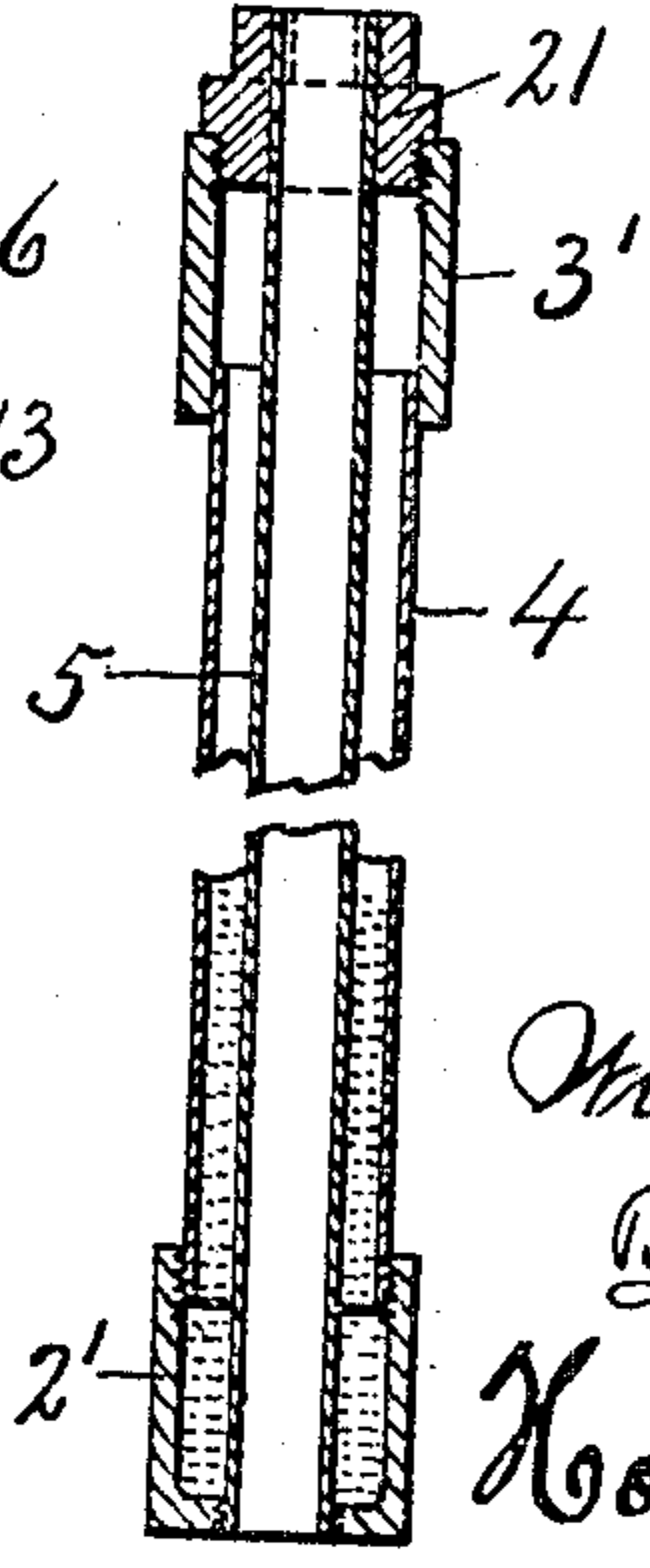
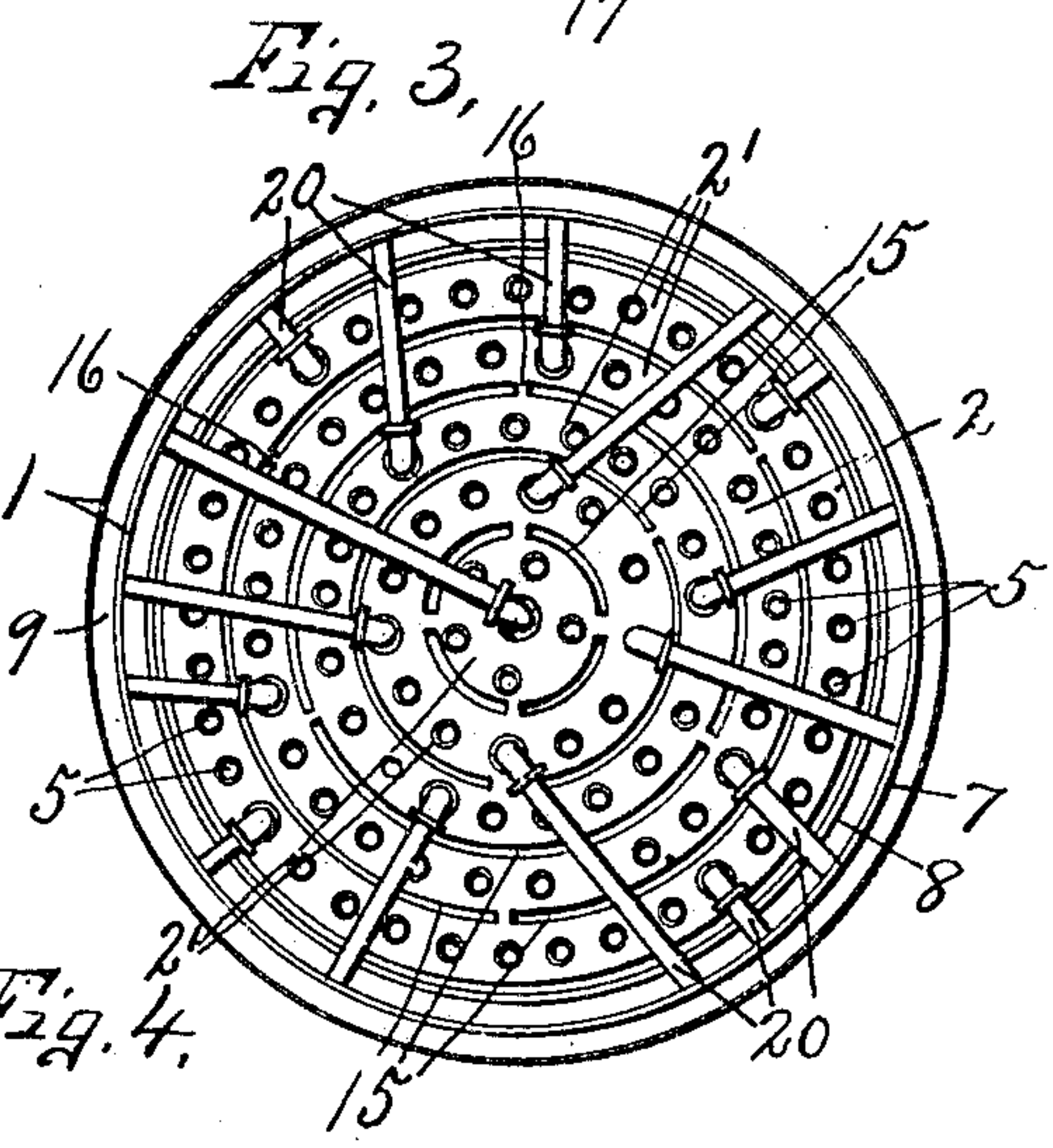
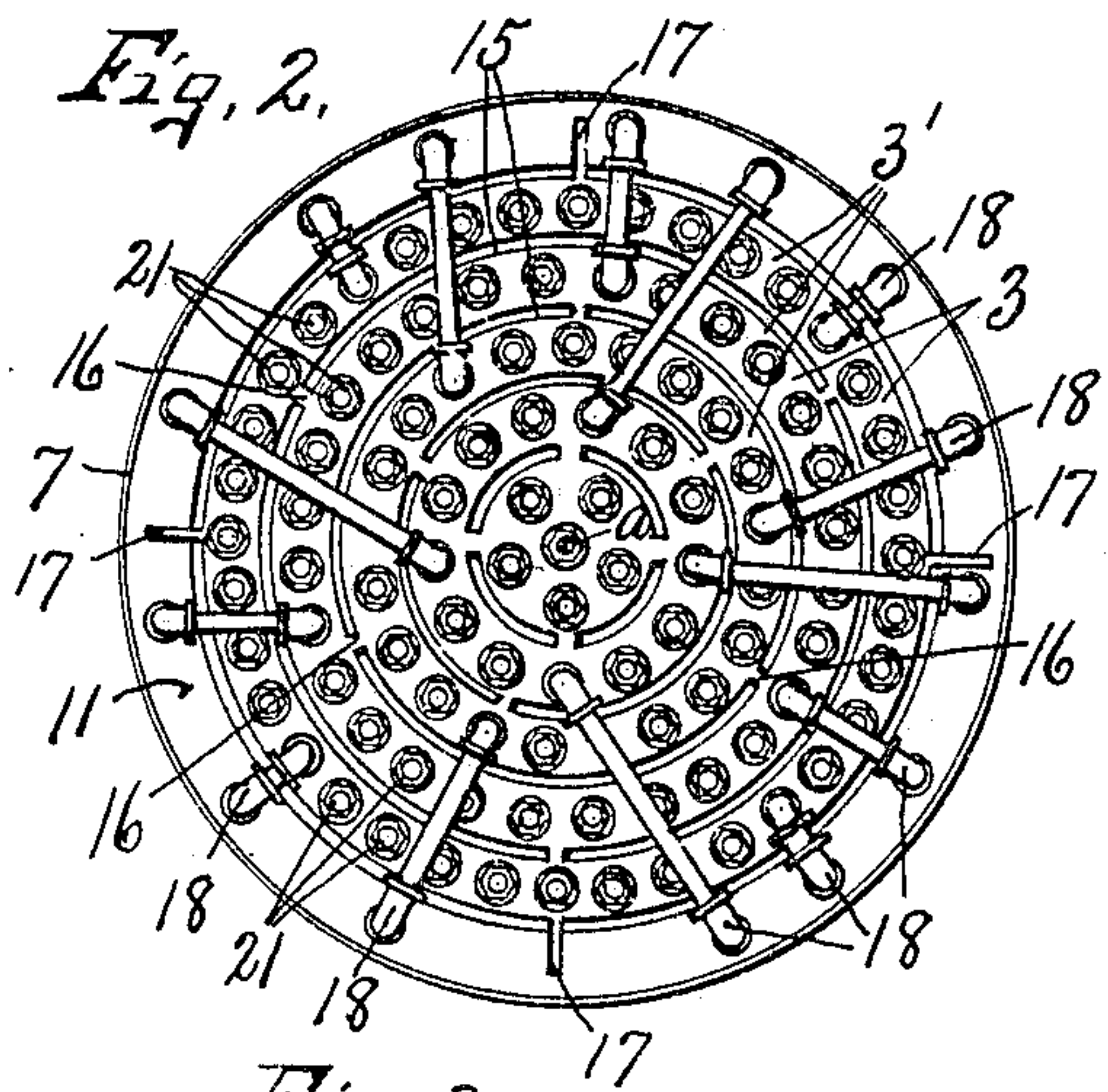
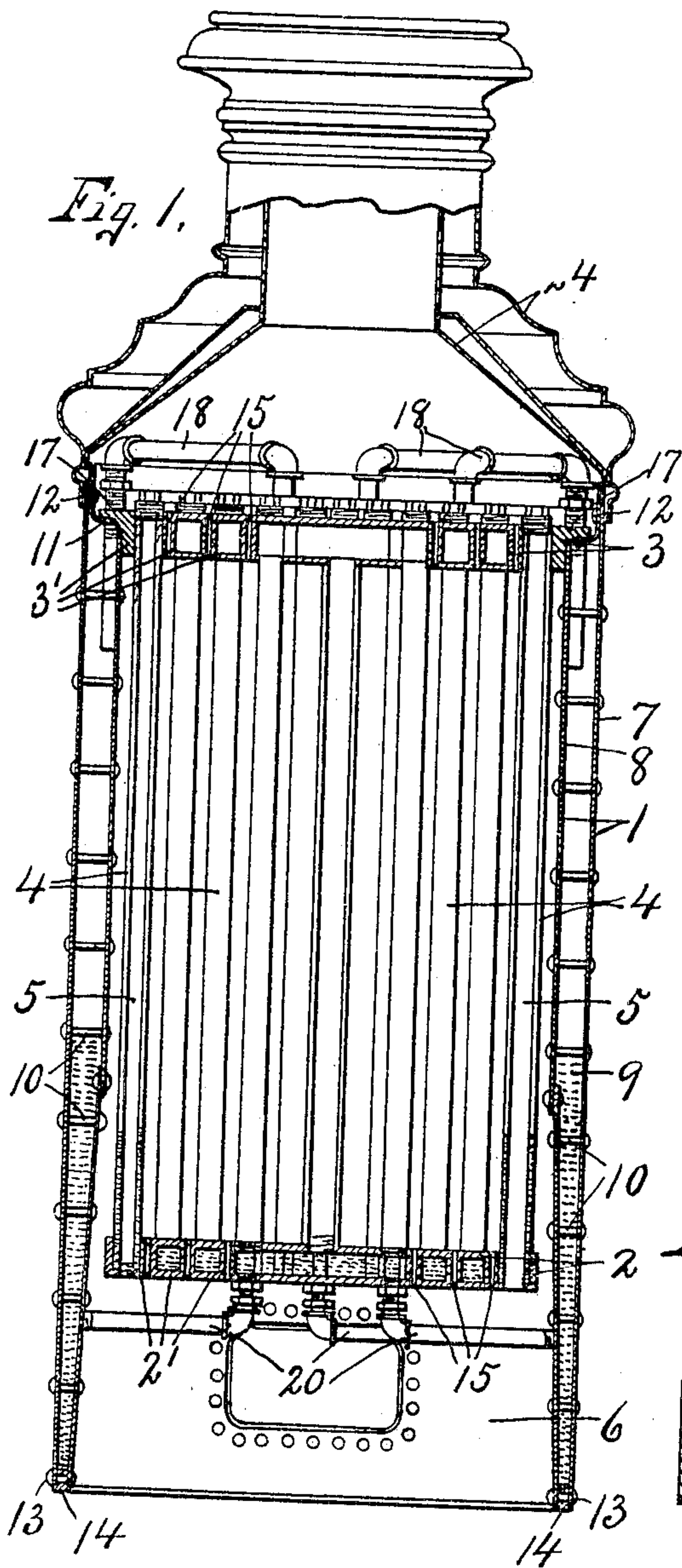


No. 819,030.

PATENTED APR. 24, 1906.

W. WÖEHLE.
UPRIGHT FLUE BOILER.
APPLICATION FILED MAY 13, 1905.



Witnesses:
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UNITED STATES PATENT OFFICE.

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UPRIGHT FLUE-BOILER.

No. 819,030.

Specification of Letters Patent.

Patented April 24, 1906.

Application filed May 13, 1905. Serial No. 260,280.

To all whom it may concern:

Be it known that I, WILLIAM WÖEHLE, of Syracuse, in the county of Onondaga, in the State of New York, have invented new and useful Improvements in Upright Flue-Boilers, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

This invention relates to certain improvements in upright water-tube boilers, and refers more particularly to the water heating and circulating systems as specifically applied to the rapid ebullition and circulation of the water and quick steaming of fire-engine boilers.

The primary object is to extend the fire-flues internally through the water-tubes of an upright tubular boiler, so as to divide the water-spaces into comparatively shallow columns surrounding the fire-flues and to allow the products of combustion to entirely envelop the water-tubes individually and collectively, whereby the shallow columns of water are exposed to a large heating area, both interiorly and exteriorly, and substantially equal to the combined areas of the water-tubes and fire-flues for the purpose of producing a rapid ebullition of the water and consequent quick steaming in the boiler.

Another object is to suspend practically the entire circulating system, together with the fire-flues, from the upper end of and within a cylindrical water-leg, so as to allow for the free expansion and contraction of the water-tubes and fire-flues without liability of opening the joints or unduly straining any of the parts of the boiler.

A further object is to provide lower and upper hollow heads constituting, respectively, a water-base and steam-drum for receiving the ends of the water-tubes and to divide each head into a series of concentric rings or segments which are spaced apart to form intervening vertical fire-passages for the purpose of increasing the heating area directly exposed to the products of combustion and to dispose the rings so as to baffle or retard the upward travel of the products of combustion, and thereby obtain a greater heating efficiency.

Other objects relating to the specific construction of the parts of the boiler will be brought out in the following description.

In the drawings, Figure 1 is a vertical sectional view of an upright water-tube boiler embodying the features of my invention.

Figs. 2 and 3 are respectively a top plan and an inverted plan of the main body of the boiler seen in Fig. 1, omitting the dome or smoke-casing. Fig. 4 is an enlarged vertical sectional view of one of the water-legs and its interior fire-flue.

It is well known that these boilers when used for fire-engine purposes are subjected to the most severe strains and usage by reason of their rapid transportation from place to place over more or less rough pavements and the constant service to which they are put in keeping them in readiness for fire emergencies. I have therefore sought not only to produce a quick steamer, but also to avoid as far as practicable the necessity for frequent repairs and also to make the parts simple and easily accessible and capable of being quickly assembled and taken apart, so that repairs may be easily and quickly made when necessary. To this end the invention consists, essentially, of a cylindrical water-leg 1, lower and upper substantially flat hollow heads 2 and 3, a series of upright water-tubes 4, and a corresponding number of upright fire or smoke flues 5, all of which parts are made of suitable boiler and flue metal adapted to withstand the strains to which they may be subjected.

The cylindrical water-leg 1 constitutes a main supporting frame or casing and combustion-chamber, as 6, and preferably comprises an outer shell 7 and an inner shell 8. The outer shell is preferably cylindrical or of uniform diameter from end to end; but the inner shell 8 is somewhat smaller in its outer diameter than and spaced apart from the interior of the outer shell to form an intervening water space or chamber 9 and is stayed in this relation by stay-bolts 10. The upper half of the shell 8 is preferably cylindrical, and its upper extremity is offset laterally to form a substantially horizontal annular shoulder 11 for receiving and supporting the upper head 3 and is secured by rivets 12 to the upper extremity of the outer shell, forming a steam and water tight joint, while the lower half flares outwardly toward the bottom and, together with the lower end of the outer shell 7, is secured by rivets 13 to a suitable reinforcing-ring 14, which also forms a water and steam tight junction with the lower ends of the shells 7 and 8.

The heads 2 and 3 are preferably made of cast-iron and each comprises a series of concentric rings or segments 2' and 3', respec-

tively, the rings of each section being disposed in substantially the same horizontal plane and are spaced apart a slight distance throughout the greater portion of their circumferences to form intervening vertical fire and smoke passages 15; but their contiguous faces are tied together at suitable intervals by comparatively thin webs 16, so that the rings of each head constitutes practically a unitary structure having a series of concentric vertical fire-passages therethrough from top to bottom. Each ring is therefore almost entirely enveloped in the rising products of combustion and contains a comparatively small volume of water which is exposed to a relatively large heating-surface, thereby producing a rapid ebullition and circulation of the water.

The upper head 3 constitutes a steam-drum and has a series of radial arms or shoulders 17, resting on the annular shoulder 11 on the upper end of the water-leg 2 to sustain the combined weight of the lower head 2, water-tubes 4, and flues 5, and each of its rings 3' is connected by one or more, in this instance four, circulating-pipes 18 to the upper end of the water-leg 1.

The lower head 2 constitutes a water-base, which is secured to and sustained by the lower ends of the water-tubes 4 and flues 5 some distance above the lower end of the water-leg 1, so as to form a crown-plate or upper wall of the underlying combustion-chamber 6, and, like the upper head, each of its rings is connected by one or more, in this instance four, circulating-pipes 20 to the base of the water-leg 1.

The water-tubes 4 are arranged in concentric rows corresponding to the number of rings in each head and have their lower ends threaded and screwed into threaded apertures in the upper side of the lower rings 2', while their upper ends are preferably secured by expanding them in suitable apertures in the lower side of the upper rings 3', thereby establishing water and steam communication between the lower and upper hollow heads 2 and 3.

The flues 5 for each water-tube are arranged centrally within and extend entirely through their respective water-tubes and rings 2' and 3', their lower ends being threaded and screwed in threaded apertures in the bottom of the lower rings 2', and their upper ends are expanded in hollow threaded plugs or bushings 21, which in turn are screwed in threaded apertures in the top of their respective rings 3' of the upper head 3. These flues 5 are of smaller diameter than the interior diameter of the water-tubes in which they are located to form intervening water-spaces which are comparatively shallow transversely, and therefore the heating area to each shallow column of water is exposed from within and without is comparatively

large and causes a rapid conversion of the water into steam and also superheats the steam to a high degree in the upper part of the circulating system.

I am thus enabled to maintain a free and ample circulation of water in the system with a minimum consumption of fuel to keep the boiler in readiness for immediate action when not in actual use, so that when called into service a high degree of steam-pressure may be obtained within a very short period of time and maintained at a comparatively light cost of fuel. This circulation takes place from the base 2 upwardly through the water-tubes 4 into the upper head 3, and thence through the pipes 18 into the water-leg 1, from which the water returns to the base 2 through the pipes 20 and is therefore direct and practically unimpeded in its expansion through the shortest distance between lower and upper heads 2 and 3.

When it is desired to quickly convert the water into steam, a part of the water in circulation may be drawn off through suitable cocks, (not shown,) leaving ample water for safety and sufficient space for its rapid conversion into steam, which latter may be taken off at any point, as *a*, from the upper head or steam-drum 3.

It will be observed that the heads 2 and 3, water-tubes 4, and flues 5 constitute a unitary structure which is suspended from its upper end by the arms 17 resting upon the shoulder 11 of the water-leg 1, so that the whole lower portion of such structure is free (except for the pipe connections 20) to expand and contract without liability of straining or opening any of the joints. It is also apparent that by disconnecting the pipes 18 and 20 from the water-leg this entire interior structure may be lifted and removed through the open upper end of the water-leg, or any one of the fire-flues may be similarly removed by simply unscrewing the plug 21, which operation also unscrews the lower end of the flue from the bottom of the lower head 2.

When the boiler is completed ready for use, the upper open end of the water-leg 1 is capped by a suitable smoke-hood or cap 24, which receives the products of combustion, but forms no part of my present invention, and it is therefore unnecessary to further describe the same. Otherwise, I have shown only such parts of the boiler as enter into the present invention.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. An upright flue-boiler, comprising a double-wall outer shell, forming a steam and water chamber, a steam-drum within and resting upon the upper end of the shell, a series of concentric rows of water-tubes secured to and depending from the drum, a water-base secured to the lower ends of the tubes and com-

communicating therewith, and a plurality of series of concentric rows of fire-flues each passing through one of the water-tubes and secured to the drum, a water-base and return-flow pipes leading from the water-chamber of the shell into the water-base, and steam-pipes leading from the steam-drum into the steam-chamber of the shell and terminating above the water-line.

2. An upright flue-boiler, comprising an outer upright shell having an annular water and steam chamber, a steam-drum composed of a series of hollow concentric rings supported in the upper end of the shell, a series of steam-pipes, each leading from one of the rings into the steam-chamber of the shell and terminating above the water-line in said shell, a water-base within the shell, a series of concentric rows of water-tubes, those of each row connecting one of the rings of the steam-drum with the water-base, and a plurality of fire-flues, each passing through one of the water-tubes and having their lower and upper ends secured respectively to the water-base, and to one of said rings of the steam-drum.

3. A boiler comprising an upright water-leg inclosing a combustion-chamber, a steam-drum supported within the upper end of the water-leg, a water-base divided into a series of separate compartments, separate pipes, each connecting one of the compartments of the water-base with the water-leg, water-tubes connecting each compartment of the water-base with the steam-drum, and a series of fire-flues, each passing through one of the water-tubes and having its lower and upper ends secured respectively to the water-base and steam-drum.

4. In a multiple water-tube boiler, an upright cylindrical water-leg in combination with a series of hollow concentric rings lying in substantially the same horizontal plane,

one within the other, and separate pipes, each connecting one of the rings with the water-leg.

5. A boiler comprising an upright cylindrical water-leg, a steam-drum composed of a series of hollow concentric rings spaced apart, forming intervening fire-passages, the outer ring resting upon the top of the water-leg, tie-pieces connecting said rings at intervals across the intervening spaces, separate pipes, each connecting one of the rings with the water-leg, a water-base composed of a series of concentric rings spaced apart, forming intervening fire-passages, a plurality of concentric rows of water-tubes, those of each row connecting one of the rings of the steam-drum with the corresponding ring of the water-base, a series of fire-flues each passed through one of the water-tubes, a series of separate pipes, each connecting one of the rings of the steam-drum to the water-leg, and additional pipes, each connecting one of the rings of the water-base with said water-leg.

6. An upright multiple water-tube boiler comprising two shells united at the top and bottom and spaced apart between their ends to form a water-leg, a steam-drum seated in and removable through the upper end of one of the shells, water-tubes secured to and depending from the bottom of said drum, smoke-flues secured to and depending from the top of said drum through the water-tubes, and a water-base secured to and supported by the lower ends of said tubes and flues, and circulating-pipes leading respectively from the steam-drum and water-base to the water-leg.

In witness whereof I have hereunto set my hand this 1st day of May, 1905.

WILLIAM WÖEHLE.

Witnesses:

THOMAS MCGOVERN,
JOSIAH T. MILLER.