

No. 619,184.

Patented Feb. 7, 1899,

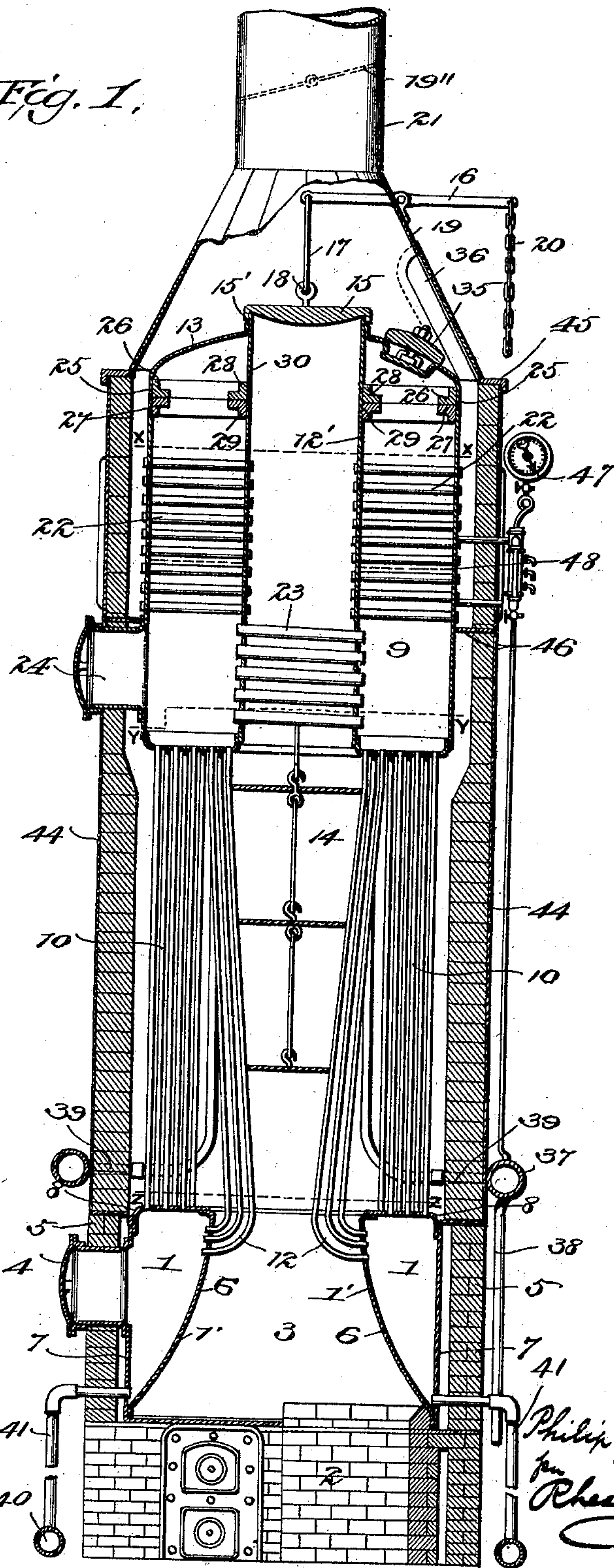
P. J. KEENE.  
BOILER.

(Application filed Apr. 7, 1898.)

(No Model.)

3 Sheets—Sheet 1.

*Fig. 1.*



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Fig. 2.

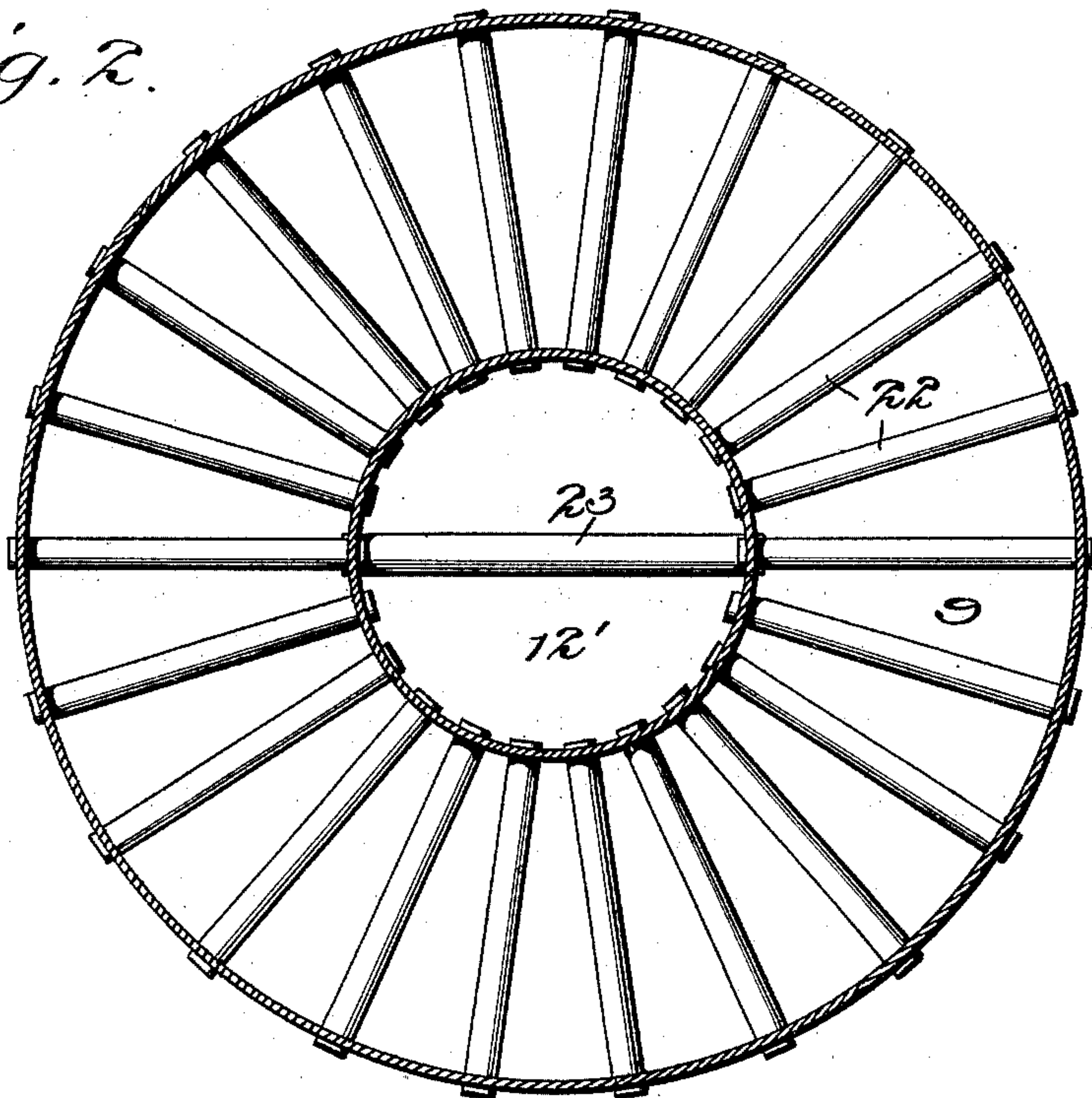
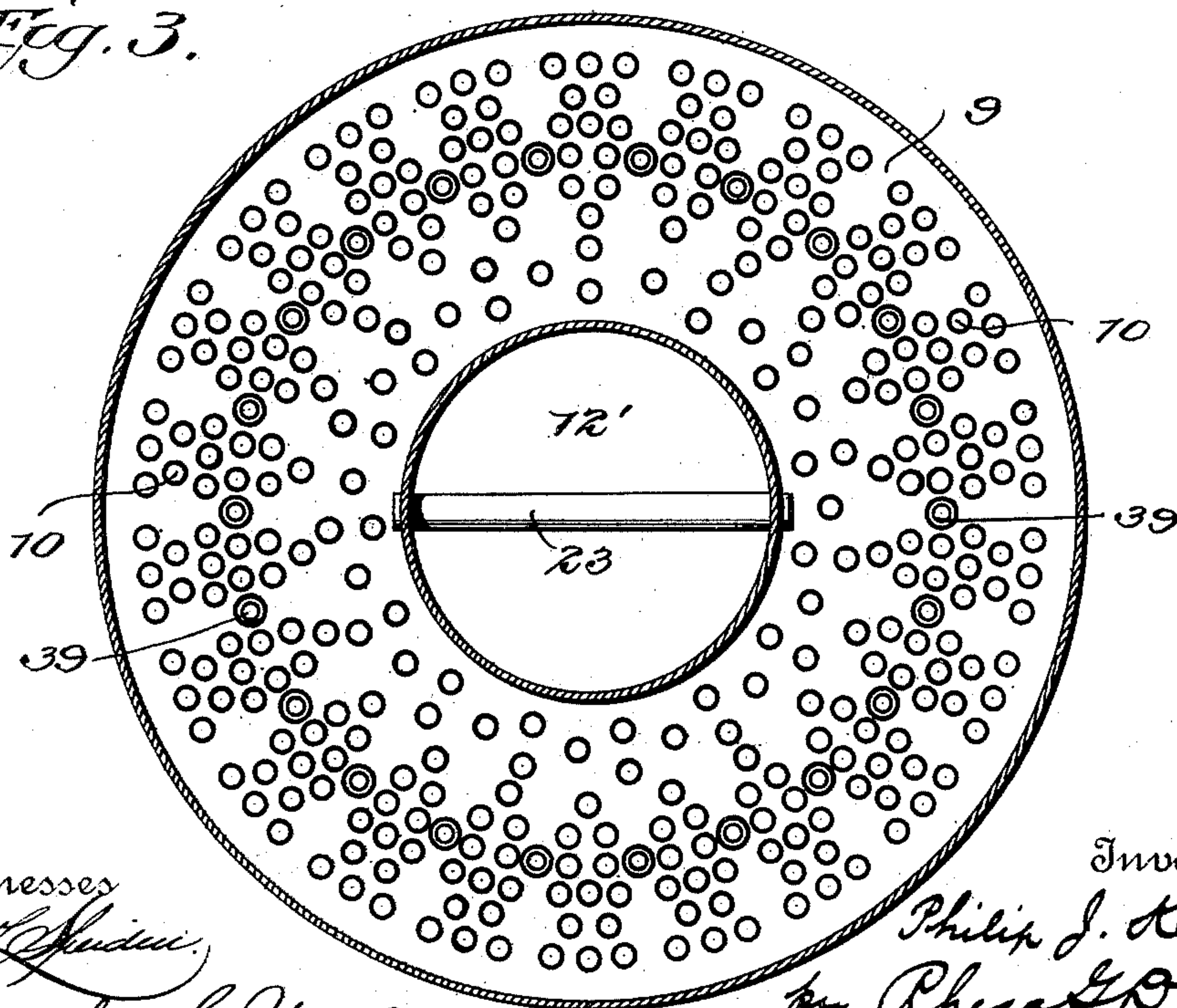


Fig. 3.



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3 Sheets—Sheet 3.

Fig. 4.

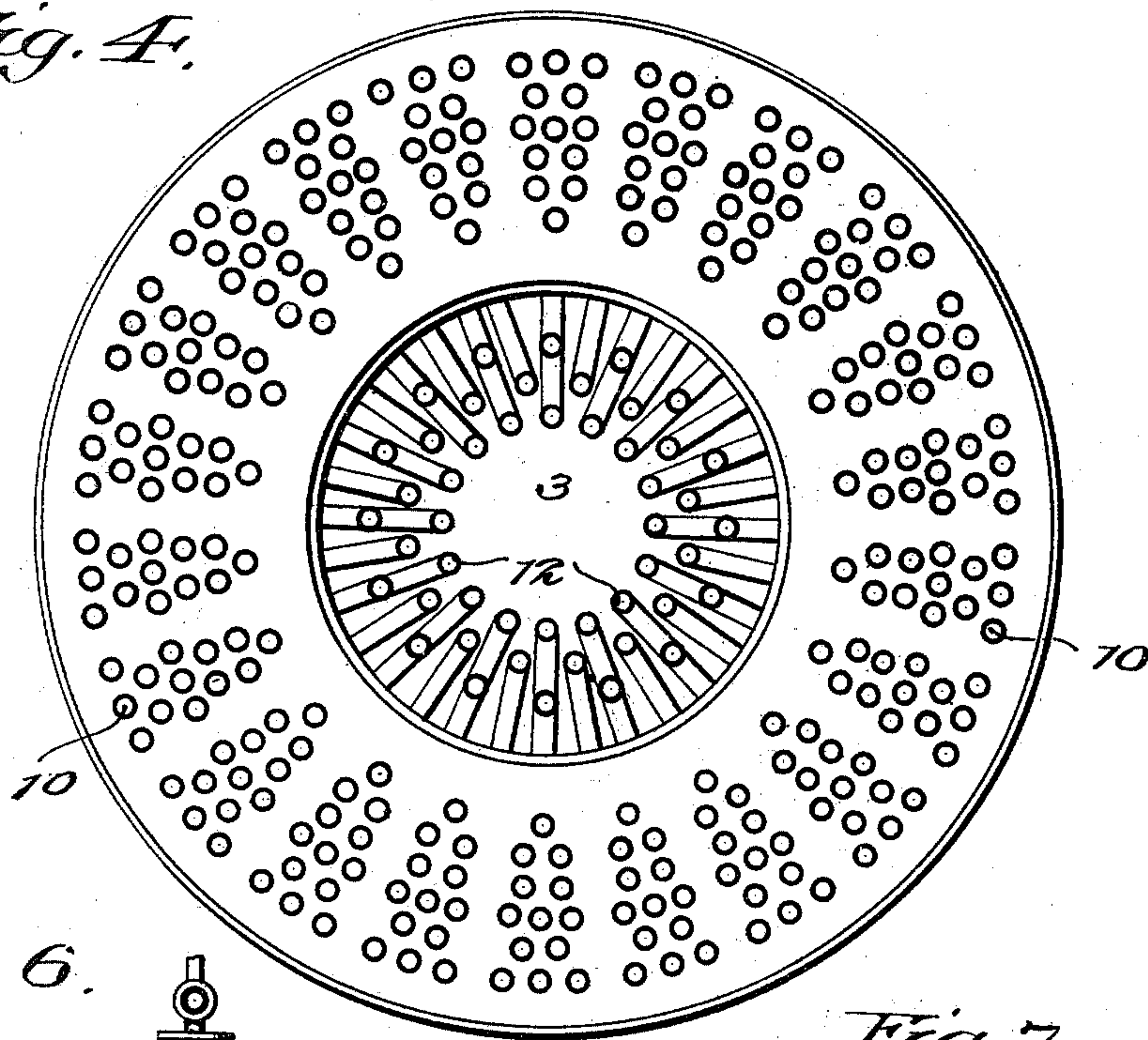


Fig. 6.

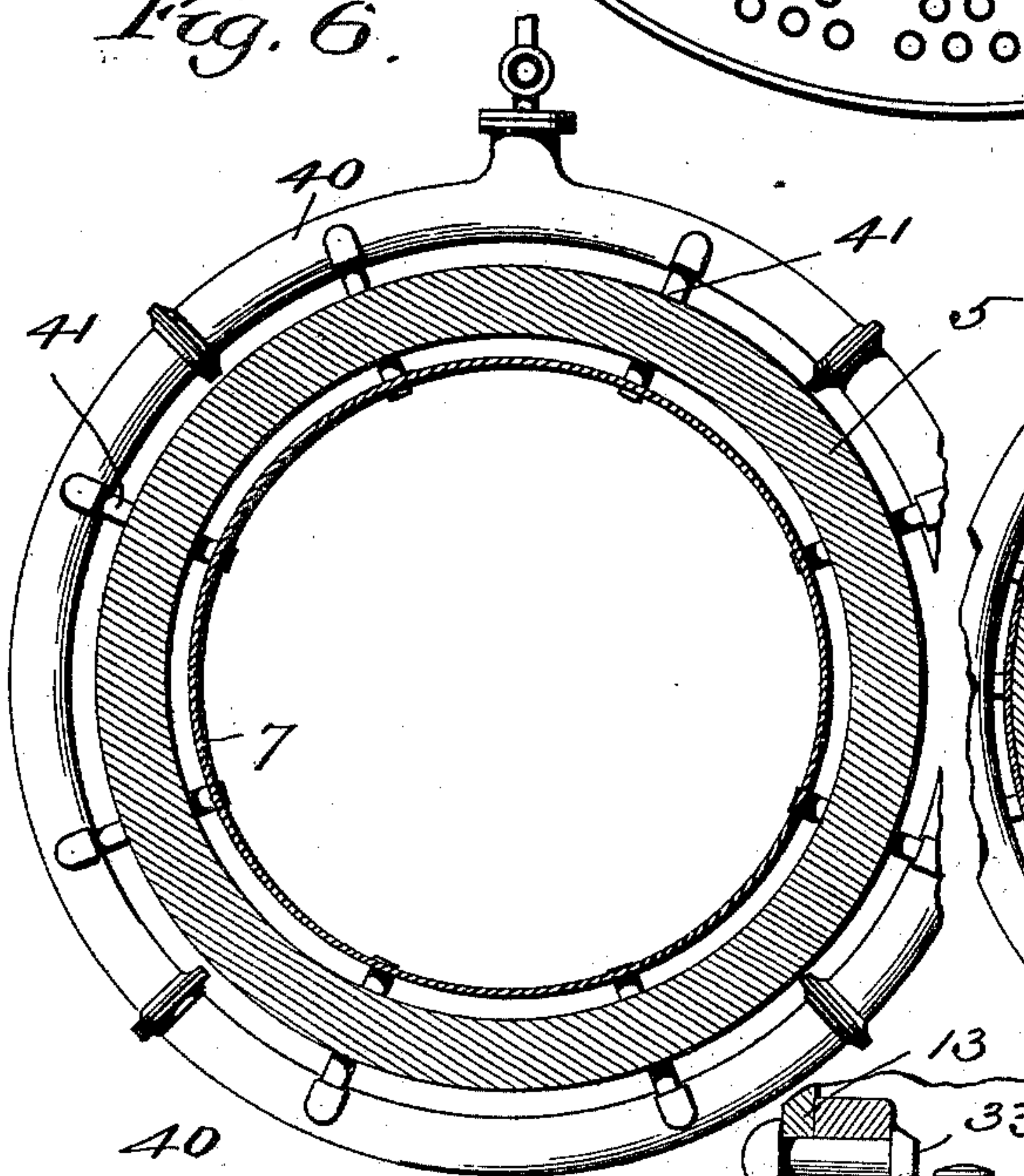


Fig. 7.

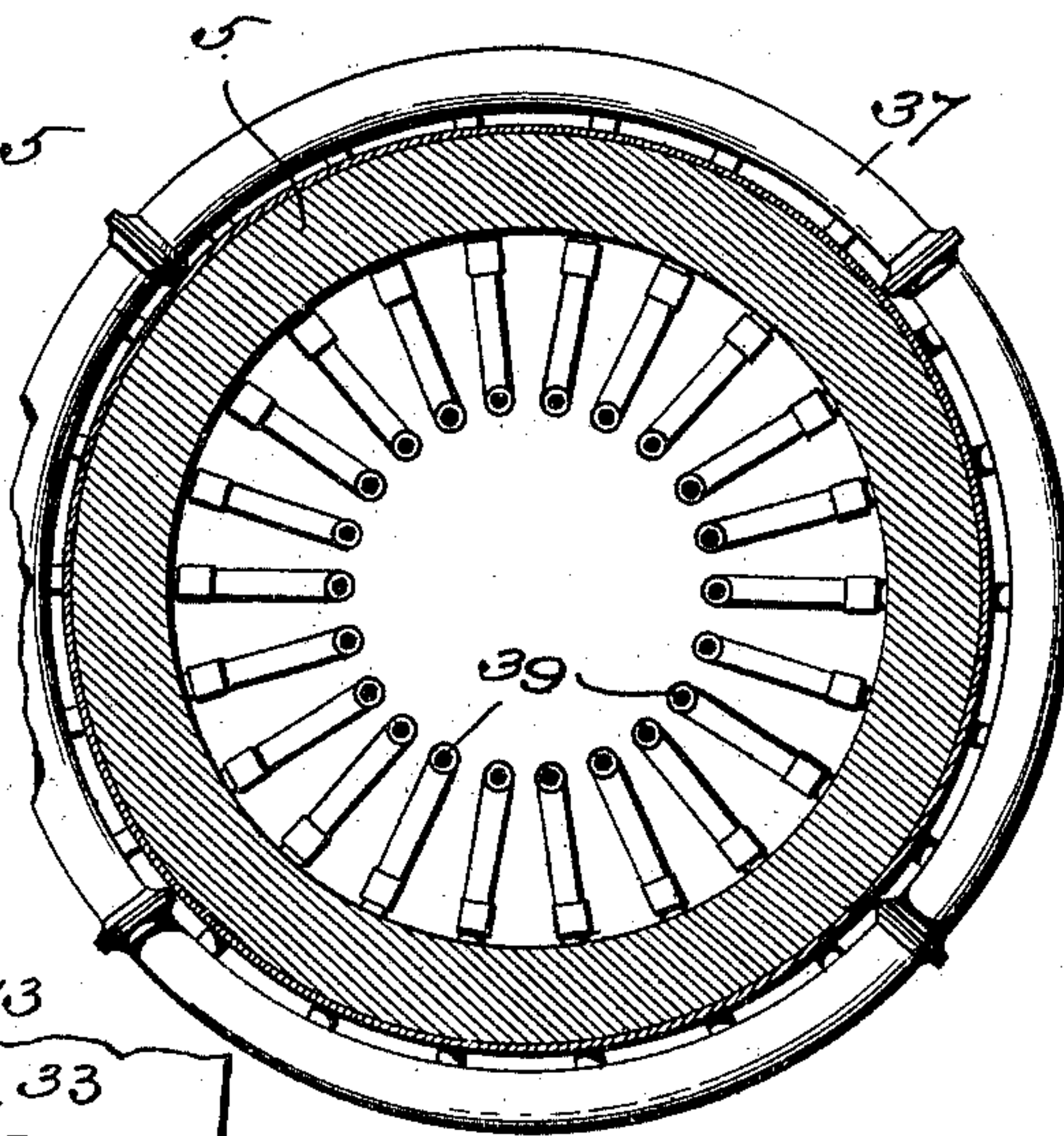
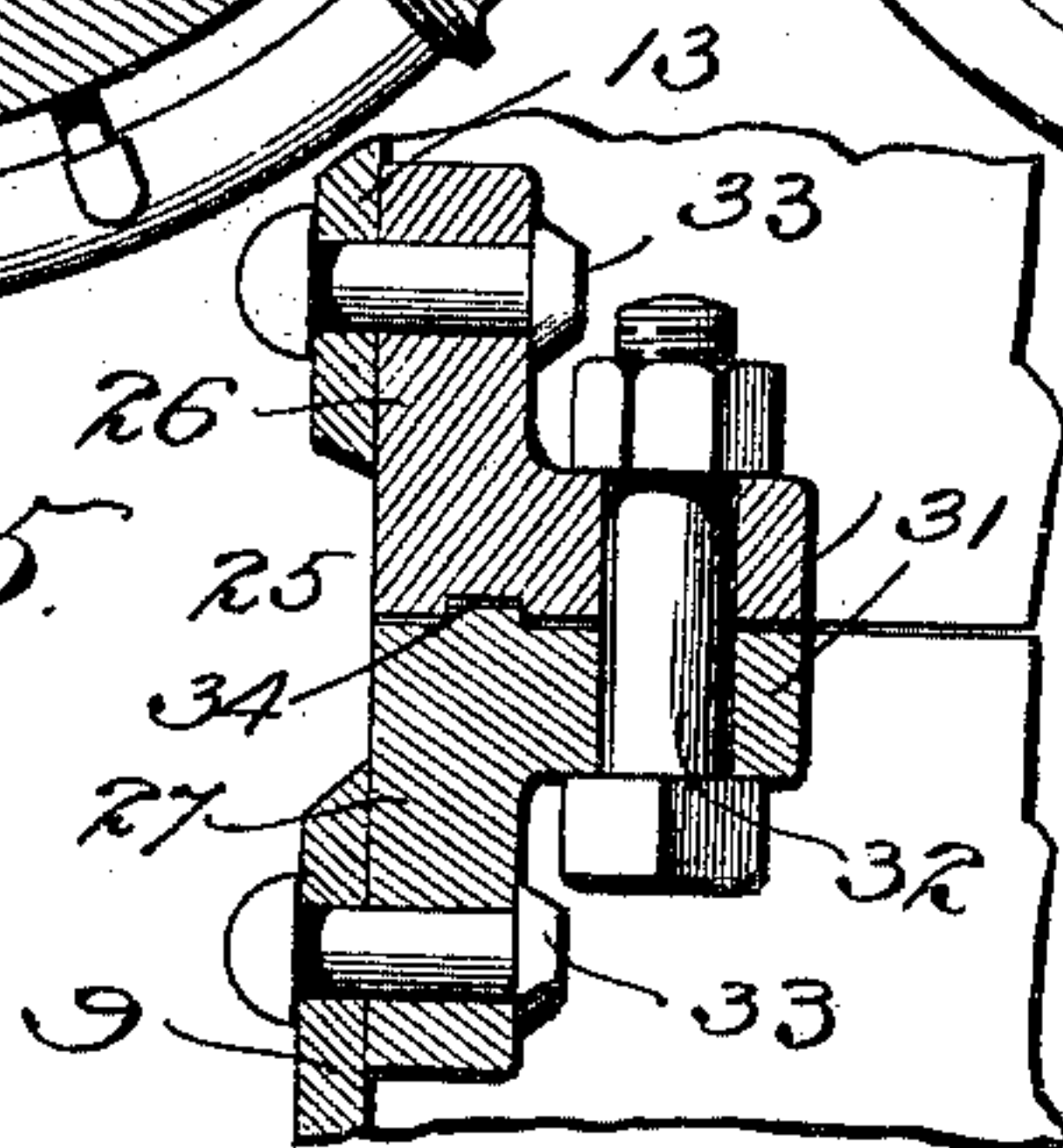


Fig. 5.



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# UNITED STATES PATENT OFFICE.

PHILIP J. KEENE, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO  
GEORGE J. ROCKWELL, OF SAME PLACE.

## BOILER.

SPECIFICATION forming part of Letters Patent No. 619,184, dated February 7, 1899.

Application filed April 7, 1898. Serial No. 676,792. (No model.)

*To all whom it may concern:*

Be it known that I, PHILIP J. KEENE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Boilers; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

My invention relates to steam-boilers of the water-tube type; and my object is to produce a more compact, effective, economical, simple, and accessible boiler than those heretofore produced.

To this end my invention consists in an incased boiler composed principally of an upper and lower water-drum connected by a set of peculiarly constructed and arranged water-tubes, in connection with a feed-water heater and other accessions and peculiarities, all of which will be more fully described hereinafter and pointed out in the claims.

In the accompanying drawings, Figure 1 represents a vertical sectional view of my complete apparatus; Fig. 2, a horizontal section through  $x x$  of Fig. 1, showing the arrangement of the water-tubes and fire-tubes in the upper water-drum; Fig. 3, a horizontal section through  $y y$  of the lower portion of the upper water-drum, showing the location and relative arrangement of the water-tubes of the boiler and water-tubes of the heater in the upper tube-sheet; Fig. 4, a horizontal section through  $z z$  of the boiler, showing the grouping of the water-tubes at the lower water-drum; Fig. 5, a detail sectional view through the flanges which connect the removable top of the upper water-drum of the apparatus; Fig. 6, a horizontal section showing the arrangement of the blow-off pipes which are connected with a circular mud-drum, and Fig. 7 a horizontal section showing the arrangement of the exterior annular feed-water header with the inturned water-pipes.

The numeral 1 denotes the lower water-drum, located directly above a furnace 2. This drum consists of a vertical cylinder having a

central frusto-conical opening 3, which forms part of the combustion-chamber 14. A man-hole 4 is provided in one side of the drum and extends horizontally through a surrounding brick casement 5. The inner plate 6 of the lower drum 1 diverges downward and is united at the bottom with the outer sheet 7 to form the frusto-conical opening 3 of the combustion-chamber 14, through which the products of combustion pass upward among the water and fire tubes. The top of the drum is covered by a horizontal flue-sheet 8. The upper water-drum 9 is also cylindrical and is connected with the lower drum by a plurality of vertical straight water-tubes 10, attached, respectively, to the top and bottom flue-sheets 8 and 11 of the two drums. An annular series of circulating water-tubes 12 extend from the inside sheet 1' of the drum 1 into the central opening 3, whence they are curved or bent upward, then slightly inclined outward until they enter the flue-sheet 11, forming the bottom of the upper water-drum 9. The bent or curved portions of these circulating-flues lie directly in the path of the heat, which impinges upon them, thereby intensely heating and driving the water within them rapidly upward, while the outer row of straight tubes 10, which are necessarily much cooler, will draw the water down into the lower drum, from which it is again sent upward through the circulating-tubes 12. This arrangement produces a healthy circulation in the boiler and prevents incrustation.

The upper water-drum 9 contains a large central flue 12'. This flue is directly above and coincident with the combustion-chamber 14 in the drum 1 below. The top 13 of the upper water-drum is made removable in the manner which will presently be described. The central flue 12' is in direct open communication with the main combustion-chamber 14 below, and is provided with a circular cast-metal damper 15. This damper is convex on the under side, with an annular flange 15' around its rim, encompassing the extended top of the flue, and is raised and lowered through the medium of a lever 16, link 17, and eyebolt 18. The lever 16 passes out through the metal hood 19 on the casement 5, on which it is fulcrumed, and its outer end



is provided with a depending chain 20. Excessive heat within the generator can be reduced by raising the damper 15 and allowing the products of combustion to pass up directly through the central flue 12' and out of the smoke-stack 21. It will be seen that the central flue 12' and damper 15 serve as a large manhole device, by which easy access can be had to the upper water-drum by merely removing the damper.

Horizontal radial fire-tubes 22 are placed in the upper water-drum with their opposite ends passing through the sides of the drum and flue, respectively. Several layers of these fire-tubes 22 in the drum 9 are above the water-line. These uncovered tubes will super-heat and dry the steam rising from the water in the steam-dome. A group of inclined water-circulating tubes 23 is placed across the lower part of the flue 12' to increase the circulation of water. A manhole 24 is located in the side of the drum opposite these circulating-tubes, whereby the tubes and interior of the drum are made accessible for repairs. The separable top or section 13 of the upper water-drum 9 is of the same diameter as that of the drum and constitutes a prolongation of the latter. This top is tightly secured by a peculiar kind of flange-joint 25, consisting principally of four cast rings 26 27 and 28 29. The outer or larger rings 26 and 27 connect and seal the contiguous edges of the top 13 and drum 9, and the smaller rings 28 and 29 encircle, connect, and seal the contiguous edges of the flue 30. Each ring is L-shaped in cross-section to provide laterally-projecting flanges 31, which are fastened together by vertical bolts 32. The peripheries of the rings are attached to the contiguous edges of the top and drum, respectively, by rivets 33. The adjoining sides of the rings are provided with an annular tongue-and-groove joint 34, capable of receiving packing to make a steam-tight joint between the two rings. By these means the top 13 may be readily separable from the drum to permit the latter to be opened wide for the easy removal or repair of any of the parts within, thus saving much time, labor, and expense of maintenance. An additional manhole 35 is provided in the top 13 to gain access to the bolts 32. Over the manhole there is a door 36 in the metal hood 19 above.

The feed-water device shown in Fig. 7 consists of an annular header 37, which encircles the casement or boiler-setting 5 at a point just above the top of the lower drum. Water is supplied to this header through pipe 38. Equidistant radial water-pipes 39 proceed from the header 37 inward through the casement 5 into the combustion-chamber 14, whence they curve upward between the groups of vertical water-tubes, terminating at the bottom flue-sheet 11 of the upper water-drum 9 above, into which they discharge. The capacity of the header 37 should equal the combined capacity of all the ingoing feed-

water pipes 39, in order to insure an abundant supply, and the number comprising the latter will be equal to the number of spaces between the groups of water-tubes connecting the lower and the upper water-drums.

A mud-drum 40 encircles the lower part of the furnace and lies below the floor. Mud is discharged from the bottom of the lower drum 1 downward into the mud-drum by means of the radial blow-off pipes 41. The casement around the furnace is composed of common brick, and above the top of the lower drum it may be lined with fire-brick. It is optional whether the casement around boiler be covered with a sheet-iron jacket or not. This brick casement is capped by a ring 45, forming a base for the hood 19 to rest upon. The smoke-pipe 21 contains a damper 19". An upper deflector 46 encircles the outside of the upper water-drum and closes the hot-air space between the drum and the surrounding casement, thereby compelling the gases to escape through the fire-tubes 22 by way of the central tube 12'. A vertical water-column extends from the header 37 of the heater up to a water-gage 47. Horizontal pipes in connection with the water-gage extend into the upper water-drum at points above and below the water-line 48.

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

1. In a steam-generator, the combination with a furnace, of a lower water-drum located directly above the furnace, an upper water-drum provided with fire-tubes and water-tubes, vertical water-tubes connecting the two drums, and a surrounding casement, substantially as described.

2. In a steam-generator, the combination with a furnace of a lower water-drum located above the furnace having a central opening through which the products of combustion pass; an upper water-drum provided with a central flue, a plurality of water-tubes connecting the two drums, water-tubes located in lower part of upper drum, fire-tubes passing through said upper water-drum, and a surrounding casement, substantially as described.

3. In a steam-generator, the combination with a combustion-chamber, of annular upper and lower drums, and water-tubes extending across the combustion-chamber from side to side of one of the drums.

4. In a steam-generator, the combination with a furnace, and lower water-drum, of an upper water-drum connected therewith by a plurality of water-tubes, fire-tubes passing through said upper water-drum, inclined circulating water-tubes in the upper drum and a surrounding casement, substantially as described.

5. In a steam-generator, the combination with a combustion-chamber, of annular upper and lower drums, and fire-tubes extending across the upper drum and opening into



the combustion-chamber, a portion of said tubes located above the water-line whereby the steam is superheated.

5 6. In a steam-generator, the combination with a furnace, of a cylindrical lower water-drum located over the furnace, said lower drum having a central opening through which the products of combustion pass, an upper water-drum, a plurality of vertical water-  
10 tubes connecting the upper drum with the lower, a plurality of bent circulating-tubes extending laterally from the inside of the lower drum outwardly and thence upwardly to said upper drum, and a surrounding case-  
15 ment, substantially as described.

7. In a steam-generator, the combination with the lower water-drum, of an upper water-drum provided with water-circulating tubes and fire-tubes and water-tubes connect-  
20 ing the two drums, substantially as described.

8. In a steam-generator, the combination with a furnace, lower water-drum and water-tubes, of an upper water-drum having a central draft-flue provided with a damper, radi-  
25 ating fire-tubes connecting the flue with the sides of the upper drum, water-circulating tubes arranged transversely across the central flue, and a surrounding casement, substantially as described.

30 9. In a steam-generator of the character described, a water-drum provided with fire-tubes, and a removable top, of internal flanged rings provided with clamping devices, whereby the top is secured to the drum, substan-  
35 tially as described.

10. In a steam-generator, the combination with a furnace, a cylindrical lower water-drum above the furnace, said drum having a central opening through which the prod-  
40 ucts of combustion pass, an upper water-drum, a plurality of water-tubes extending from the inside of the lower drum laterally and thence diverging outwardly, a central flue through the upper water-drum, fire-tubes  
45 passing from the flue outwardly through the sides of the upper drum, and one or more deflectors located in the vertical space between the water-tubes, substantially as de-  
50 scribed.

11. In a steam-generator, of the character

described, the combination with the furnace, of a lower water-drum above the furnace, an upper water-drum, water-tubes connecting the two drums, a surrounding casement and a feed-water device consisting of a header-pipe 55 encircling the exterior of the casement and provided with inwardly-extending radial water-tubes entering the lower portion of the combustion-chamber, and passing upwardly to the upper water-drum, substantially as 60 described.

12. The herein-described steam-generator having an upper water-drum consisting of a vertical cylinder provided with a central flue, slightly-inclined water-tubes passing through 65 central flue in bottom portion of upper drum, fire-tubes placed above the water-tubes and radiating from the central flue through the sides of the upper drum, several of these fire-  
70 tubes being above the water-line, by which arrangement the uncovered tubes dry the steam and act as a superheater, substantially as described.

13. In a steam-generator, a boiler contain-  
75 ing a water-drum provided with a horizontal series of radial pipes connected with the bottom of the drum, the pipes extending outward and downward, and an annular mud-drum connected with their lower termini, said drum having a frusto-conical interior which deflects 80 the heat directly against the lower ends of said pipes in its ascent through the combustion-chamber substantially as described.

14. In a steam-generator, the combination with the vertical water-tube boiler and its 85 casement, of a hot-water heater consisting of a horizontal circular header surrounding the casement, a series of feed-water pipes passing from the header horizontally through the casement into the boiler, thence extending 90 upward and terminating in lower tube-sheet of upper drum, said pipes having a combined capacity equal to that of the header, substantially as described.

In witness whereof I affix my signature in 95 presence of two witnesses.

PHILIP J. KEENE.

Witnesses:

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