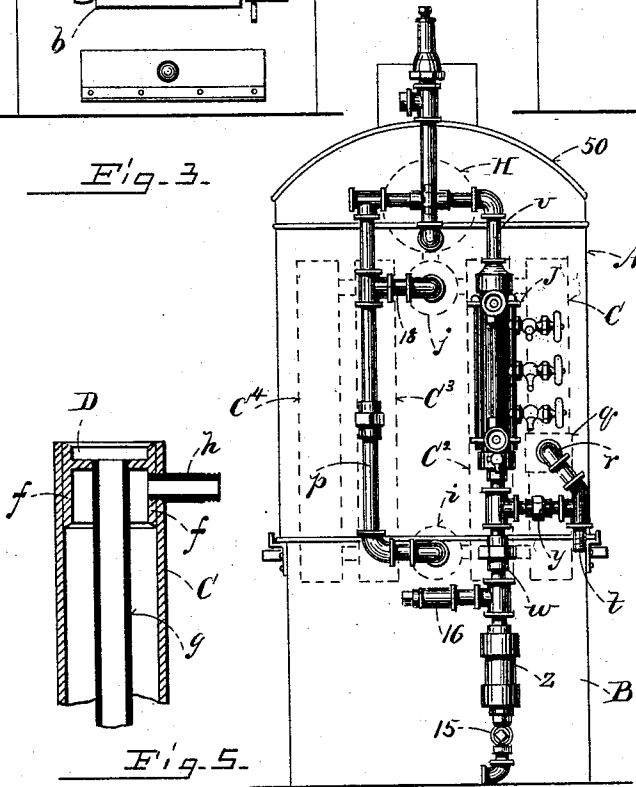


Fig. 5.

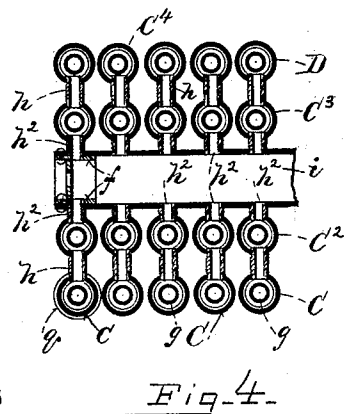


Fig. 4.

WITNESSES: James H. Gibson Fig. 1. Walter B. Fowler. INVENTOR=
H. Durfee BY C. A. Shaw & Co., ATTY-S.

UNITED STATES PATENT OFFICE.

WALTER B. FOWLER, OF LAWRENCE, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO LEWIS SAUNDERS, OF SAME PLACE.

BOILER.

SPECIFICATION forming part of Letters Patent No. 482,999, dated September 20, 1892.

Application filed March 24, 1892. Serial No. 426,222. (No model.)

To all whom it may concern:

Be it known that I, WALTER B. FOWLER, of Lawrence, in the county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Boilers, of which the following is a description sufficiently full, clear, and exact to enable any person skilled in the art or science to which said invention appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a rear end elevation of my improved boiler; Fig. 2, a side elevation of the same, the casing being removed and a portion of the fire-box represented as broken away; Fig. 3, a front elevation of the same; Fig. 4, a horizontal section taken on line *x x* in Fig. 3, and Fig. 5 a sectional view of one of the tubes.

Like letters and figures of reference indicate corresponding parts in the different figures of the drawings.

My invention relates especially to a vertical tubular boiler, the object being to produce a large heating-surface by a peculiar arrangement of parts with greatly-decreased cost of construction and saving of fuel in use of the boiler.

The nature and operation of the improvement will be readily understood by all conversant with such matters from the following explanation:

In the drawings, A represents the boiler-casing, and B the fire-box. The fire-box is rectangular in form and provided in its forward end with the ordinary door *b*. Vertical circulation-tubes C C² C³ C⁴ are disposed and secured by their lower ends in the top of the fire-box B over the grate, the series of tubes being arranged in parallelism. These tubes are constructed of comparatively thin material, and the heads D thereof are secured in the ends of said tubes by welding, avoiding the use of rivets employed in ordinary constructions. The heads D are each provided with an inwardly-projecting annular reinforcing-flange *f*. Passing centrally through each tube and secured in and opening through the heads D thereof is a flue *g*. Corresponding tubes of each series of tubes C C² and C C⁴ are connected by horizontal circu-

lation-ducts *h*. These ducts are turned into suitable openings tapped through the tubes and the reinforcing-flanges *f* of the heads D thereof.

Arranged horizontally between the lower ends of the series C² C³ and longitudinally over the grate of the fire-box there is a tube *i* of larger diameter than the vertical tubes, said tube being provided at each end with heads D, having flanges *f*. These heads are secured in the tube *i* by riveting, as shown in Fig. 4, it being inconvenient to weld said heads when the tube is of large diameter. The tubes of the series C² C³ are connected by circulation-ducts *h*², passing through their head-flanges, with the tube *i*, as shown in Fig. 4. Vertically over the tube *i* there is a similarly-constructed tube *j*, arranged horizontally and connected with the vertical tubes of the series C² C³ by ducts *h*². A cylindrical steam-chest H is arranged directly over the tube *j*, its ends being closed by reinforced heads D, and in the same manner as the tubes *i j*. Vertical steam-ducts *h*⁴ connect through the head-flanges of the tube *j* with said chest. A drain-pipe *k* at the front of the boiler taps through the lower portion of the front end of the steam-chest and connects with the corresponding head of the horizontal tube *i*, said drain-pipe passing outside of the casing A, so that its temperature may be less than said tubes. A discharge-pipe *m* taps the opposite or rear end of the steam-chest near the top and passes outside the casing-body below the cap or top 50, Fig. 1. The rear ends of the tubes *i j* are connected outside the casing with a vertical pipe *p*. The rear tube in the series C is provided centrally with a reinforcing-strap *q*. (Shown in Fig. 2.) A pipe *r* (see Fig. 1) taps said tube through said strap and passes outside the casing. The lower end of said pipe is provided with a nipple *t*, through which the water-supply is received. A gage-glass J, of ordinary construction and provided with the usual petcocks, is connected at its top by a pipe *v* with the pipe *p*. A pipe *w* from the lower end of said tube is connected by a branch *y* with the supply-pipe *r*. The lower end of the pipe *w* opens into the waste-tank *z*, which discharges by means of a cock 15. Above said tank a pipe 16 passes through

the wall of the fire-box over the grate vertically under the tube *i* (see Fig. 2) and taps said tube centrally at 17. The tube *j* is connected at its rear end by a pipe 18 with the pipe *p*. A circulation-pipe 25 connects the forward end of the tube *j* with the drain-pipe *k*. The tubes arranged as described present an extraordinary large heating-surface to the action of the fire in comparison with the size of the boiler. By means of the form of reinforcing-heads employed to secure the connecting-ducts the material used in constructing the tubes may be very thin, cheapening the cost and rendering the heating of the water much more rapid. These tubes may be multiplied in series, furnishing extraordinarily large heating-surface and effecting an extremely rapid steam generation with little waste of fuel. A constant supply of cold water is taken in at the nipple *t*, and, mingling with the hot water from outer tube *C* through pipe *r*, is carried through coupling *y*. The temperature being thus reduced, the water passes through pipes *w* and 16 into the fire-box directly over the fire, where it rapidly heats and passes into the horizontal tube *i*, the heated water passing through ducts *h*² *h* into vertical tubes *C*² *C*³ and *C* *C*⁴ and in rising passes therefrom into upper horizontal tube *j*. Steam generated passes into chest *H*. Condensation in said chest drains through pipe *k* into lower horizontal tube *i*. Direct circulation is also maintained between the horizontal tubes *i* *j* by pipes *p* *k* and connections 25 18. By this arrangement it is found that water never rises into the steam-chest, and "dry" steam is delivered to the discharge *m*. The cooling of the pipes *p* *k* outside the casing renders the circulation very rapid. The constant feed for the boiler through the nipple *t* being mingled with the heated water and carried directly over the fire by the peculiar arrangement of pipes described tends to greatly save fuel and increase the efficiency of the boiler. By offsetting the discharge *m*, so that it will pass through the body of the casing, the top 50 can be removed and the flues *g* cleaned with very little labor.

Having thus explained my invention, what I claim is—

1. In a boiler, vertical tubes arranged in parallel series over the fire-box, inwardly-depressed heads welded into said tubes and provided with inwardly-projecting reinforcing-flanges, flues connecting the heads of each tube, and horizontal circulation-ducts opening through said flanges and connecting the tubes of adjacent series, substantially as described.

2. In a boiler, a horizontal tube disposed over the fire-box, a supply-pipe opening through said box into said tube, a horizontal tube disposed vertically above said first tube,

vertical circulation-tubes provided with flues and connected by horizontal ducts with said horizontal tubes, a steam-chest and discharge connected with said upper tube, and a pipe connecting one of said vertical tubes with the supply outside the boiler-casing, substantially as and for the purpose set forth.

3. In a boiler, two horizontal tubes arranged vertically in parallelism above the fire-box and having their corresponding heads connected by pipes outside the casing, in combination with a steam-chest connecting with the upper tube, a series of parallel vertical tubes provided with flues and having their ends respectively connected by horizontal ducts with said horizontal tubes, a supply-opening through the fire-box into the lower horizontal tube, a pipe connecting a vertical tube with the supply outside the casing, and a pipe connecting the supply with the horizontal tube connection, substantially as described.

4. In a tubular boiler, a supply leading through the casing and entering one of the circulation-tubes centrally over the grate, in combination with a pipe tapping one of the circulation-tubes above the supply and connecting therewith outside the casing, substantially as and for the purpose set forth.

5. In a boiler, two horizontal circulation-tubes arranged vertically in parallelism above the boiler and having corresponding heads connected by pipes outside the casing, a cylindrical steam-chest arranged vertically in parallelism with the upper tube and connected therewith, a drain for the chest, opening into one of said outside pipes, a supply for the tubes, and a discharge for the chest, combined substantially as described.

6. The fire-box and casing, in combination with the horizontal tubes *i* *j*, connected by pipes *p* *k* outside said casing, the series of vertical tubes *C*² *C*³, provided with flues and connected by ducts *h*² *h*³ with the horizontal tubes, the steam-chest connected with the tube *j*, a supply for said tubes, and a discharge for said chest, substantially as described.

7. The fire-box and casing, in combination with the tubes *i* *j*, connected by pipes *p* *k* outside said casing, a series of vertical tubes, as *C*² *C*³, connected by ducts with the tubes *i* *j*, the chest connected with said tube *j*, a drain opening into the pipe *k*, the supply 16, opening centrally into the tube *i*, the pipe *r*, connecting a vertical tube with said supply, a pipe connecting the pipe *p* with said supply, and a discharge for the chest, all being arranged to operate substantially as described.

WALTER B. FOWLER.

Witnesses:

FRANK E. BRITTON,
JOHN S. GILE.