

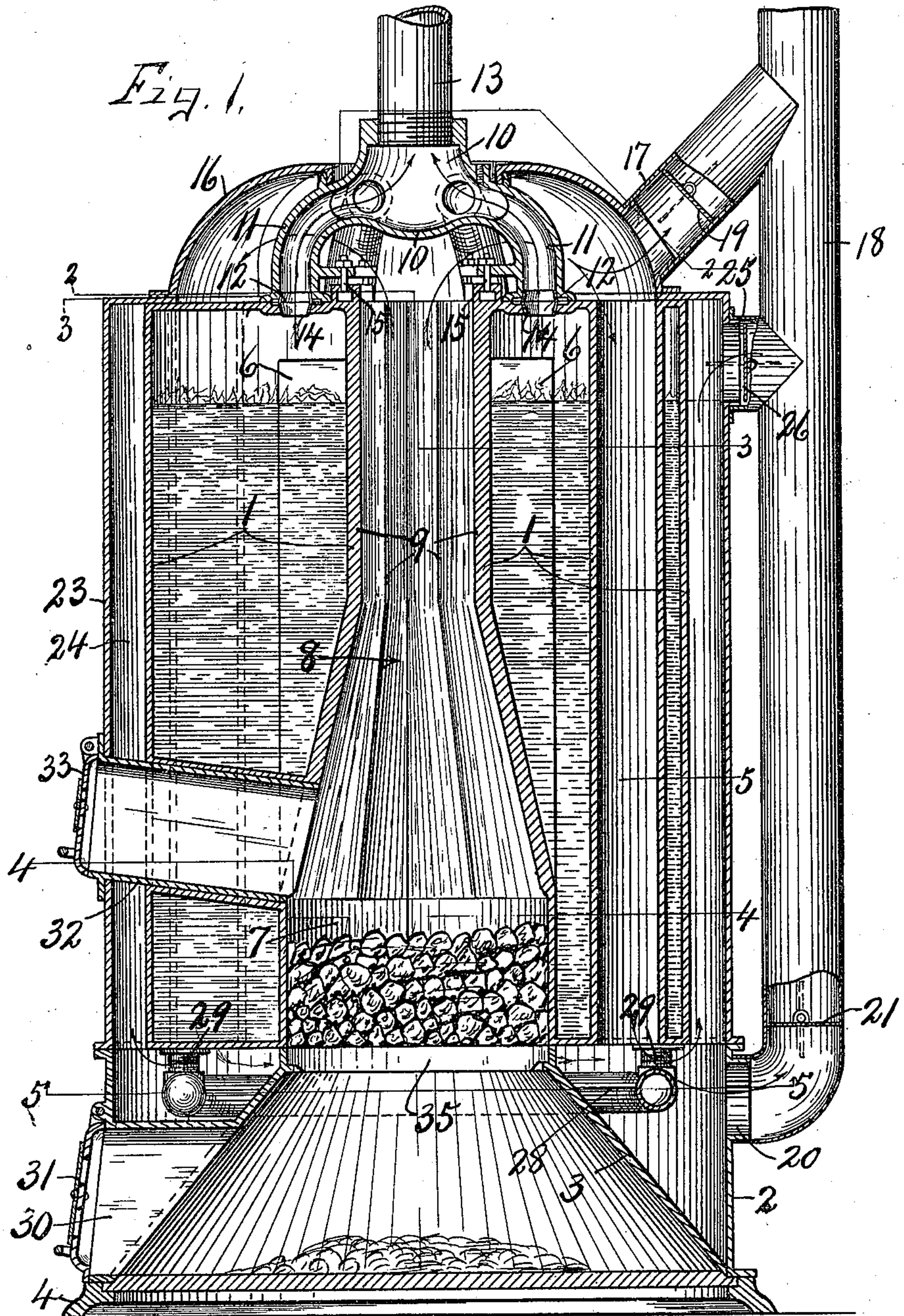
W. S. TUTTLE.
STEAM BOILER.

APPLICATION FILED MAR. 15, 1909.

975,736.

Patented Nov. 15, 1910.

2 SHEETS-SHEET 1.



WITNESSES
Gleas. H. Hughes.
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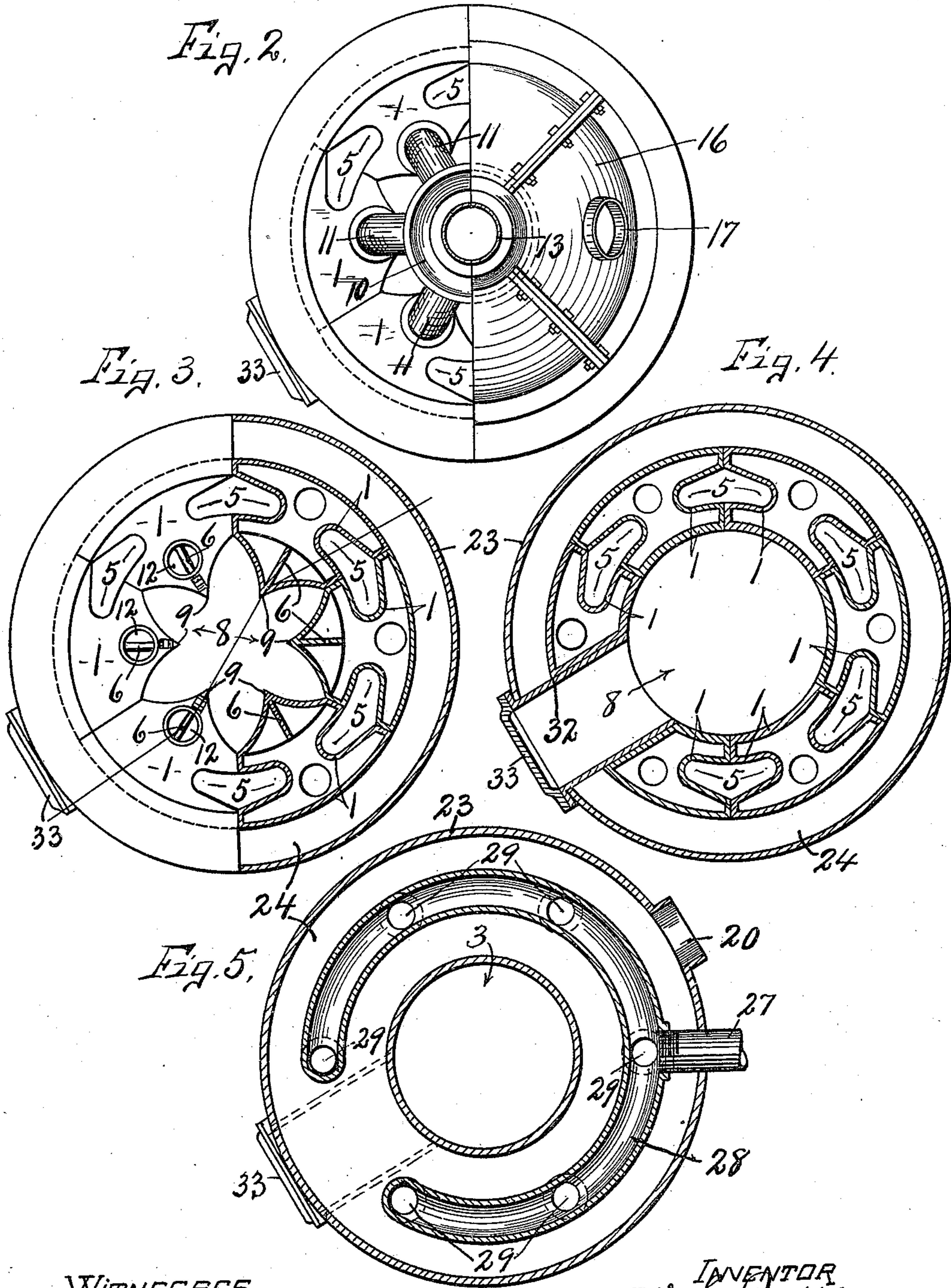
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W. S. Tuttle
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WITNESSES
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UNITED STATES PATENT OFFICE.

WILLARD S. TUTTLE, OF PHILADELPHIA, PENNSYLVANIA.

STEAM-BOILER.

975,736.

Specification of Letters Patent.

Patented Nov. 15, 1910.

Application filed March 15, 1909. Serial No. 483,500.

To all whom it may concern:

Be it known that I, WILLARD S. TUTTLE, of Philadelphia, in the county of Philadelphia, in the State of Pennsylvania, have invented new and useful Improvements in Steam-Boilers, of which the following, taken in connection with the accompanying drawing, is a full, clear, and exact description.

This invention relates to certain improvements in steam boilers, preferably of the low pressure type for heating purposes, and comprises a circular series of hollow upright sections arranged side by side about a common center for forming a central fire box and combustion chamber, and having their meeting faces provided with registering lengthwise channels or recesses forming upright smoke and fire flues or passages extending from bottom to top of the sections, the upper ends of the flues and combustion chamber being capped by a suitable dome having an outlet leading directly to the chimney for direct draft, while the lower ends of the flues lead into a closed chamber surrounding the ash pit and communicating directly with the chimney or smoke flue, whereby when the upper outlet is closed the products of combustion may be diverted downwardly through the fire passages between the water sections into the lower chamber and thence into the chimney, thereby obtaining a maximum heating efficiency of the heated products. In like manner the upper ends of the water sections are capped by a suitable steam dome located within the first named dome and serving to collect the steam into a single pipe which leads to the radiating system of the building, the return water of condensation being conducted to a sub-ring underlying the water sections and communicating therewith through separate branch passages.

My main object is to produce a heater of the class described, having a maximum steam efficiency with a minimum consumption of fuel. In other words, I have sought to expedite or quicken the conversion of water into steam by subdividing the water chambers into comparatively shallow compartments lying between the combustion chamber and return flues for the products of combustion, and also by providing the inner sides of the water tubes next to the combus-

tion chamber with comparatively thin integral wings or fins projecting laterally or radially into the water chambers so as to afford a greater radiating surface in immediate contact with the water.

Other objects and uses will be brought out in the following description:

In the drawings—Figure 1 is a central vertical sectional view from front to rear of a steam boiler embodying the various features of my invention. Fig. 2 is a top plan of the same boiler showing one half of the dome or smoke chamber as broken away to disclose the underlying portions of the steam dome and adjacent ends of the water sections. Fig. 3 is a top plan of the boiler, the fire dome and steam dome being removed and one half of the water sections being shown in section. Figs. 4 and 5 are horizontal sectional views taken respectively on lines 4—4 and 5—5 Fig. 1, Fig. 5 being inverted.

This boiler comprises a series of upright water sections —1— arranged side by side in circular series around a common center with their lower ends resting upon an underlying circular frame or housing —2— which surrounds a suitable ash pit —3—, the latter resting upon a suitable base —4—. In this particular boiler the meeting faces of the hollow upright water sections —1— abut against each other in radial planes, and are provided with registering channels or recesses —5— extending from bottom to top of the sections and forming upright fire and smoke flues. It, therefore, follows that portions of the meeting faces of the upright water sections between their inner and outer edges are depressed inwardly toward each other, thereby dividing the interior of the water sections into comparatively shallow water passages or compartments communicating with each other and at the same time affording a considerably greater heating area or radiating surface exposed to the heated products of combustion for transmitting the heat to the water in the water sections. As a further means of increasing the water heating or radiating surface, I provide the inner side of each water section with a lateral or radial fin, wing or blade —6— projecting into the water chamber and extending upwardly from the fire box, preferably

above the water level and into the steam chamber of the water section.

The inner sides of the water sections form a fire box —7— and combustion chamber —8—, the latter extending upwardly from the fire box to the top of the water sections. The lower portions of the inner sides of the water sections forming the fire box —7— are preferably perpendicular, thereby giving the fire box a cylindrical form. The remaining upper portions of the inner sides of each water section are formed with a central lengthwise rib —9— having its opposite sides diverging transversely in concave planes toward the meeting faces of such section, the upper portions of said ribs through substantially one half of their length being vertical, while the lower portions incline downwardly and outwardly to the plane of the inner face of the fire box, so that the lower portions of said opposite ribs are diverged downwardly from each other, leaving practically the entire series of ribs overhanging the fire box to increase the area of the combustion chamber exposed to the heated products of combustion, and at the same time to increase the heat impact of such products as they pass upwardly from the fire box.

The radial wings or fins —6— project outwardly from the apexes of the ribs —9— with their outer edges in vertical planes substantially coincident with the outer faces of the fire box, and inasmuch as the sides of the ribs —9— are comparatively thin, the wings —6— divide the intervening water space between said sides equally, thereby affording a large radiating surface directly adjacent to the combustion chamber, and together with the laterally depressed central portions of the meeting faces of the sections, serve to break up the body of water into shallow channels.

The steam generated in the upper portion of the water sections is collected in a common steam dome or cap —10— through the medium of branch pipes or legs —11— which communicate with suitable openings —12— in the upper ends of their respective sections, said dome being provided with an up-flow steam pipe —13— adapted to be connected to the radiating system of a building. This steam dome —10— lies directly over the upper end of the combustion chamber —8— so that the rising products of combustion impinge directly against the under side of said dome and escape laterally between the legs —11— thereby practically enveloping the greater portion of the dome and legs and tending to superheat the steam, or at least to more quickly convert the water vapor into steam.

The connections between the legs —11— and steam dome —10— and upper ends of the water sections —1— are made by means

of tapering nipples —14— and clamping bolts —15—, the latter serving to draw the legs of the dome into close engagement with the tapering nipples to prevent leakage of steam or gas through these joints.

The entire series of smoke and fire flues —5— are capped by a common dome —16— which is secured to the upper ends of the water sections —1— and surrounds the steam dome —10—, and is provided with an outlet —17— communicating with a smoke flue —18—, said outlet being provided with a damper —19— to control the passage of the products of combustion there-through.

The lower ends of the smoke flues —5— communicate with the interior of the shell or frame —2— which surrounds the ash pit —3—, said shell —2— being provided with an outlet —20— communicating with the smoke pipe or chimney —18—, and in which is placed a suitable damper —21— for controlling the passage of the products of combustion from the shell or chamber —2— into the chimney below the water legs.

The entire series of water legs is inclosed within a suitable casing or jacket —23— which is spaced apart from the outer side of the water legs forming an intervening chamber —24— closed at its upper end but communicating at its lower end with the chamber or shell —2—.

The upper end of the chamber —24— is provided with a branch passage —25— leading to the smoke flue —18— and in which is placed a damper —26— to control communication between the upper end of the chamber —24— and smoke flue.

The water of condensation from the entire heating system of the building is returned through a pipe —27— to a sub-conduit or pipe ring —28—, the latter being connected by branch passages —29— to the lower ends of the water sections.

The ash pit —3— is provided with suitable outlet —30— having a draft-door —31— through which the ashes may be withdrawn, or such door may be opened or closed to regulate the draft.

A fuel inlet conduit or frame —32— is secured in proper position just above the fire box and is provided with a door —33—, the frame —32— being interposed as shown in Fig. 4 between two adjacent water sections having their meeting faces formed with recesses for receiving said frame and still allow the water to circulate freely around the same.

The ash pit —3— is substantially conical with its upper end open and is of substantially the same diameter as the fire pot and adapted to support a grate —35—.

When starting the fire the dampers —21 and 26 may be closed and the damper —19— opened for direct draft, whereupon

the products of combustion pass directly upwardly from the combustion chamber and into the dome —16— and thence into the smoke pipe —18— through the conduit —17—. After the fire is well under way, the damper —19— may be closed and the damper —21— opened leaving the damper —26— closed, which will cause the products of combustion to pass from the dome —16— downwardly through the flues —5— into the underlying chamber —2—, from which they escape through the branch passage —20— into the smoke conduit —17—. If it is desired to further utilize the heat of the products of combustion in the conversion of the water into steam, the damper —26— may be opened leaving the dampers —19— and —21— closed, whereupon the products of combustion will pass from the dome —16— downwardly through the flues —5— and thence upwardly between the outer faces of the water sections and jacket —23— and escape through the branch passage —25— into the smoke pipe —18—, thereby utilizing to the fullest degree the heat for conversion of water into steam.

It will be observed that the radiating blades —6— bi-sect the angle of the diverging portions of the inner sides of the water sections and that the diverging sides of adjacent water sections form vertical channels between the ribs —9—, thereby exposing a very large area of the water section to the products of combustion and similarly exposing the water in said sections to a correspondingly large radiating surface which is materially increased by the inwardly deflected portions of the meeting sides of said sections through which the products of combustion may be caused to pass when the direct draft damper —19— is closed and the indirect draft dampers —21— or —26— opened. It will also be observed that by spacing the legs —11— of the steam dome —10— some distance apart the products of combustion pass from the combustion chamber between them and into the smoke dome —16—, thereby enveloping the greater portion of the steam dome in the heated products of combustion and quickening the conversion of water or water vapor into steam.

What I claim is:—

1. A steam boiler comprising a series of vertically-disposed hollow water sections arranged side by side in close juxtaposition and forming a combustion chamber, each of said sections having its inner wall formed of an upper, a lower and an intermediate portion, said lower portion segment-shaped in contour and arranged to one side of the intermediate portion, said intermediate portion inclining upwardly toward the axis of the combustion chamber and said upper portion arranged inwardly of the plane of the lower portion and said upper and interme-

diate portions diverging from their vertical centers laterally in opposite directions and toward the side walls of the sections, and each of said sections furthermore provided with a vertically-disposed radiating plate formed integral with and projecting centrally from the inner face of the inner wall of the section centrally thereof.

2. A steam boiler comprising a series of vertically-disposed hollow water sections arranged side by side in close juxtaposition and forming a combustion chamber, each of said sections having its inner wall formed of an upper, a lower and an intermediate portion, said lower portion segment-shaped in contour and arranged to one side of the intermediate portion, said intermediate portion inclining upwardly toward the axis of the combustion chamber and said upper portion arranged inwardly of the plane of the lower portion and said upper and intermediate portions diverging from their vertical centers laterally in opposite directions and toward the side walls of the sections, each of said sections furthermore provided with a vertically-disposed radiating plate formed integral with and projecting centrally from the inner face of the inner wall of the section centrally thereof, and each of said sections having each of its side walls formed with an inwardly-extending portion, the inwardly-extending portions of one section registering with the inwardly-extending portions of adjacent sections, thereby providing channels substantially heart-shaped in section and constituting flues for products of combustion.

3. A steam boiler comprising a series of vertically-disposed hollow upright water sections arranged side by side in close juxtaposition forming a combustion chamber, the side walls of said sections provided with means to constitute flues, the inner walls of each of said sections formed of an upper, a lower and an intermediate portion, said lower portion segment-shaped in contour and arranged to one side of the intermediate portion, said intermediate portion inclining upwardly toward the axis of the combustion chamber and said upper portion arranged inwardly of the plane of the lower portion and said upper and intermediate portions diverging from their vertical centers laterally in opposite directions with respect to each other, and further having projecting from its inner face a vertically-disposed radiating plate.

4. A steam boiler comprising a series of vertically-disposed hollow upright water sections arranged side by side in close juxtaposition forming a combustion chamber, the side walls of said sections provided with means to constitute flues, the inner walls of each of said sections formed of an upper, a lower and an intermediate portion, said

lower portion segment-shaped in contour and arranged to one side of the intermediate portion, said intermediate portion inclining upwardly toward the axis of the combustion chamber and said upper portion arranged inwardly of the plane of the lower portion and said upper and intermediate portions diverging from their vertical centers laterally in opposite directions with respect to each other, and further having projecting from its inner face a vertically-disposed radiating plate, a closure for the top of each of said sections, a steam dome, and means communicating with the dome and extending through said closures for establishing communication between the sections and dome.

5. In a steam boiler, means to constitute an ash-pit, a frame surrounding said means and in connection therewith forming a chamber, a series of hollow upright water sections arranged side by side in close juxtaposition and forming a combustion chamber, each of said sections having its inner wall formed of an upper, a lower and an intermediate portion, said lower portion segment-shaped in contour and arranged to one side of the intermediate portion, said intermediate portion inclining upwardly toward the axis of the combustion chamber and said upper portion arranged inwardly of the plane of the lower portion and said upper and intermediate portions diverging from their vertical centers laterally in opposite directions and toward the side walls of the sections, said sections having the side walls thereof provided with means to constitute flues for the products of combustion, a steam dome communicating with the upper ends of the water sections and having an outlet, a water ring arranged within said chamber and surrounding said ash-pit and provided with nipples communicating with the lower ends of the water sections, a return flow pipe opening into said water ring, a dome for the products of combustion communicating with the upper ends of the smoke flues, said flues communicating at their lower ends with said chamber, and outlets for the smoke dome and said chamber.

6. A steam boiler comprising means to constitute an ash-pit, a frame surrounding said means and forming a chamber, a series of vertically-disposed water sections arranged side by side in close juxtaposition and forming a combustion chamber, each of said sections having its inner wall formed of an upper, a lower and an intermediate portion, said lower portion segment-shaped in contour and arranged to one side of the intermediate portion, said intermediate portion inclining upwardly toward the axis of the combustion chamber and said upper portion arranged inwardly of the plane of the lower portion and said upper and intermediate

portions diverging from their vertical centers laterally in opposite directions and toward the side walls of the sections, said sections mounted upon said frame and having the sides thereof provided with means to constitute flues communicating with said chamber, a water ring arranged within said chamber and surrounding the ash-pit and having nipples communicating with the lower ends of the water sections, a return flow pipe communicating with said ring, an outlet for the flues, an outlet for said chamber, and a steam outlet for the water sections.

7. A steam boiler comprising a series of vertically-disposed water sections abutting against each other and forming a combustion chamber, each of said sections having its inner wall formed of an upper, a lower and an intermediate portion, said lower portion segment-shaped in contour and arranged to one side of the intermediate portion, said intermediate portion inclining upwardly toward the axis of the combustion chamber and said upper portion arranged inwardly of the plane of the lower portion and said upper and intermediate portions diverging from their vertical centers laterally in opposite directions and toward the side walls of the sections, the side walls of each of said sections provided with means to constitute flues, each of said sections having arranged therein a vertically-disposed radiating plate projecting from the inner face of the inner wall of its respective section, means for establishing communication between the upper end of the flues and the combustion chamber, outlets for the upper and lower ends of the flues, and a steam outlet communicating with the upper end of said sections.

8. A steam boiler comprising a series of vertically-disposed water sections abutting against each other and forming a combustion chamber, each of said sections having its inner wall formed of an upper, a lower and an intermediate portion, said lower portion segment-shaped in contour and arranged to one side of the intermediate portion, said intermediate portion inclining upwardly toward the axis of the combustion chamber and said upper portion arranged inwardly of the plane of the lower portion and said upper and intermediate portions diverging from their vertical centers laterally in opposite directions and toward the side walls of the sections, the side walls of each of said sections provided with means to constitute flues, each of said sections having arranged therein a vertically-disposed radiating plate projecting from the inner face of the inner wall of its respective section, means for establishing communication between the upper end of the flues and the combustion chamber, outlets for the upper

and lower ends of the flues, a steam outlet communicating with the upper end of said sections, a sub-chamber arranged below said sections and into which opens the lower end
5 of the flues, and a water supply means arranged within said sub-chamber and opening into said sections.

In witness whereof I have hereunto set my hand this sixth day of March, 1909.

WILLARD S. TUTTLE.

Witnesses:

EDWARD FELL LUKENS,
A. C. SAMPSON.