

No. 788,174.

PATENTED APR. 25, 1905.

T. SUZUKI.
VERTICAL BOILER.
APPLICATION FILED JUNE 30, 1904.

2 SHEETS—SHEET 1.

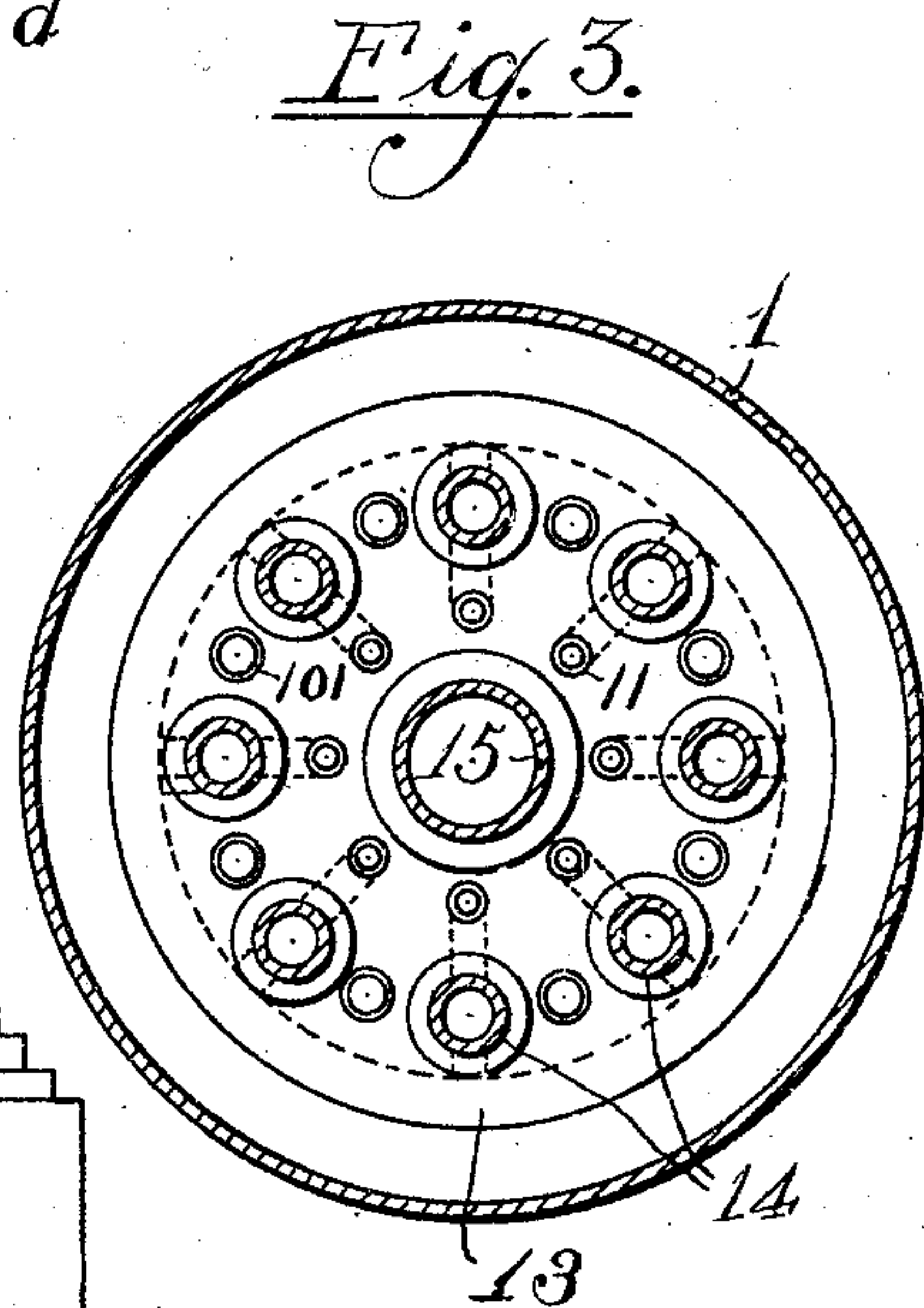
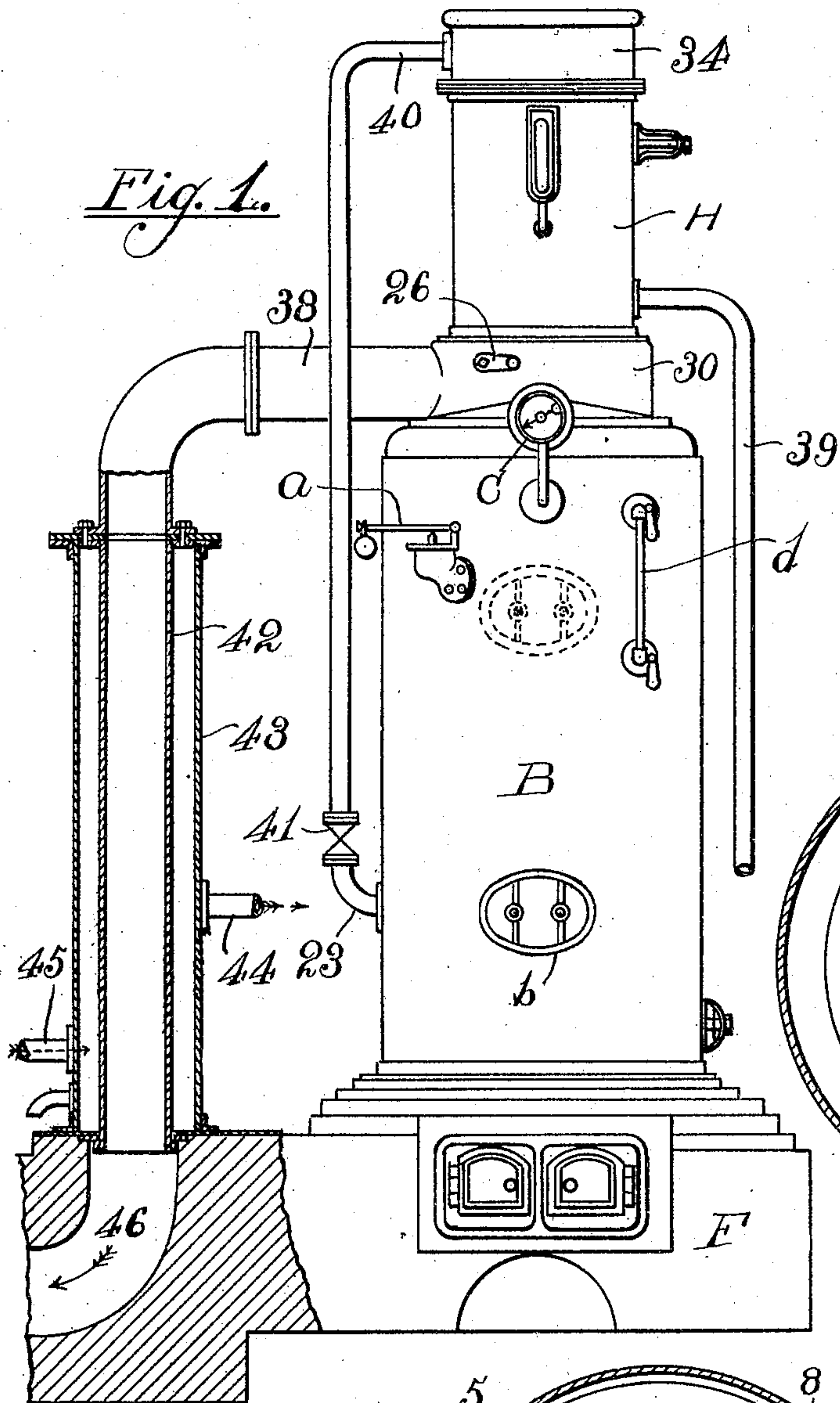
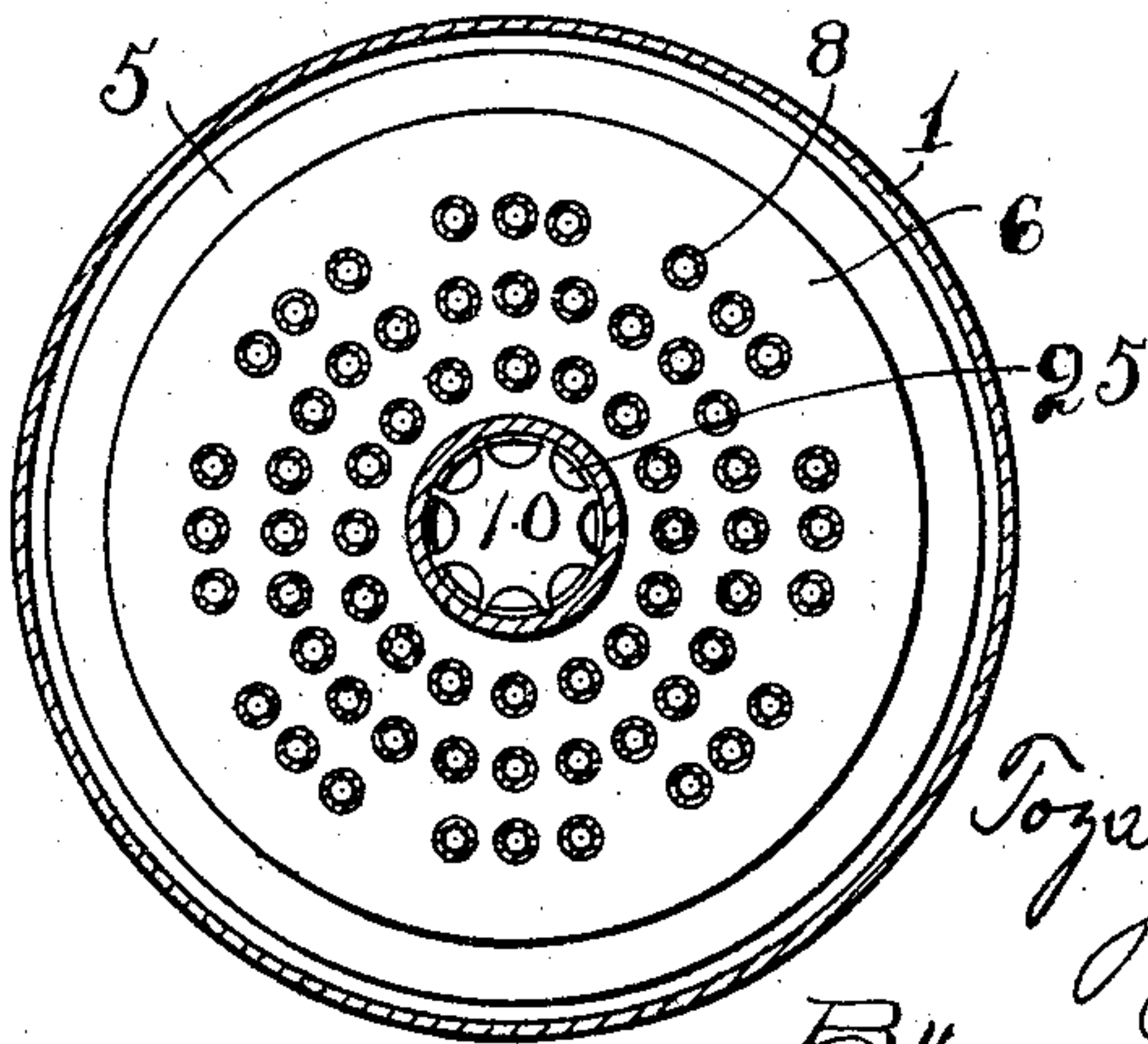


Fig. 4.



Witnesses:

E. F. Wilson
J. Heeren

Inventor:

Togaburo Suzuki
P. Singer

By

Attorney.

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2 SHEETS—SHEET 2.

Fig. 2.

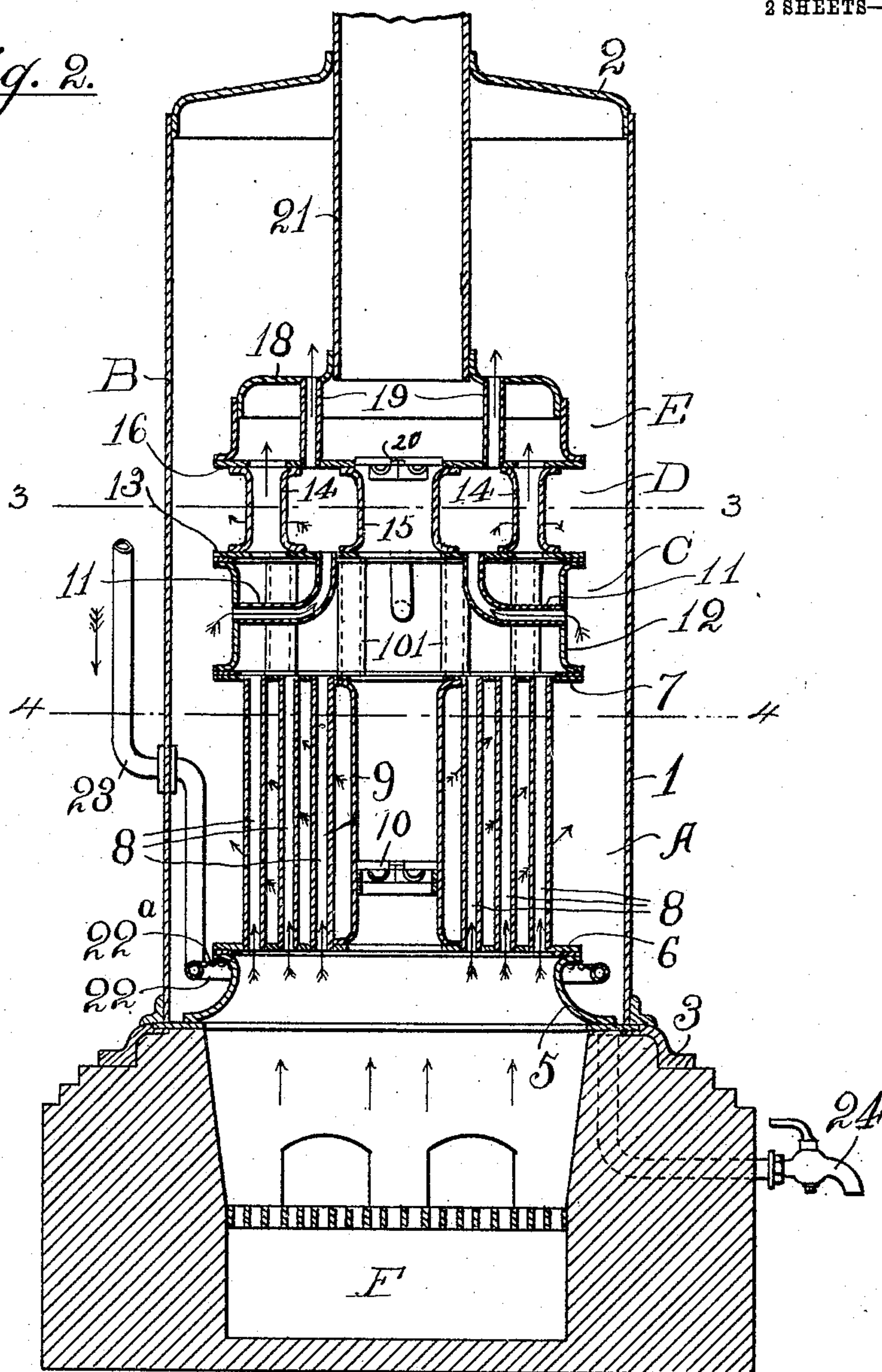


Fig. 5.

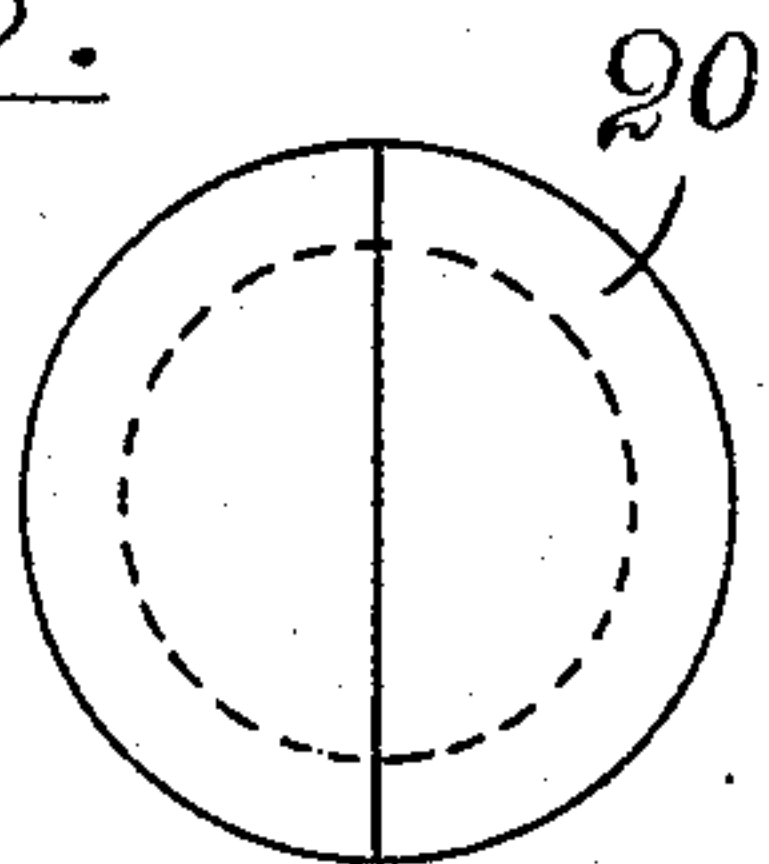
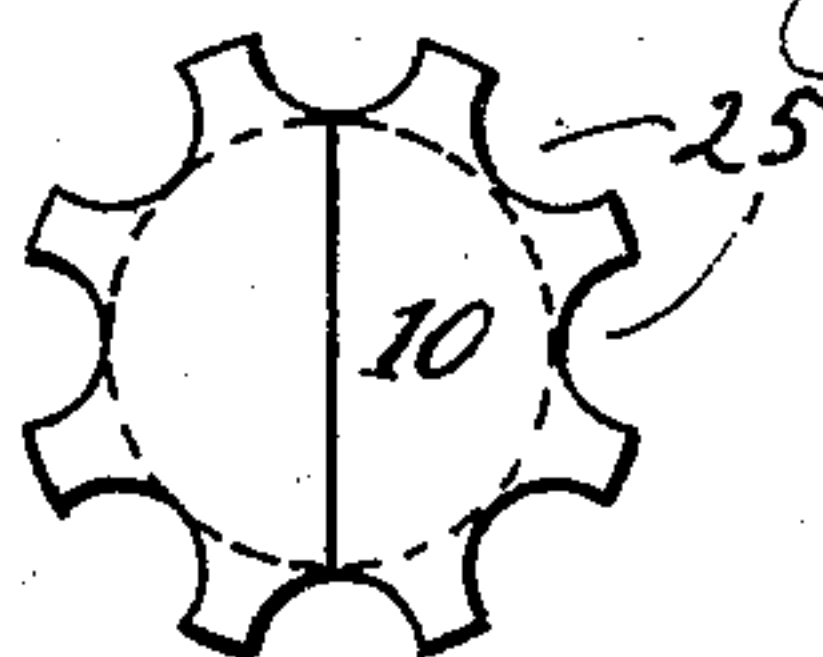



Fig. 6.



Witnesses:

C. F. Wilson
J. Beerer

By

 Inventor:
Tosaburo Suzuki
B. Singer

Attorney,

UNITED STATES PATENT OFFICE.

TOZABURO SUZUKI, OF SUNAMURA, JAPAN.

VERTICAL BOILER.

SPECIFICATION forming part of Letters Patent No. 788,174, dated April 25, 1905.

Application filed June 30, 1904. Serial No. 214,754.

To all whom it may concern:

Be it known that I, TOZABURO SUZUKI, a subject of the Emperor of Japan, residing at No. 401 Jibeishinden, Sunamura, in the county of Minami Katsushika and prefecture of Tokio, in the Empire of Japan, have invented certain new and useful Improvements in Vertical Boilers, of which the following is a specification.

In this invention the vertical boiler is anchored upon an independent brick furnace and is built up inside with a plurality of fire-chamber sections to such extent as may be required or demanded by exigencies, these chambers being provided with a plurality of water-tubes, a plurality of fire-flues, and a trunk-section having an inner diameter sufficient to admit a cleaner.

The objects of the invention are to enable the capacity of the combustion-chamber or boiler to be enlarged at pleasure, to simplify the construction of the boiler, to increase the durability with minimum danger, to enlarge at will the heat-conducting surface, while facilitating the assembling, cleaning, and repair of parts, to expedite the circulation of water and insure the economic use of heat, and otherwise to increase the efficiency of the boiler.

In the accompanying drawings, Figure 1 is an elevation, partly in section, of apparatus embodying my invention, omitting the fuel-saving device. Fig. 2 is a vertical central section therethrough; Fig. 3, a like transverse section on the line 3 3 of Fig. 2. Fig. 4 is also a transverse section, seen from above, on the line 4 4 of Fig. 2. Figs. 5 and 6 are top plan views of fire-regulating dampers, diaphragms, or stand-plates used in the apparatus.

Referring now to said drawings, the furnace F is constructed of brick, with a capacity determined according to the amount of steam to be developed and according to the exigencies of the fuel to be used, as coal, coke, bagasse, &c. The fireplaces of the furnace may be in any desired number and separate from each other.

The vertical boiler B, secured upon the top of the furnace, comprises in general the shell 1, provided with safety-valve *a*, manhole *b*,

pressure-gage *c*, water-gage *d*, cover 2, and base-ring 3, by which latter it is secured to the furnace. The inner diameter of the base-ring nearly equals that of the flame-opening diameter of the furnace, but is sufficiently less to insure that the ring will not touch the flames. This ring is connected by main flue 5 with lower annular plate 6 of the first section A of the fire-chamber.

Several fire-chamber sections A C D E are provided within the boiler. Section A rises from annular plate 6 to annular plate 7, connecting these two plates by means of plural fire-flues 8 and central flame-trunk 9 of diameter sufficient to admit a man for cleaning and repair purposes. This central trunk is provided near its base with the removable fire-regulating diaphragm or damper 10, which may serve also as a stand-plate for the cleaner. This diaphragm is circumferentially toothed or jagged, as at 25, so as to allow the flame to pass up the trunk even when it is in place. Sometimes the diaphragm 20, Fig. 8, with unbroken circumferential outline, may be substituted for it to entirely prevent the passage of flames up the trunk and divert them to the flues. The employment of these diaphragms therefore enables the passage of flames through the flues to be regulated and rendered uniform.

The annular plate 7 is connected by short cylinder 12 of fire-chamber section C with the overhead annular plate 13. The latter plate is perforated and connected with perforations in the sides of cylinder 12 in the same vertical plane by a plurality of curved water-tubes 11 and vertical water-tubes 101, connecting edge plates 7 and 13. The flames from flues 8 and also from flame-trunk 9 in the first fire-section circulate freely around the water-tubes in section C, impinging upon the curved tubes at practically right angles. This section has no central trunk, but has central openings corresponding in diameter with trunk 9. Obviously section A may be dispensed with under certain conditions and section C connected directly with short flue 5 immediately above the furnace.

Fire chamber or section D, having also a central flame-trunk, connects edge plate 13

and edge plate 16 and is provided with a plurality of fire-flues 14, receiving from fire-section C. The central trunk 15, registering with the flame-trunk of section C and flame-trunk 9 of section A, has fire-regulating diaphragm or stand-plate 20, interchangeable with diaphragm 10. It is preferable to arrange the fire-flues 14 in the same vertical plane with curved water-tubes 11 of section C, so that the flames may be drawn directly thereacross.

Section D is capped by section E, comprising a short exterior cylinder connecting edge plate 16 with cap-plate 18. There is no central flame-trunk to this section. It is simply a combustion-chamber open to the flame-trunk 21, passing up through the boiler-cover, except that it has a series of vertical water-tubes 19, connecting the water-chamber of section D with the larger boiler-chamber, across which tubes the flames are drawn at nearly right angles, since they are arranged within the line of fire-flues 14 and between such line and trunk 21.

Water is introduced into the boiler through inlet-pipe 23 and annular distributing-pipe 22, arranged near the bottom of the boiler inside thereof and perforated at its upper side with a plurality of small holes 22^a. The base-ring 3 is provided with one or more blow-off or exhaust cocks 24.

Draft-pipe 38 is connected with smoke-trunk 42, which communicates by passage 46 with the smoke-stack or chimney. A jacket 43 may surround this smoke-trunk, receiving feed-water through inlet-pipe 45 and delivering it to the boiler through pipes 44 and 23, thus utilizing the last remnant of heat in the gases in what may be termed a "supplemental" feed-water heater. This arrangement will have the further effect of preventing an excessive rise of temperature in the boiler-room. Of course, however, this device is not strictly essential, and when it is not available the smoke-stack will lead directly upward from draft-pipe 38.

In operation when fire is started in furnace F flame enters main flue 5, imparting heat to its interior and lower surface of annular plate 6. From this main flue the flames will ascend through the plurality of fire-flues 8 of fire-chamber A, and also, by the interdental spaces of damper 10, through flame-trunk 9, heating it uniformly. From section A the flames from the fire-flues and flame-trunk will enter the cylindrical chamber of section C, heating the water-pipes therein, and then pass up into flues 14 and flame-trunk 15 of section D, heating the water in the cylindrical chamber thereof, thence passing through fire-chamber E will escape to flame-trunk 21, impinging against and heating on the way the water-tubes 19, by which, it will be observed, steam escapes from the series of three upper sections into the boiler.

Although vertical boilers have hitherto been employed, I am not aware that one of large capacity has ever been successfully applied, on account of inconvenience and defects of construction as well as economic disadvantages in use. By the separation of boiler from furnace and other features of construction hereinbefore pointed out these deficiencies have been entirely overcome and an extraordinary amount of heating-surface has been secured. Moreover, it will be noticed that those parts where sedimentary matter is deposited are not allowed to come in contact with the flames, thus minimizing danger.

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

1. The combination with a furnace and a vertical boiler superposed thereon, of a fire-chamber within said boiler comprising a cylindrical chamber having water-pipes therein communicating with the boiler and bent to bring them at right angles to the path of the flames or heated products of combustion, a series of vertical water-pipes passing through said chamber, and means for directing the furnace-flames through said chamber.

2. The combination with the furnace and superposed boiler, of the fire-chamber A extending up within the boiler and comprising a central flame-trunk of diameter sufficient to admit a man, and a plurality of surrounding fire-flues, and the superposed fire-chamber C having exterior cylinder 12 and central flame-openings of diameter corresponding to the flame-trunk beneath, with vertical and curved water-pipes connecting with the boiler.

3. The combination with a furnace, of a vertical boiler superposed thereon, a base ring or plate for said boiler, shielded from direct contact with the flames, and fire-chambers extending vertically into said boiler, comprising a chamber C having curved and vertical water-tubes connecting with the water of the boiler and exposed to the flames from the furnace, and a superposed fire-chamber D open to the boiler and to which said water-tubes deliver, having a central flame-trunk, and a plurality of fire-flues surrounding said trunk.

4. The combination with a furnace, of a vertical boiler superposed thereon, a base ring or plate for said boiler, shielded from direct contact with the flames, and fire-chambers extending vertically into said boiler, comprising a chamber C having curved and vertical water-tubes connecting with the water of the boiler and exposed to the flames from the furnace, a superposed fire-chamber D open to the boiler and to which said water-tubes deliver, having a central flame-trunk, and a plurality of fire-flues surrounding said trunk, a third fire-chamber E superposed upon chamber D, provided with water-flues 19 between the fire-flues and central trunk of chamber D,

and a flame-trunk 21 leading from said last chamber through the top of the boiler.

5. The combination with a furnace, of a vertical boiler superposed thereon, a base ring or plate for said boiler, a short main flue shielding said ring from direct contact with the flame, a fire-chamber A above said flue comprising a central flame-trunk and a plurality of circumferentially-disposed fire-flues, a second fire-chamber C above said chamber A, comprising a cylinder centrally perforated to register with the flame-trunk beneath and having water-pipes therein fed from the boiler and exposed to the heated products of combustion coming from said trunk and flues, a third fire-chamber D, superimposed upon chamber C, and provided with central flame-trunk and a plurality of surrounding fire-flues, a final chamber E, receiving from said trunk and the fire-flues of chamber D, and provided with a series of vertical water-tubes between the trunk and flues, and a flame-trunk conducting from this chamber through the top of the boiler.

6. The combination with a furnace and a vertical boiler supported thereon, of a plurality of superposed communicating fire-chambers within said boiler comprising cylindrical chambers having water-pipes therein communicating with the boiler, the pipes of one of said chambers being bent to bring them at right angles to the path of the flames or heated products of combustion, and means whereby the flames are directed through said chamber.

7. The combination with a furnace, of a vertical boiler supported thereon, a base-plate for the boiler, a short main flue 5 shielding

said base-plate from direct contact with the flames of the furnace, and a plurality of superposed communicating fire-chambers over said flue extending up within the boiler, each chamber comprising annular top and bottom plates carrying a plurality of fire-flues and central connecting flame-trunks for said chambers of sufficient diameter to admit a man.

8. The combination with a furnace, of a vertical boiler supported thereon, a base-plate for the boiler, a short main flue 5 shielding said base-plate from direct contact with the flames of the furnace, and a plurality of superposed communicating fire-chambers over said flue, extending up within the boiler, each chamber comprising annular top and bottom plates carrying a plurality of fire-flues, and an annular feed or distributing pipe surrounding said short main flue and distributing feed-water to the boiler at a point nearest the furnace.

9. The combination with a furnace and a vertical boiler superposed thereon, a plurality of fire-chambers extending up within said boiler, each comprising water-pipes communicating with said boiler and combustion-tubes communicating with said furnace and an outlet, the water-pipes of one chamber extending transversely of the path of the products of combustion passing through upper and lower adjacent chambers.

In testimony whereof I affix my signature in presence of two witnesses.

TOZABURO SUZUKI.

Witnesses:

R. S. MILLER,
U. ISHIWARA.