

T. KERNER.

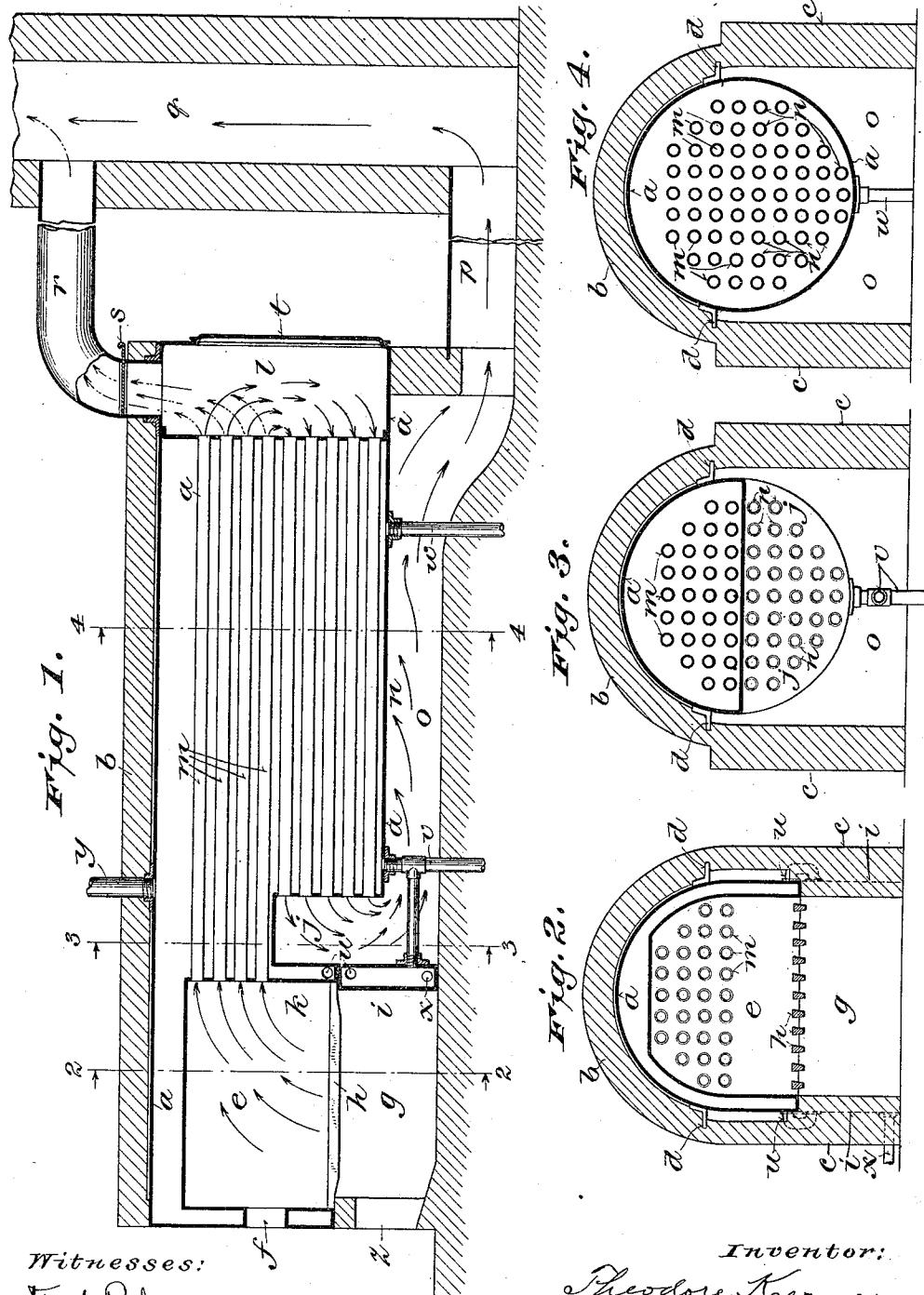
## STEAM BOILER AND FURNACE.

APPLICATION FILED JULY 11, 1910.

1,132,778.

Patented Mar. 23, 1915.

2 SHEETS—SHEET 1.



*Witnesses:*

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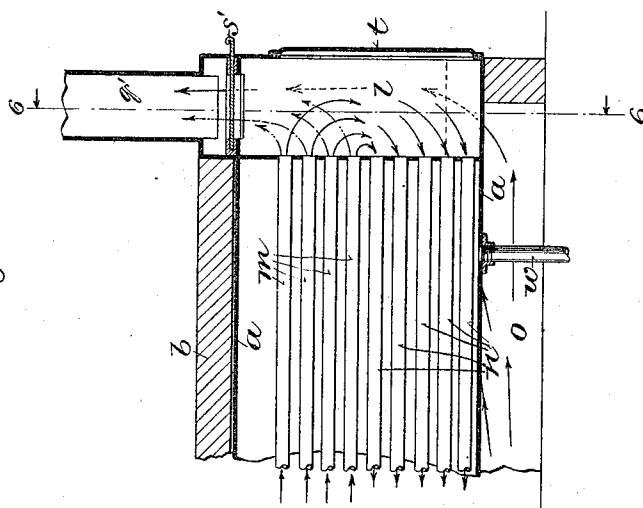
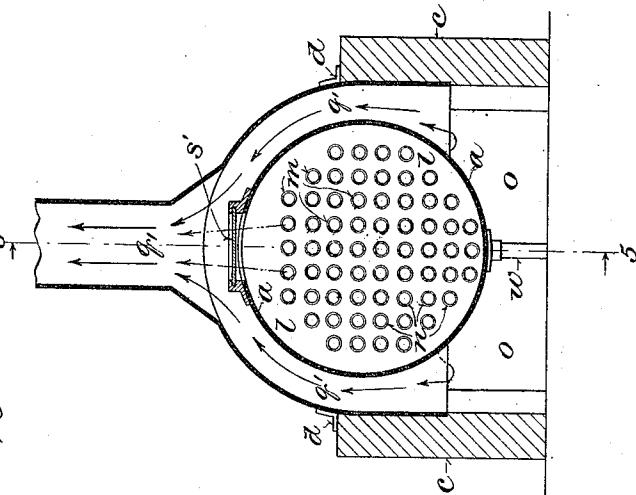
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2 SHEETS—SHEET 2.

Fig. 5.  
Fig. 6.



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# UNITED STATES PATENT OFFICE.

THEODORE KERNER, OF MILWAUKEE, WISCONSIN.

## STEAM-BOILER AND FURNACE.

1,132,778.

Specification of Letters Patent. Patented Mar. 23, 1915.

Application filed July 11, 1910. Serial No. 571,328.

To all whom it may concern:

Be it known that I, THEODORE KERNER, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Steam-Boilers and Furnaces, of which the following is a specification, reference being had to the accompanying drawing, forming a part thereof.

10 The main object of this invention is to increase the efficiency of boilers for producing steam or heating water by utilizing to the fullest extent the heating surfaces of the boiler shell and flues and absorbing all the available heat of the products of combustion.

15 It consists in the construction, arrangement and combination of parts as herein-20 after particularly described and finally defined in the claims.

25 In the accompanying drawing like characters designate the same parts in the several figures.

Figure 1 is a vertical longitudinal section of a boiler and furnace embodying the invention; Figs. 2, 3 and 4 are vertical cross sections of the same on the lines 2 2, 3 3 and 4 4 respectively, Fig. 1; Fig. 5 is a vertical longitudinal section on the line 5 5, Fig. 6 of the rear portion of a boiler and furnace showing a modification of the smoke stack or escape flue connection; and Fig. 6 is a vertical cross section of the same on the 35 line 6 6, Fig. 5.

Referring to Figs. 1 to 4 inclusive, *a* designates a substantially cylindrical boiler shell inclosed in a brick setting or other suitable casing forming an arch *b* over and close to the upper part of the shell and side walls *c* upon which the boiler is supported in any suitable manner, for example, as shown in Figs. 2, 3 and 4, by saddles or brackets *d*. An internal fire box *e* is provided in the front part of the boiler and surrounded at the top, sides and ends by water circulating spaces. *f* is the feed door opening into the fire box. Below the fire box the boiler shell is cut away to provide for the upper part of the ash pit *g* above which the grate bars *h* are located, resting at their front ends on the brick setting or front wall of the furnace and at their rear ends upon a water back *i*. A flue chamber *j* extends trans-

versely through the lower part of the boiler adjacent to the fire box *e* and ash pit *g*, being separated therefrom by a water leg *k* which forms an upward continuation of the water back *i*. At the rear end of the boiler a flue chamber *l* is inclosed in the shell *a* or a continuation thereof. The upper part of this chamber is connected by longitudinal tubular flues *m* with the rear end of the fire box *e*, and the lower part is connected by tubular return flues *n* with the front flue chamber *j*. The side walls *c* of the brick setting or boiler inclosure form along the lower part and outside of the boiler shell, a flue *o*, which communicates at its front end with the front flue chamber *j*. At the rear end it connects in the present case by a passage *p* below the floor level with the smoke stack or escape flue *q*. The flue *o* which extends upwardly on the sides of the boiler shell to the saddles or brackets *d*, enveloping a large portion of its external surface, is of considerably greater cross sectional area than the combined cross sectional area of all the return flues *n*, and thus operates to retard the flow of gases underneath the boiler to the smoke stack or escape flue, giving them time to import their heat to the boiler shell and incidentally permitting soot to separate from the gases and settle, thereby acting as a smoke arrester. A direct flue 85 connection *r*, provided with a valve *s* for opening and closing it at will, is made between the upper part of the rear flue chamber *l* and the smoke stack or escape flue *q*. The flue chamber *l* is provided at its rear end with an opening and a door or doors *t* through which access is had to said chamber and the flues *m* and *n* opening into it, for the purpose of cleaning them. The upper part of the water back *i* is connected with the lower part of the water leg *k* by pipes or passages *u*, as shown in Figs. 1 and 2. A feed water pipe *v* passing through the flue *o* below the flue chamber *j* connects with the lower part of the water back *i* and also with the lower part of the boiler behind the chamber *j*. A drain pipe *w* connects with the lower part of the boiler, and a drain pipe *x* connects with the lower part of the water back *i*. *y* is a steam or hot water delivery pipe connecting with the upper part of the boiler. The ash pit is provided with the usual clean out and draft opening *z*.

In the normal operation of the boiler and furnace the heated products of combustion 110 pass from the fire box as indicated by arrows on Fig. 1, first through the upper flues *m*

into the chamber *l*, thence forward through the lower flues *n* in the lower part of the boiler into the chamber *j* and thence back through the flue *o* along and in contact with the outside and lower part of the boiler shell by way of the passage *p* into the smoke stack or escape flue *q*. In this way all the available heat produced by the combustion of the fuel is most effectively utilized to raise the temperature of the water in the boiler, the hottest gases passing through the upper flues *m*, which are in contact with the hottest portion of the water in the upper part of the boiler, the cooler gases returning through the lower flues *n* in contact with the cooler portion of the water in the intermediate and lower parts of the boiler, and the waste gases escaping through the flue *o* along the lower part and outside of the shell in contact with the coolest portion of the water in the boiler. The temperature of the feed water on its way into the boiler is gradually raised as it passes through that portion of the pipe *v* exposed to the escaping products of combustion in the flue *o* and through the water back *i* and water leg *k*, which are exposed on the front side to the heat of the fire in the furnace and on the back side to the heated products of combustion passing through the chamber *j*.

To facilitate starting a fire in the furnace or fire box *e* the valve *s* may be opened, thereby establishing a direct draft between the flue chamber *l* and the smoke stack *q*. The products of combustion will then pass as indicated by dotted arrows on Fig. 1, from the upper tubes *m* through the chamber *l* and pipe *r* into the smoke stack without returning through the lower flues *n*. When the fire is well started, the valve *s* is closed and the products of combustion pass in a sinuous course back and forth through and underneath the boiler as first explained, imparting their heat first to the hottest, then to the cooler and finally to the coolest portions of the water contained in the boiler.

Referring to Figs. 5 and 6, the lower end of the smoke stack or escape flue *q'* is branched and its branches straddle the flue chamber *l*, opening at their lower ends into the rear end of the flue *o* on each side of the boiler. A direct draft opening controlled by a valve *s'* is provided between the upper part of the chamber *l* and the smoke stack or escape flue *q'*. This modified arrangement operates substantially like that shown in Fig. 1, the course of the products of combustion both for the indirect and the direct draft being indicated by arrows.

Various changes in minor details of construction and arrangement of parts may be made without departing from the principle of the invention.

By the term "steam boiler" as herein em-

ployed, it is intended to include a boiler for simply heating water as well as a boiler for converting water into steam.

I claim:

1. In a steam boiler and furnace the combination of the boiler shell, an inclosure forming a flue along the lower part and outside of the shell, a flue chamber at the rear end of the boiler, a fire box at its front end, a flue chamber adjacent to its front end communicating with said flue, upper flues extending lengthwise through the shell from the fire box to the rear flue chamber, lower flues extending lengthwise through the shell from the rear flue chamber to the front flue chamber, and an escape flue leading out of said lower outside flue which is of greater area in cross section than the combined cross sectional area of the lower internal flues. 70

2. In a steam boiler and furnace the combination of the boiler shell having an internal fire box at the front end and a flue chamber in the lower part thereof adjacent to the fire box, a flue chamber at the rear end, an inclosure forming a longitudinal flue 75 along the outside and lower part of the shell in communication with the front flue chamber, an escape flue leading from said flue, upper flues extending through the boiler from the fire box to the rear flue chamber, 80 and lower flues extending through the boiler from the rear flue chamber to the front flue chamber, said outside flue being of greater cross sectional area than all the lower internal flues and serving as a soot separating 85 and smoke arresting chamber. 90

3. In a steam boiler and furnace the combination of the boiler shell having a transverse flue chamber in the lower part thereof adjacent to the front end, a fire box adjacent 105 to and extending above said chamber, a flue chamber at the rear end of the boiler, an inclosure forming a longitudinal flue along the lower part and outside of said shell in communication with the front flue chamber, 110 flues extending through the boiler from the fire box to the rear flue chamber, return flues extending through the boiler from the rear flue chamber to the front flue chamber, an escape flue leading from said lower outside flue and a valve controlled direct 115 flue connection with the rear escape flue chamber, said outside flue being of greater cross sectional area than all said return flues and serving as a soot separating and 120 smoke arresting chamber. 125

4. In a steam boiler and furnace the combination of the boiler having an internal fire box at the front end, a flue chamber at the rear end and a transverse flue chamber in the lower part behind the fire box and separated therefrom by a water leg, an ash pit below the fire box, an inclosure forming a longitudinal flue along the lower part and outside of the boiler in communication with 130

the front flue chamber, a water back between the ash pit and the lower outside flue and below said water leg, a circulating connection between said water back and water leg, a feed water connection with the water back, flues extending through the boiler from the fire box to the rear flue chamber, return flues extending through the boiler from the rear flue chamber to the front flue chamber, and an escape flue leading from said lower outside flue, said outside flue being of greater cross sectional area than all of said return flues.

5. In a steam boiler and furnace the combination of a boiler having a fire box at the front end, a flue chamber at the rear end and a transverse flue chamber in the lower part adjacent to the fire box, an inclosure forming a flue along the lower part and out-

side of the boiler communicating at one end 20 with the front flue chamber, upper flues extending through the boiler from the fire box to the rear flue chamber, return flues extending through the boiler from the rear flue chamber to the front flue chamber, an escape flue having branches extending downwardly around the rear flue chamber and communicating at their lower ends with the lower outside flue, and a valve controlled direct draft opening between said escape flue and 30 the rear flue chamber.

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

THEODORE KERNER.

Witnesses:

CHAS. L. Goss,  
ALICE E. Goss.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents.  
Washington, D. C."