

No. 799,198.

PATENTED SEPT. 12, 1905.

W. H. SHAFER.
STEAM GENERATOR.
APPLICATION FILED MAR. 6, 1905.

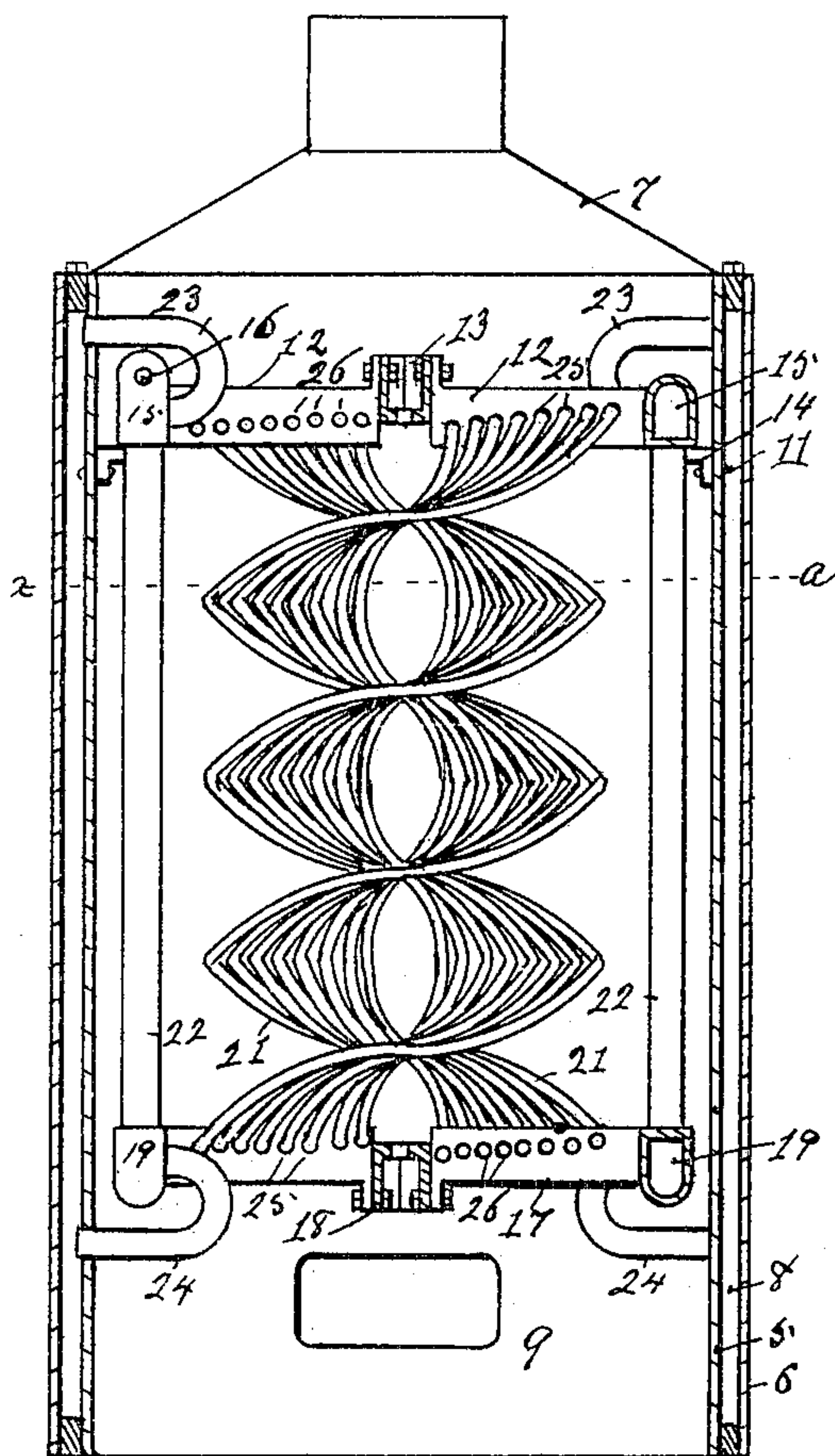


Fig. 1.

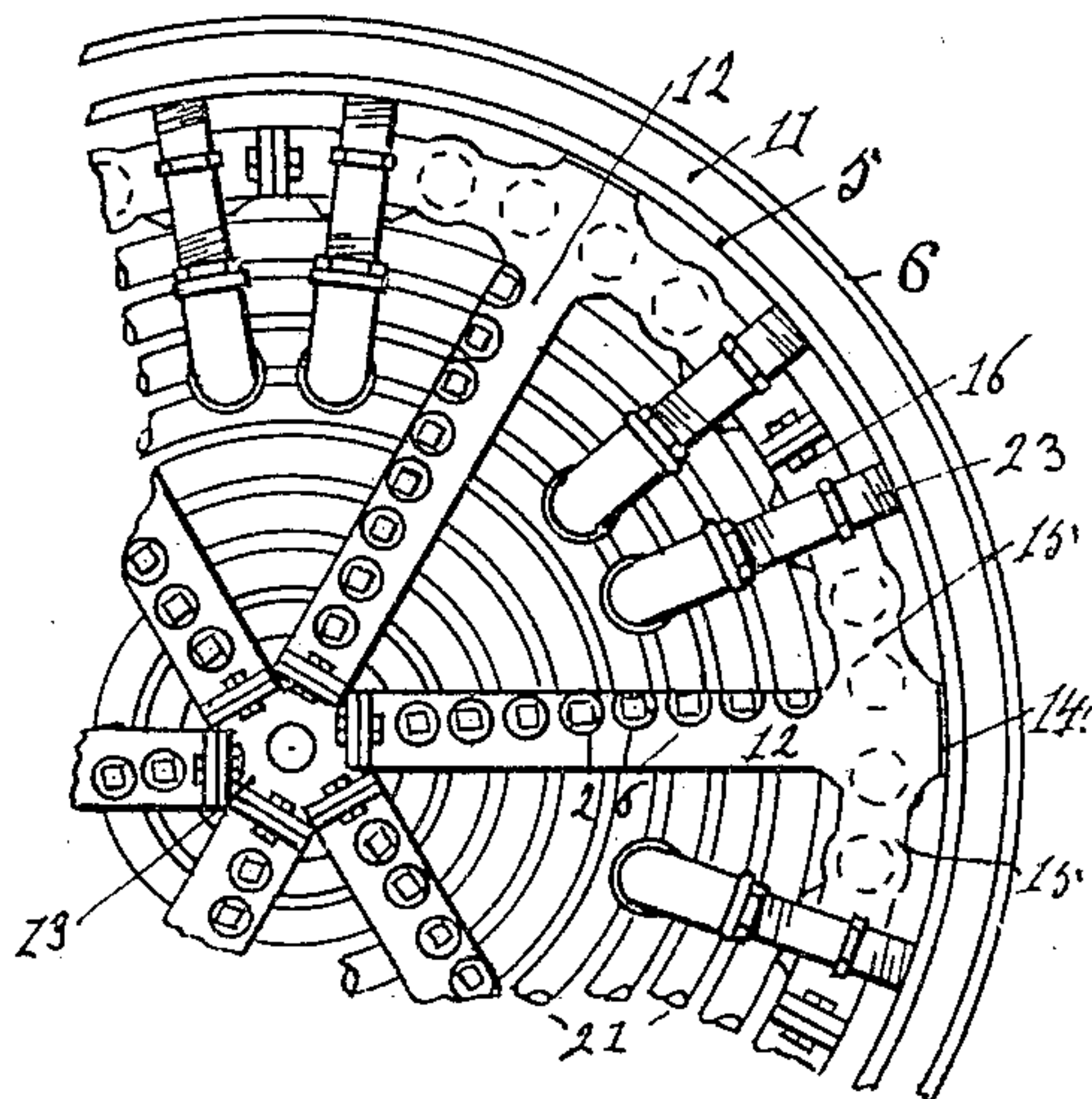


Fig. 2.

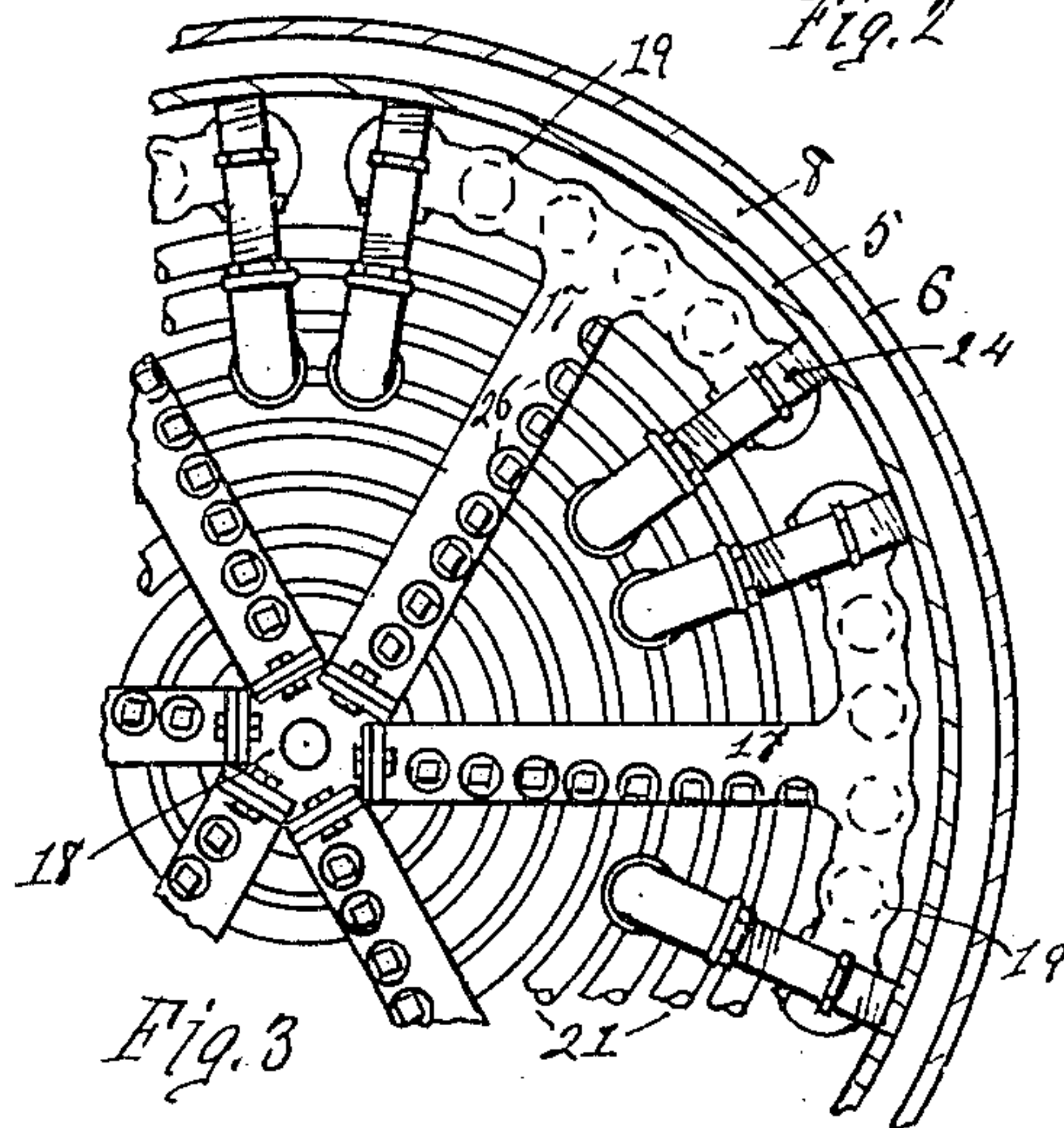


Fig. 3.

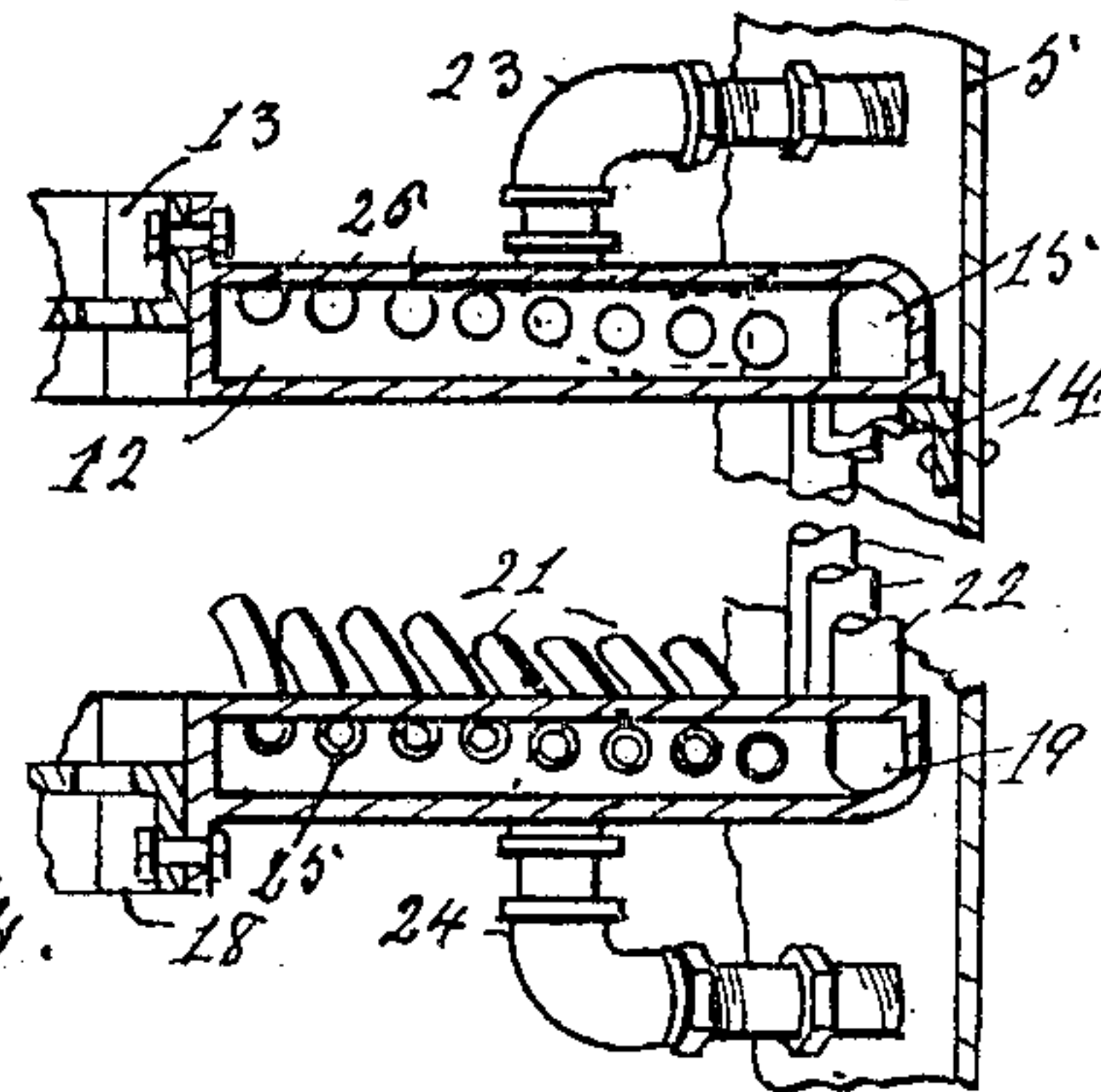


Fig. 4.

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UNITED STATES PATENT OFFICE.

WILLIAM H. SHAFER, OF CINCINNATI, OHIO, ASSIGNOR TO THE AHRENS
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STEAM-GENERATOR.

No. 799,198.

Specification of Letters Patent.

Patented Sept. 12, 1905.

Application filed March 6, 1905. Serial No. 248,597.

To all whom it may concern:

Be it known that I, WILLIAM H. SHAFER, a
citizen of the United States, residing at Cin-
cinnati, Ohio, have invented a new and useful
5 Improvement in Steam-Generators, of which
the following is a specification.

My invention relates to steam-generators
adapted to use for fire-engines and other pur-
poses; and the objects of my improvement
10 are to provide concentric shells inclosing an-
nular water and steam chambers; a series of
units of circulation and generation, each com-
municating with said chambers, said units each
15 consisting of helical ascending and straight de-
scending tubes, whereby the circulation is
automatically maintained in one and the same
direction; to interpose the straight tubes be-
tween the helical tubes and the steam-cham-
ber, whereby the water may be separated from
20 the steam before reaching the steam-chamber,
and to provide such construction and assem-
blage of the various parts as to obtain the
greatest efficiency and durability combined
with simplicity and economy. These objects
25 are attained in the following described man-
ner, as illustrated in the accompanying draw-
ings, in which—

Figure 1 is an elevation with parts in dia-
metrical vertical section of a steam-generator
30 embodying my improvement; Figs. 2 and 3,
plans, respectively, with parts broken away,
of the top and inverted bottom headers and
their connections; and Fig. 4, a vertical lon-
gitudinal section of a top and a bottom header.

35 In the drawings, 5 and 6 represent concen-
tric inner and outer shells surmounted by a
hood 7, 8 an annular water-leg encircling fire-
box 9, and 11 an annular steam-chamber sepa-
rated therefrom by the water-line *a a*, all be-
40 ing constructed and arranged in the ordinary
manner. A series of tubular top headers 12,
secured to and substantially radiating from
central plate 13, are removably supported with-
in the inner shell on brackets 14, secured
45 thereto. They each communicate with closed
tubular arms 15, which are extended laterally
from opposite sides thereof in the form of an
arc. The said contiguous arms of adjacent
headers are secured together by means of
50 bolts 16 and form a continuous ring adjacent
to and concentric with the inner shell. A
series of bottom headers 17, similar to the top
headers, substantially radiate in registration
therewith from central bottom plate 18, to

which they are secured. They each terminate 55
in closed tubular arms 19, which extend later-
ally from opposite sides and in registration
with corresponding arms 15. Corresponding
top and bottom headers communicate through
a series of connecting helical tubes 21 and the 60
corresponding arms thereof through a series
of connecting straight vertical tubes 22, thus
forming an independent unit of circulation
and generation.

Removable discharge-pipes 23, formed with 65
return-bends, communicate with the extrem-
ity of the respective arms 15 and with the
steam-chamber at points in a plane above the
arms, and removable supply-pipes 24, similar
thereto, communicate with the extremity of 70
respective arms 19 and with the water-leg at
points in a plane below said arms.

The top and bottom headers are secured to
their respective central plates at a tangential
angle in the same direction from correspond- 75
ing radii sufficient to bring the line of open-
ings 25 therein substantially in a plane at right
angles to the extremities of the series of helical
tubes which are respectively secured in said
openings. Openings 26, provided with remov- 80
able plugs, are formed in the headers directly
opposite the respective openings 25 to permit
access to the extremities of the helical tubes
for swaging or other purposes.

In operation the most rapid generation of 85
steam occurs within the helical tubes, owing
to their central location and inclined exposure
to the ascending heat-currents from the fire-
box. In the passage of the steam from the heli-
ces its direction is abruptly changed by the op- 90
posite inner wall of the corresponding top
header, by the transverse interior wall at the
juncture of the arms, by the extremities of
the arms, and by the turns in the discharge-
tubes, by which it is elevated and delivered 95
in the steam-chamber in a plane above said
arms. The water being less volatile than the
steam is thus retarded and separated there-
from and automatically tends to return
through the vertical tubes and complete a 100
cycle of circulation to the bottom of the heli-
ces again. In the passage of the water from
the vertical tubes through the bottom arms
and header any deficiency from conversion to
steam is supplied from the water-leg through 105
the supply-pipes. In this manner an inde-
pendent unit or cycle of circulation and gen-
eration is interposed and automatically main-

tained between the water-leg and the steam-chamber.

Having fully described by improvement, what I claim as my invention, and desire to secure by Letters Patent of the United States, is—

1. The combination of concentric shells inclosing an annular water and steam chamber a top header supported thereby and provided with a discharge-pipe, a bottom header provided with a supply-pipe, a helical tube concentric within the shell, and a straight tube outside of the circle thereof, both tubes forming channels of communication between said headers.

2. The combination of concentric shells inclosing an annular water and steam chamber a top header supported thereby and provided with a pipe which discharges in a higher plane, a bottom header provided with a supply-pipe, a series of concentric helical tubes, and a series of straight tubes located without the space embraced by the helical tubes, both series of tubes communicating with said headers.

3. The combination of a top and a bottom header each having a lateral tubular arm on one end, a helical tube connecting said headers together and a straight tube extending between the arms.

4. The combination of a top and a bottom header each formed with a lateral arm, a helical tube communicating between the headers, and a straight tube communicating between the arms outside thereof.

5. The combination of a series of headers secured to a common center piece and extending therefrom at the same acute angle to corresponding radii, for the purpose specified.

6. The combination of a series of headers, respective series of concentric helices secured thereto, said headers being secured to a common center piece and at an acute angle to corresponding radii.

7. The combination with a top header, a helical tube secured at right angles thereto, a lateral arm formed on the header, a discharge-

pipe formed with return-bends secured at right angles to the arm, and terminating in a plane above the header, and a vertical tube depending from said arm, for the purpose specified.

8. The combination of a series of top headers radiating from a common center and terminating in lateral tubular arms having closed ends, means to secure the contiguous arms of adjacent headers together to form a continuous connection between them, of a series of helical tubes communicating with the header, a series of vertical tubes communicating with the arms thereof and pipes extending from the arms and arranged to discharge in a higher plane.

9. In a steam-generator, a series of headers secured to a common center piece and extending therefrom at an acute angle to corresponding radii.

10. In a steam-generator, a header formed with openings in a helical line adapted to the engagement of tubes therein, and with a lateral arm, for the purpose specified.

11. In a steam-generator, a series of headers secured to a common center piece at an acute angle to corresponding radii and terminating in lateral arms removably connected together.

12. In a steam-generator, a series of radiating headers secured to a common center piece at one end and each terminating at the other end in a lateral arm in the form of an arc concentric to the center piece.

13. The combination of a series of radiating top headers terminating in lateral arms removably connected together, a series of similar bottom headers formed with arms and registering therewith, a series of helical tubes communicating with corresponding top and bottom headers, and a series of straight tubes communicating with the respective arms thereon.

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Witnesses:

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