

Jan. 14, 1930.

A. L. HITCHCOCK-SPENCER

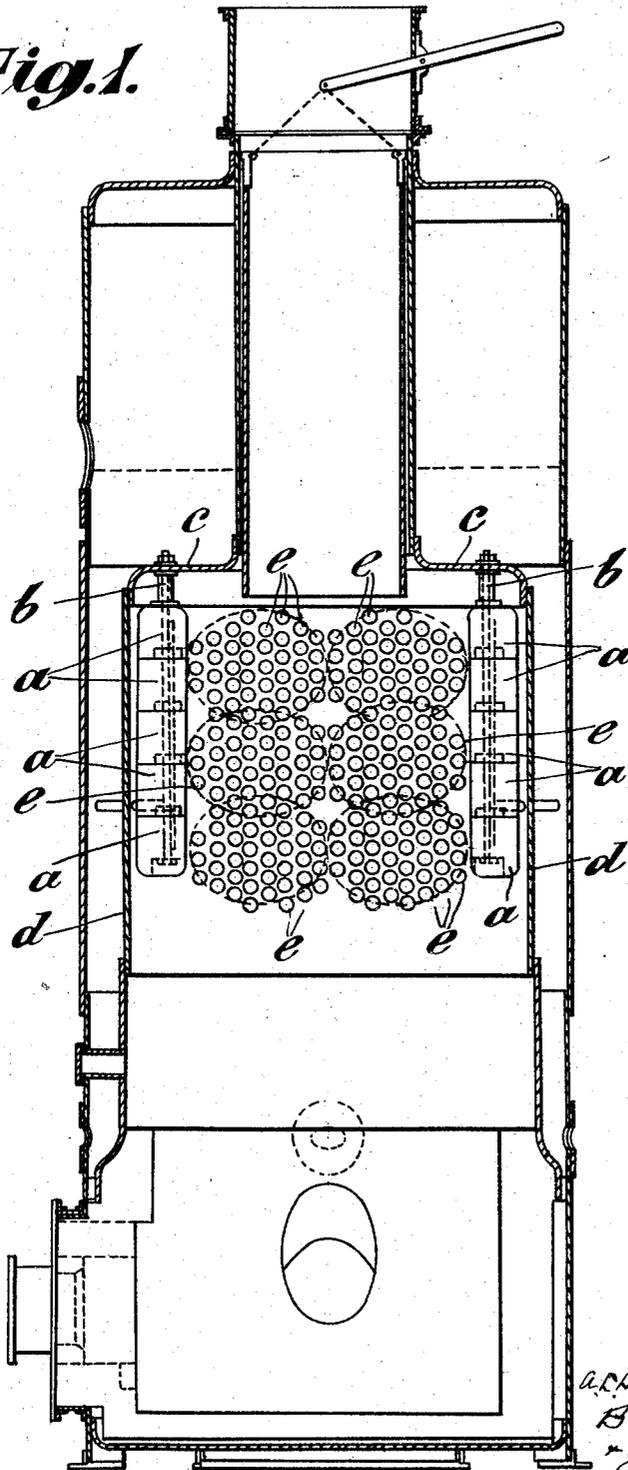
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BOILER FOR EVAPORATING OR HEATING LIQUIDS

Filed March 27, 1929

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*Fig. 1.*



INVENTOR,  
*A. L. Hitchcock-Spencer*  
By *T. M. Blair*,  
*J. H. Kilgus*  
ATTYS.

Jan. 14, 1930.

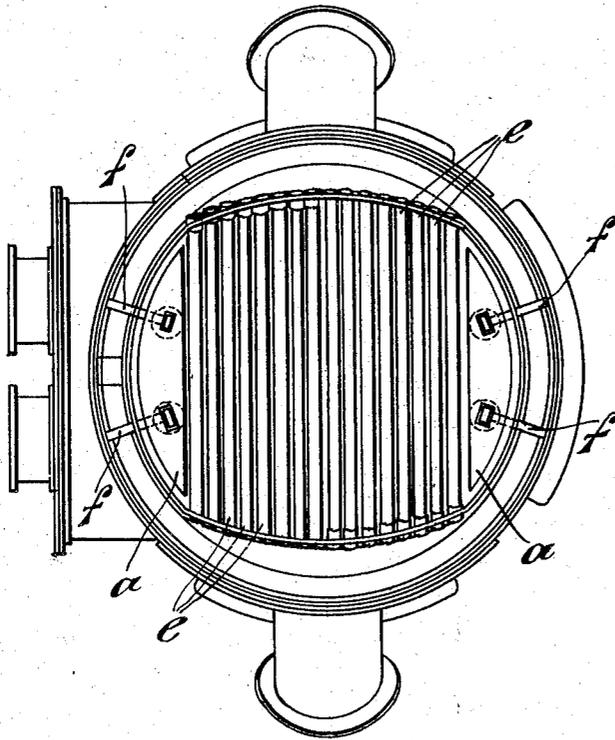
A. L. HITCHCOCK-SPENCER

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**Fig. 2.**

INVENTOR  
A. L. Hitchcock-Spencer  
By  
P. H. Blair & J. H. Keayne  
ATTYS.

Jan. 14, 1930.

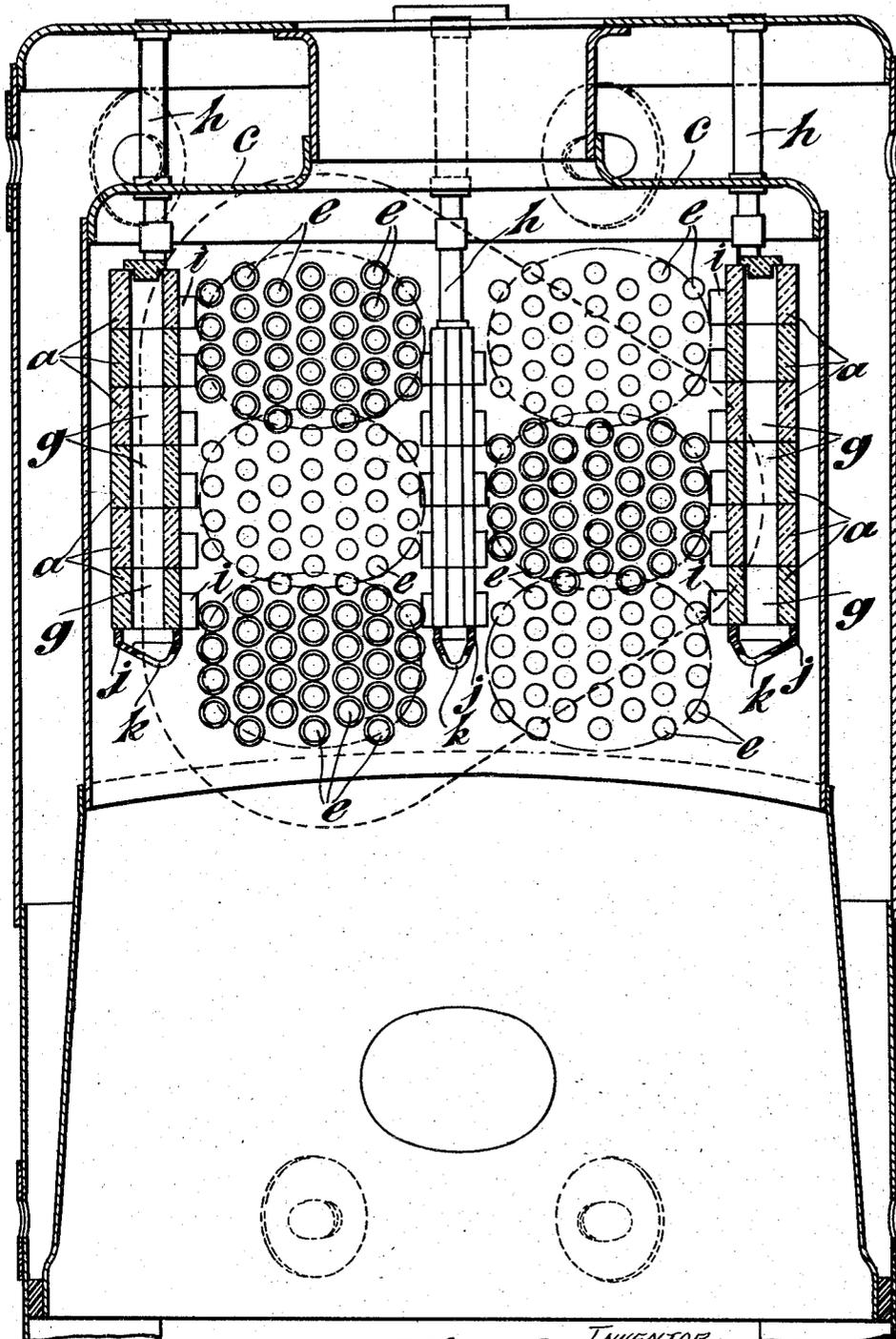
A. L. HITCHCOCK-SPENCER

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BOILER FOR EVAPORATING OR HEATING LIQUIDS

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**Fig. 3.** INVENTOR  
A. L. Hitchcock-Spencer,  
By R. H. Blair & J. H. Wilcoxon ATTYS.

Jan. 14, 1930.

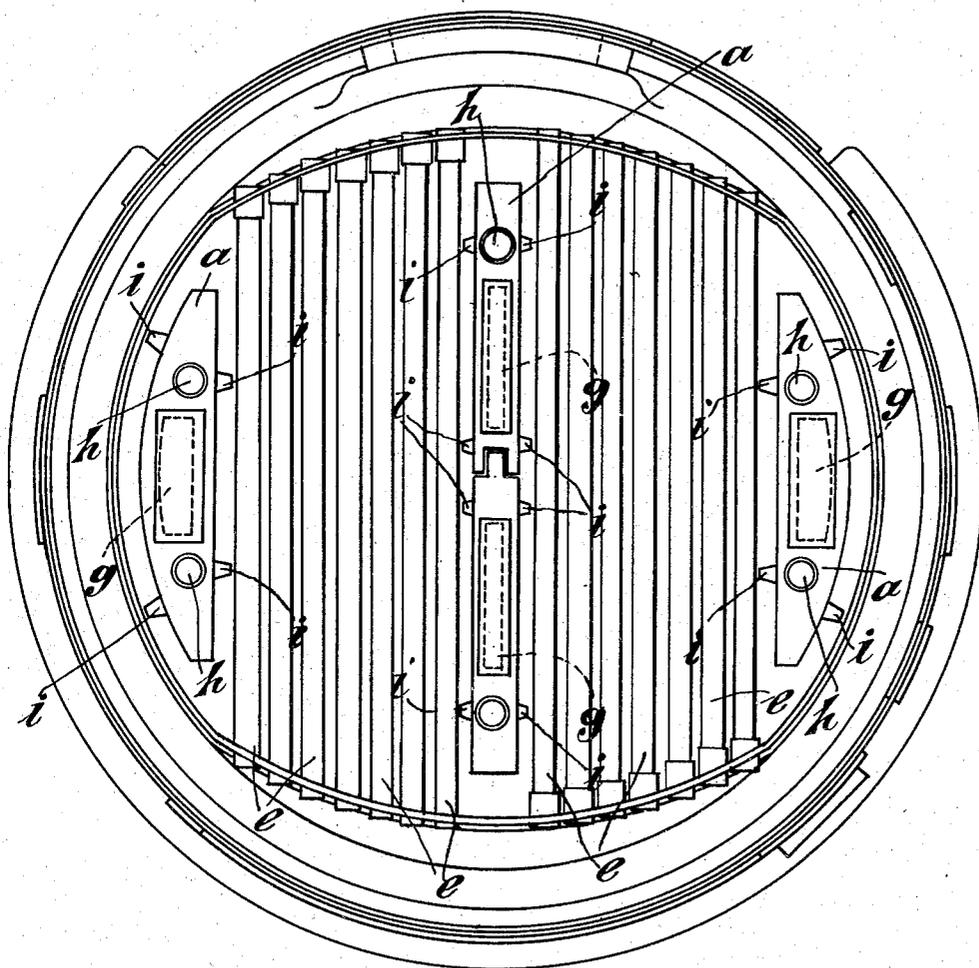
A. L. HITCHCOCK-SPENCER

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BOILER FOR EVAPORATING OR HEATING LIQUIDS

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*Fig. 4.*

INVENTOR  
*A. L. Hitchcock-Spencer*  
By *R. Blair & J. H. Leary*  
ATTYS.

Jan. 14, 1930.

A. L. HITCHCOCK-SPENCER

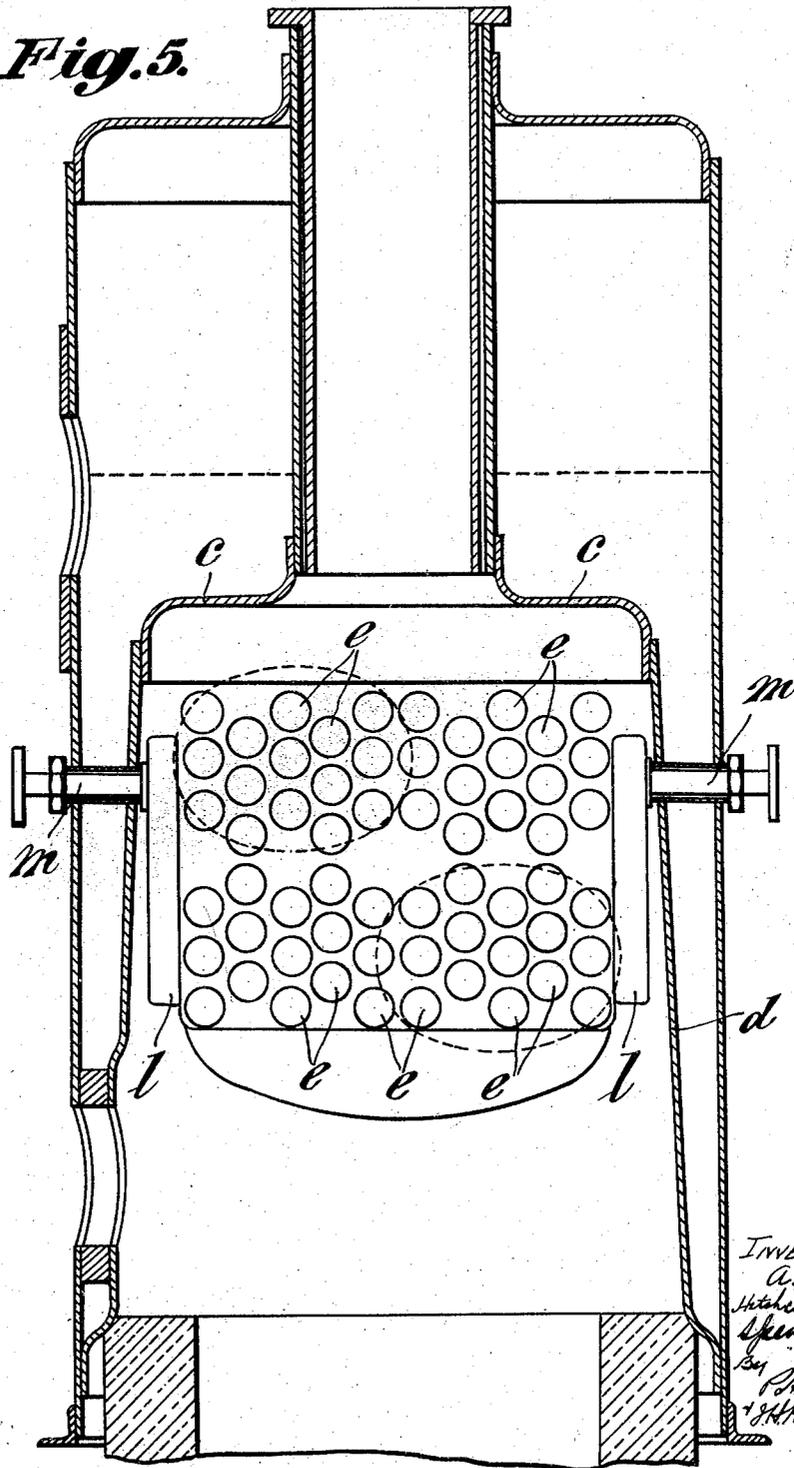
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BOILER FOR EVAPORATING OR HEATING LIQUIDS

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*Fig. 5.*



# UNITED STATES PATENT OFFICE

ARTHUR LINCOLNE HITCHCOCK-SPENCER, OF ASHWELL, NEAR BALDOCK, ENGLAND

## BOILER FOR EVAPORATING OR HEATING LIQUIDS

Application filed March 27, 1929, Serial No. 350,228, and in Great Britain March 23, 1928.

This invention relates to boilers for evaporating or heating liquids having water-tubes in the fire-box but particularly to vertical boilers of this type in which such water-tubes are arranged in the form of one or a plurality of nests of comparatively small diameter tubes extending across the fire-box and communicating at each end with the surrounding water space.

In practice these tubes are so grouped as to leave a sector-shaped passage relative to the curved wall of the fire-box which constitutes considerable dead space at each vertical side of the fire-box and between adjacent nests of tubes up which the products of combustion can flow with the freedom necessary for the creation of an adequate draught.

One of the primary objects of the present invention is to obviate some of the heat losses resulting from the presence of these dead spaces and preferably in such a manner as to render unnecessary the employment of an excessive member of closely grouped cross-tubes.

Broadly the invention consists of a boiler for evaporating or heating liquids having one or more nests of water-tubes extending across the combustion chamber or fire-box in which a solid or hollow member of refractory or other material is located in one or more of the aforesaid normally dead spaces and disposed in slightly spaced relation from the fire-box wall to thus permit the products of combustion to flow therethru, for the purpose of usefully absorbing heat from and of baffling the gases which pass through such dead spaces.

By making the members according to this invention hollow air steam or other gases may be introduced and be thereby heated for any useful purpose such as primary and/or secondary air for supporting combustion in the same or one or more auxiliary boilers or for heating waste or live gases or air for use in heating one or more auxiliary boilers or heaters or for drying and feed water heating.

Where the hollow members are to be used for heating air or other gas and where such air or other gas is to be used in supporting or adding to combustion in the fire-box of

the same boiler the lower ends of the hollow members may be shaped to form nozzles or otherwise provided with outlets for causing the heated air or other gas to be projected into the fire-box.

For ease in assembly each member may be built up from a plurality of hollow sections and such sections may either communicate to form a continuous passage through the centre of the member or each section may form a separate and noncommunicating chamber.

The elements which are physically independent of the fire-box wall may be suspended in position from the fire-box crown by means of a central depending rod or tube which may conveniently extend through the fire-box crown, the water space and the opposite crown plate of the boiler. Where a tube is used for this purpose such tube may be used for the admission into the interior of the element or each section thereof of the water air steam or other gas to be heated therein. Where air or gas is to be introduced into each element and used subsequently after heating as primary and/or secondary air or burnt the same may be admitted to the interiors of the elements under pressure or suction such as by a suitable blower or exhauster.

Alternatively the interior of each element or the sections of each element may communicate with the exterior of the boiler or heater by means of one or more pipes extending laterally through the sides of the boiler or through the base or furnace or down the up-take.

As a further alternative the members according to this invention may be constructed to form part of a superheater for which purpose the superheating tubes are arranged within the thickness of each member so that such tubes will absorb some of the heat from such members. If desired these tubes may constitute the means or a part of the means for suspending the members within the fire-box. Alternatively such tubes may constitute water-tubes for the purpose of assisting the evaporation or heating of the water.

The members according to this invention may be either parallel or tapered in a verti-

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cal direction the thickest part of each member being either at the top or at the bottom. By suitably shaping these members the velocity of the gases past the heating surface will be increased without unduly restricting the draught.

In order that the invention may be clearly understood and carried into effect several examples will now be described by aid of the accompanying drawings in which:—

Fig. 1 is a vertical section through a vertical boiler in which the members according to this invention are solid and built up from shaped sections of refractory material supported from the fire-box crown by means of bolts.

Fig. 2 is a transverse section showing similar solid members but illustrating a modified method of supporting the same in position.

Fig. 3 is a view similar to Fig. 1 illustrating the use of hollow built up members supported by tubes which extend through the fire-box crown the water-space and the top flange of the boiler.

Fig. 4 is a transverse section through the same showing a top plan view of the members.

Fig. 5 is a vertical section through a boiler showing in elevation modified forms of hollow members adapted to be constructed of metal and used for the heating of steam or other gases to be used exteriorly of the boiler.

Referring now to Fig. 1 the members illustrated are composed of a plurality of solid shaped pieces *a* of refractory material which are threaded upon suitably long bolts *b* which are affixed by their upper ends to the fire-box crown *c* so as to depend therefrom into the space between the fire-box sides *d* and the nests of water-tubes *e*.

In the modification illustrated in Fig. 2 the members composed of the sections *a* are supported in position by means of lateral bolts *f*. Such lateral bolts may however also be used in conjunction with the depending bolts *b* illustrated in Fig. 1 and serve the purpose of imparting lateral stability to the members.

The solid members in the examples just described serve the purpose of heat exchanging elements only heat being taken up from the ascending hot gases and imparted to the adjacent water-tubes *e* by radiation.

In the example illustrated in Figs. 3 and 4 the nests of tubes *e* are arranged in two vertical groups each group comprising three superimposed nests thus leaving three normally dead spaces for the free passage of the hot gases. In each of these spaces is arranged a member according to this invention and in the example illustrated these members, which are built up from refractory sections *a* are hollow and form a series of communicating spaces *g* throughout the length of each member. The hollow interiors of these members are adapted in the present ex-

ample to be supplied with steam, air or other gases which is introduced by way of pipes *h* serving also as a means for supporting the members in position. These pipes extend to the outside of the boiler through the fire-box crown *c* and by their outer extremities are connected to the required source of supply or left unconnected and open for the admission of air by natural draught. Such air may however be forced in under pressure by means of a blower or be induced in by suction.

Lateral lugs *i* are formed on the members to assist the same in maintaining their positions relatively to the water-tubes.

The lower end of each member is composed of a metal casting, forging or the like *j* having each an opening *k* so shaped as to project the heated air, gas or the like from the interiors of the members into the interior of the fire-box. In the case of a boiler heated by waste-heat some of the gases may be admitted from the lower end of the fire-box and the remainder by way of the inlet openings *k*. This arrangement is also suitable for the admission of pre-heated primary and/or secondary air into the combustion chambers of coal or oil fired boilers.

In the modification illustrated in Fig. 5 the members, which are indicated at *l* are each in one piece, hollow, and composed of metal. They are supported in position by means of lateral pipes *m* forming outlets for the air or other gases heated within the hollow interiors of the members. Suitable inlets, not shown, for such gases may also be provided. These members *l* are primarily intended for use in heating air or gases for use exteriorly of the boiler but the same may of course be returned to the fire-box of the boiler for any suitable purpose. Such members may of course be composed of a number of sections and constructed of refractory material instead of metal.

As a further alternative the members according to this invention may be constructed to form part of a superheater for which purpose the superheating tubes are arranged within the thickness of each member so that such tubes will absorb some of the heat from such members. If desired these tubes may constitute the means or a part of the means for suspending the members within the fire-box. Alternatively such tubes may constitute water-tubes for the purpose of assisting the evaporation or heating of the water.

#### Claims:

1. In a vertical flue boiler having a fire-box substantially circular in cross section and a nest of water tubes extending transversely across said fire-box and defining in conjunction with the wall of said fire-box a vertical sector-shaped passage, a combined baffling and heat absorbing member disposed in said passage and spaced from said fire-box

wall and having a connection with the fire-box whereby it is supported therefrom.

2. In a vertical flue boiler having a fire-box substantially circular in cross section and a nest of water tubes extending transversely across said fire-box and defining in conjunction with the wall of said fire-box a vertical sector-shaped passage, a combined baffling and heat absorbing member disposed in said passage and spaced from said fire-box wall and having a connection with the fire-box whereby it is supported therefrom, said member being composed of a plurality of assembled sections.

3. In a vertical flue boiler having a fire-box substantially circular in cross section and a nest of water tubes extending transversely across said fire-box and defining in conjunction with the wall of said fire-box a vertical sector-shaped passage, a combined baffling and heat absorbing member disposed in said passage having fluid connections whereby the absorbed heat is transmitted to said fluid.

4. In a vertical flue boiler having a fire-box substantially circular in cross section and a nest of water tubes extending transversely across said fire-box and defining in conjunction with the wall of said fire-box a vertical sector-shaped passage, a combined baffling and heat absorbing member disposed in said passage in spaced relation to the fire-box wall and having fluid connections whereby the absorbed heat is transmitted to said fluid.

5. In a vertical flue boiler having a fire-box substantially circular in cross section and a nest of water tubes extending transversely across said fire-box and defining in conjunction with the wall of said fire-box a vertical sector-shaped passage, the combination of a combined baffling and heat absorbing member disposed in said passage, means to deliver fluid to be heated to the hollow interior of the member, and means formed at the lower end of the member to deliver the heated fluid to the interior of the fire-box.

In testimony whereof I affix my signature.  
**ARTHUR LINCOLNE HITCHCOCK-SPENCER.**