

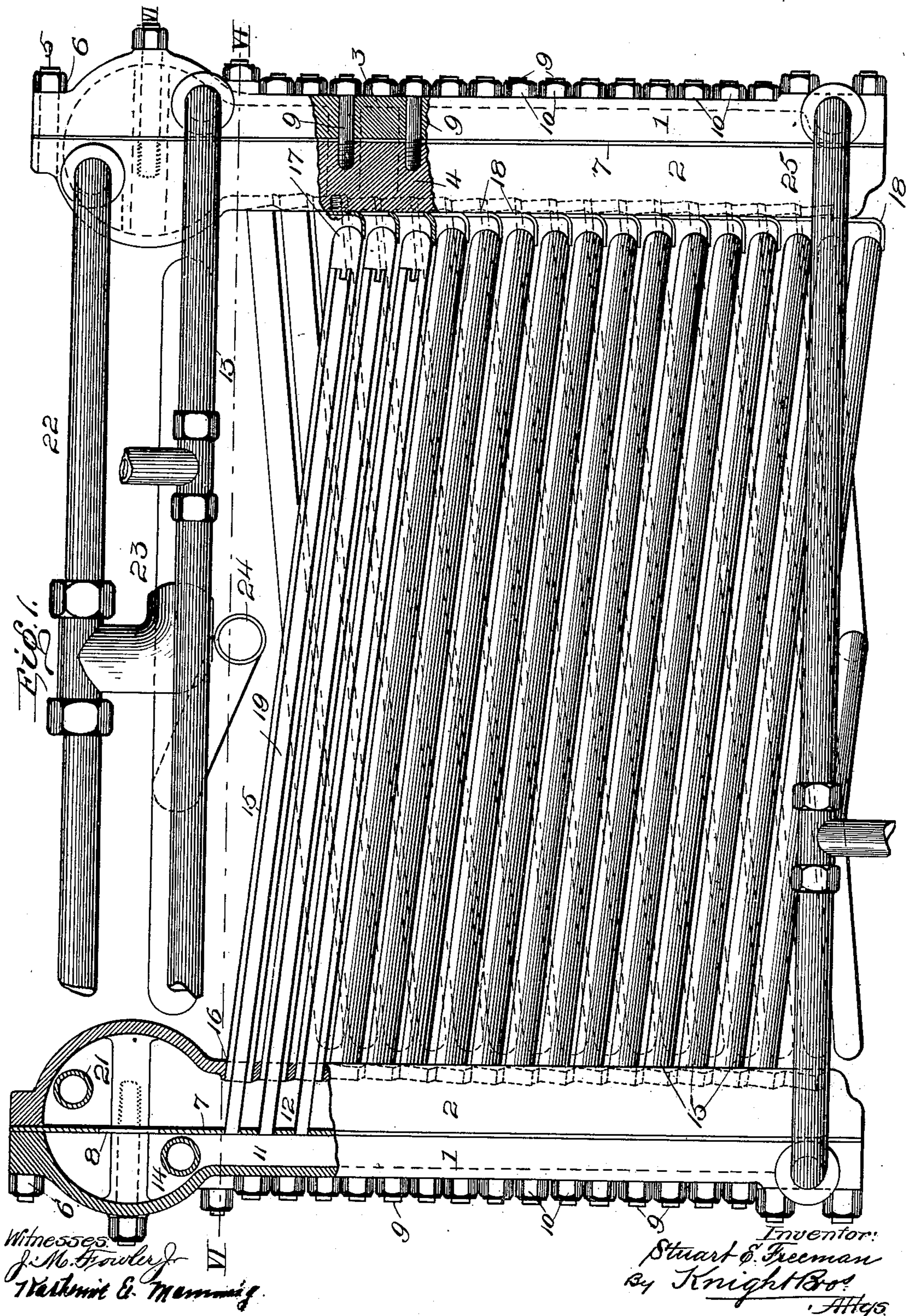
No. 698,697.

Patented Apr. 29, 1902.

S. E. FREEMAN.  
WATER TUBE BOILER.  
(Application filed Apr. 30, 1900.)

(No Model.)

4 Sheets—Sheet 1.



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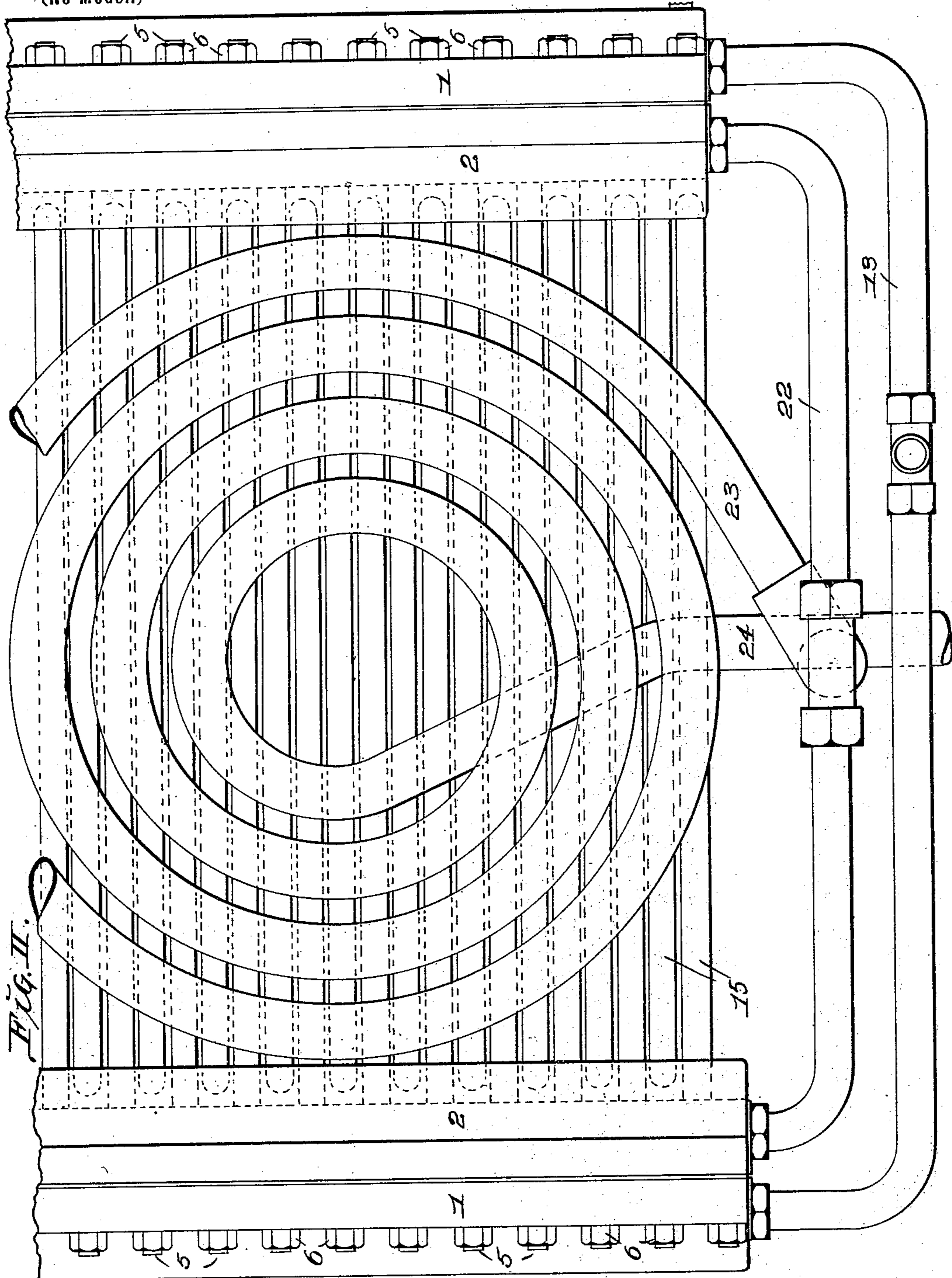
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INVENTOR:—  
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By Thayer Bros attys

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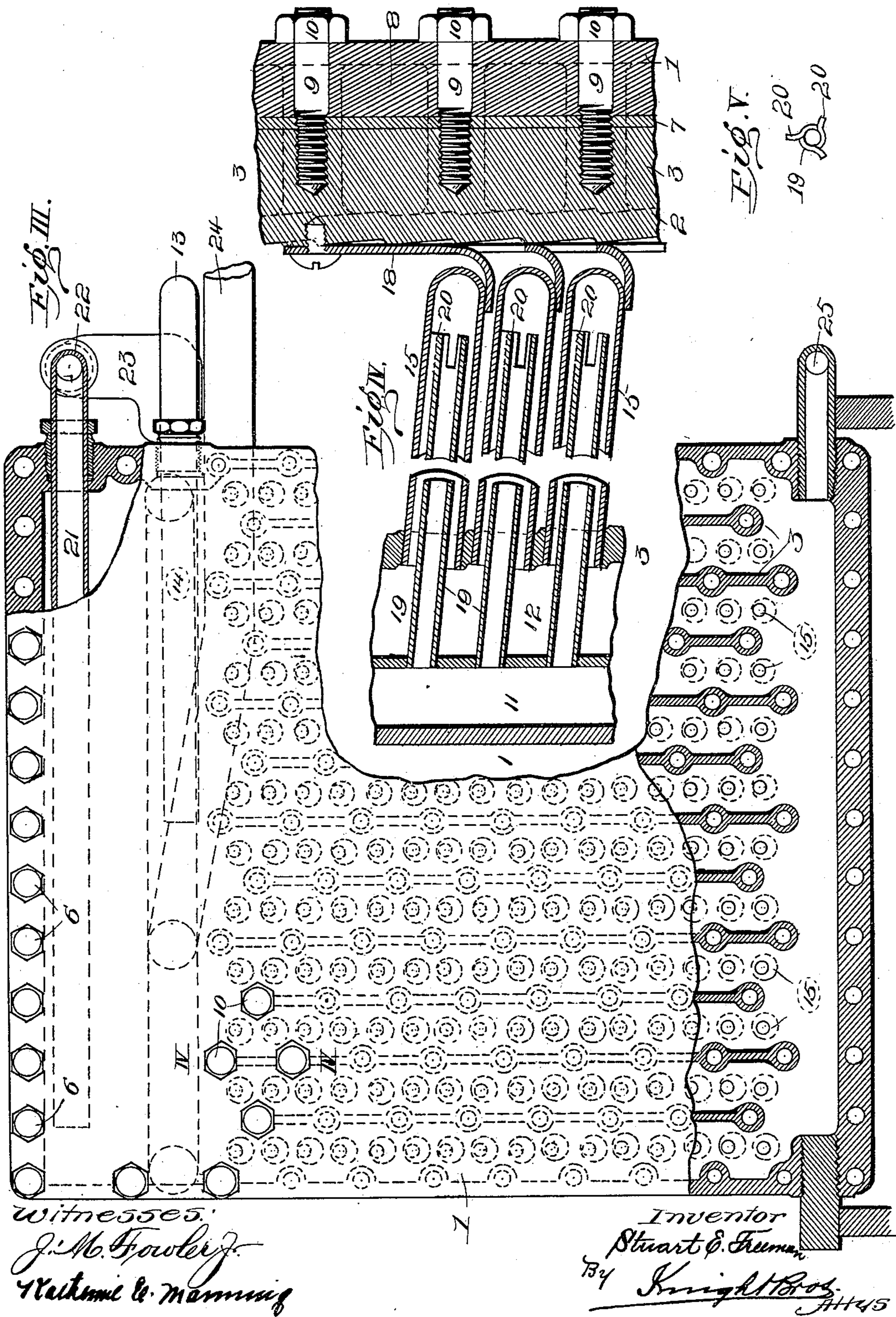
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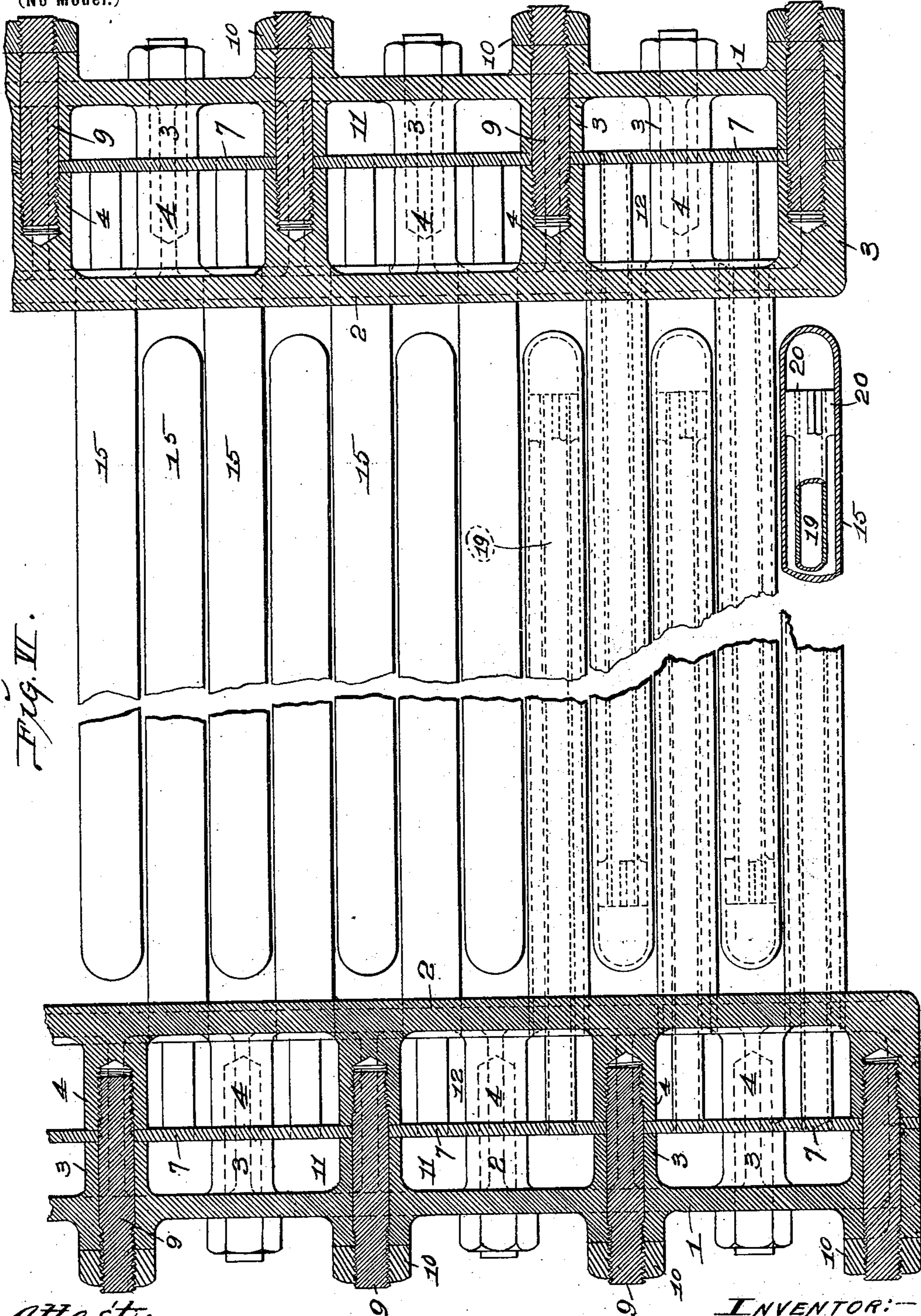
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# UNITED STATES PATENT OFFICE.

STUART E. FREEMAN, OF ST. LOUIS, MISSOURI.

## WATER-TUBE BOILER.

SPECIFICATION forming part of Letters Patent No. 698,697, dated April 29, 1902.

Application filed April 30, 1900. Serial No. 14,921. (No model.)

*To all whom it may concern:*

Be it known that I, STUART E. FREEMAN, a citizen of the United States, residing at the city of St. Louis, in the State of Missouri, have  
5 invented certain new and useful Improvements in Water-Tube Boilers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.  
10 tion.

My invention relates to that class of steam-boilers wherein are utilized series of field and circulating water-tubes; and the object of the invention is to produce a boiler of small size  
15 wherein the greatest degree of steam-producing capacity may be obtained commensurate with the dimensions of the boiler.

A further object of the invention is to produce a water-tube boiler of simplest form of  
20 construction and composed of a minimum of parts that may be readily assembled and disassembled in making repairs or cleaning it.

My invention consists in features of novelty hereinafter fully described, and pointed  
25 out in the claims.

Figure I is a view, partly in side elevation and partly in vertical section, of my improved boiler. Fig. II is a top or plan view. Fig. III is an end view, partly in vertical section.  
30 Fig. IV is an enlarged detail longitudinal sectional view taken on the line IV IV, Fig. III, the central parts of the water-tubes being broken out. Fig. V is a detail end view of one of the circulating-tubes. Fig. VI is a  
35 view in horizontal section taken on the line VI VI, Fig. I, through the boiler-heads and showing the boiler-tubes in top or plan view.

The heads of the boiler are composed of outer chambered sections 1 and inner chambered sections 2, the sections 1 being provided  
40 with inwardly-extending apertured ribs 3 and the sections 2 with tapped ribs 4, that are located in line with the ribs projecting from the sections 1. The sections 1 and 2 are joined  
45 at the edges by connecting stud-bolts 5, provided with tightening-bolts 6. Located between the head-sections are partition-plates 7, provided with apertures 8 (see Fig. I) at  
50 their upper ends. These partition-plates are clamped between the head-sections and the head-sections tightly assembled by binding-bolts 9, that pass through the ribs 3 and have

screw-threaded engagement with the tapped ribs 4, as seen in Fig. VI. The binding stud-bolts 9 are provided at their outer ends with  
55 tightening-nuts 10, by which the sections may be firmly drawn together with the partition-plates between them. It will be seen that the head-sections 1 and 2 are, in the manner described, firmly secured and bound together by  
60 the stud-bolts 5 and 9 and that through the medium of the ribs 3 and 4 the head-sections are stiffened at the locations of the binding-bolts and the entire heads so constructed that the liability of their bursting is extremely  
65 remote.

Between the wall of the sections 1 and the partition-plate 7 are compartments 11, and between the wall of sections 2 and the partition-plate are compartments 12, (see Figs. I, IV, 70  
and VI,) the compartments 11 and 12 in each head having communication with each other through the apertures 8 in the partition-plates.

The entire boiler is inclosed within a suitable casing (not shown) in order that the heat  
80 applied from beneath it may ascend around and among the parts of the boiler to heat the water passed therethrough and convert it into steam.

13 designates a water-supply pipe that leads into the compartment 11 in each head and is provided with open discharge ends 14. (See Figs. I and III.) All of the water fed into  
85 the boiler therefore necessarily first enters the compartments 11, from which it passes to the water-tubes.

15 designates field-tubes having open ends 16, seated in the walls of the head-sections 2 and having communication with the compartments 12, as seen most clearly in Figs. I and  
90 IV, and closed seamless ends 17, that are supported by hooks 18 independently of each other at their free ends. (See Figs. I and IV.)

19 designates circulating-tubes that are at  
95 their outer ends seated in the partition-plates 7 and having communication with the compartments 11. These circulating-tubes 19 extend into the field-tubes 15 to positions near  
100 their closed ends, the inner ends of said circulating-tubes being centrally supported within the field-tubes by tongues 20, (see Figs. I, IV, V, and VI,) that are cut out of the tube-body and sprung outwardly therefrom. These

tongues securely support the circulating-tubes centrally within the field-tubes, while at the same time they interfere very little with the free passage of water past them. The field-tubes 15 being formed with seamless inner ends 17, they offer no opportunity for leakage by the breaking of a seam and consequent damage and annoyance, and said inner ends being independently supported by the hooks 18 they are held separated from each other to permit free passage of heat among them, while at the same time opportunity is offered for expansion and contraction of the tubes in the process of their being heated and in cooling.

In the practical use of the boiler the water enters the compartments 11 in each head thereof and flows into the circulating-tubes 19, from which it discharges into the inner ends of the field-tubes 15, in which the heating thereof is accomplished by heat rising among the water-tubes from a suitable heater. The heated water or saturated steam passes from the field-tubes 15 into the compartments 12 in the boiler-heads, and the steam rises in said compartments 12 to the upper ends thereof, from which it passes into the open ends 21 of the steam-pipe 22 and from the steam-pipe 22 into the coil 23, located above the water-tubes of the boiler. The coil 23 receives the heat arising through the boiler, and the saturated steam conveyed into said coil is superheated therein to dry it and render it serviceable, after which it passes through the outlet part 24 of the coil that extends beneath the main body of the coil into close proximity with the water-tubes, so that the portion of the superheated coil through which the steam last passes receives the greatest intensity of the heat, causing the steam to be converted completely from the saturated condition to a dry or superheated one.

25 designates water-equalizing pipes extending from the lower ends of the boiler-heads and having communication with the

water-receiving compartments 11, as seen in Fig. III.

By my construction of boiler, wherein two heads are utilized, to both of which water is conducted from a pipe common to both and from which the steam is withdrawn in a pipe common to both, I am enabled to economize greatly in the dimensions of the boiler. The water-tubes being connected to each head independently of the other head, the steam produced in one set of tubes passes to its individual head, while the steam produced in the other set passes to its individual head. The water-tubes may therefore be much smaller and be much more quickly heated. Furthermore, the tubes are arranged in alternating tiers from each head, extending across the space between the two heads, the tiers being closely assembled together into much closer relation than would be possible if all of the tubes were connected to a single head, in which latter instance the tiers of tubes would have to be spaced farther apart in order to leave sufficient substance of the inner head-sections between the tubes to hold them.

I claim as my invention—

1. In a water-tube boiler, the combination of a pair of heads, water-supply and steam pipes each having connection to both of said heads, field-tubes and circulating-tubes connected in independent sets to said heads, and a superheater-coil connected to said steam-pipe and arranged above said circulating and field tubes, substantially as described.

2. In a head for water-tube boilers, the combination of two sections provided with interior ribs, a partition-plate located between said sections, and stud-bolts inserted into said ribs by which the sections are bound together, substantially as described.

STUART E. FREEMAN.

In presence of—

E. S. KNIGHT,  
N. V. ALEXANDER.