

(No Model.)

R. G. RUFFLES.  
STEAM GENERATOR.

No. 507,169.

Patented Oct. 24, 1893.

FIG. 1.

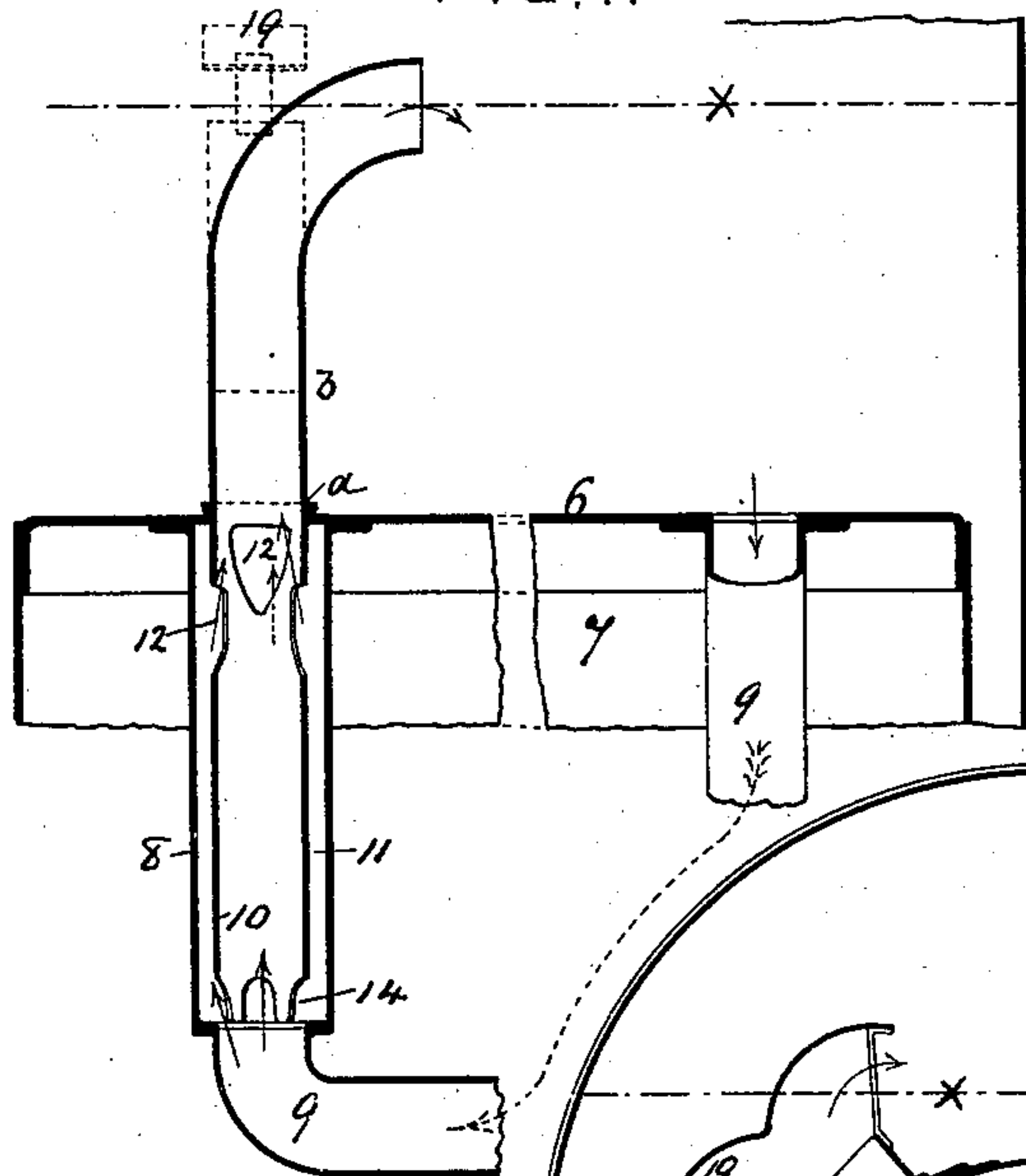


FIG. 2.

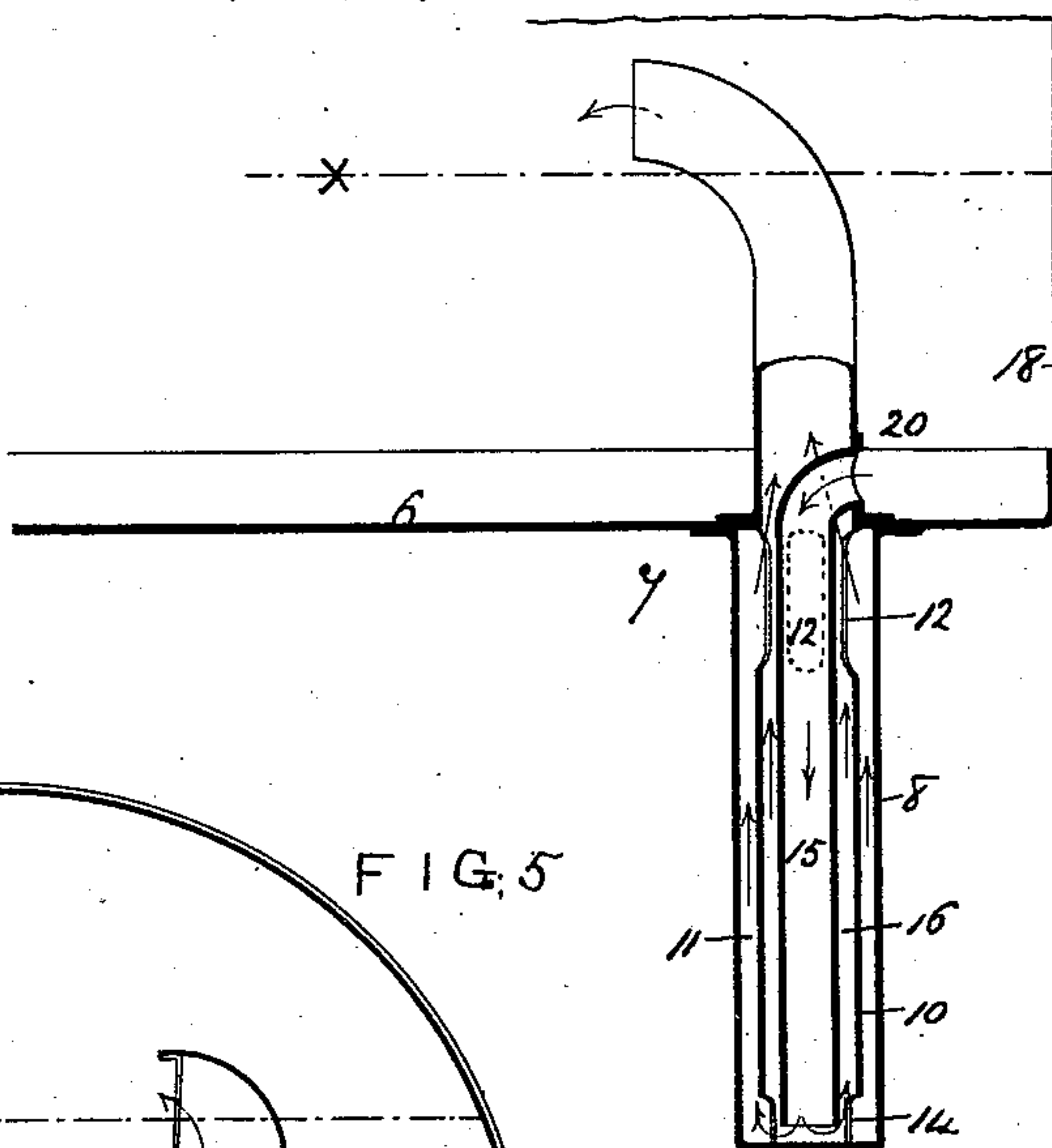


FIG. 5

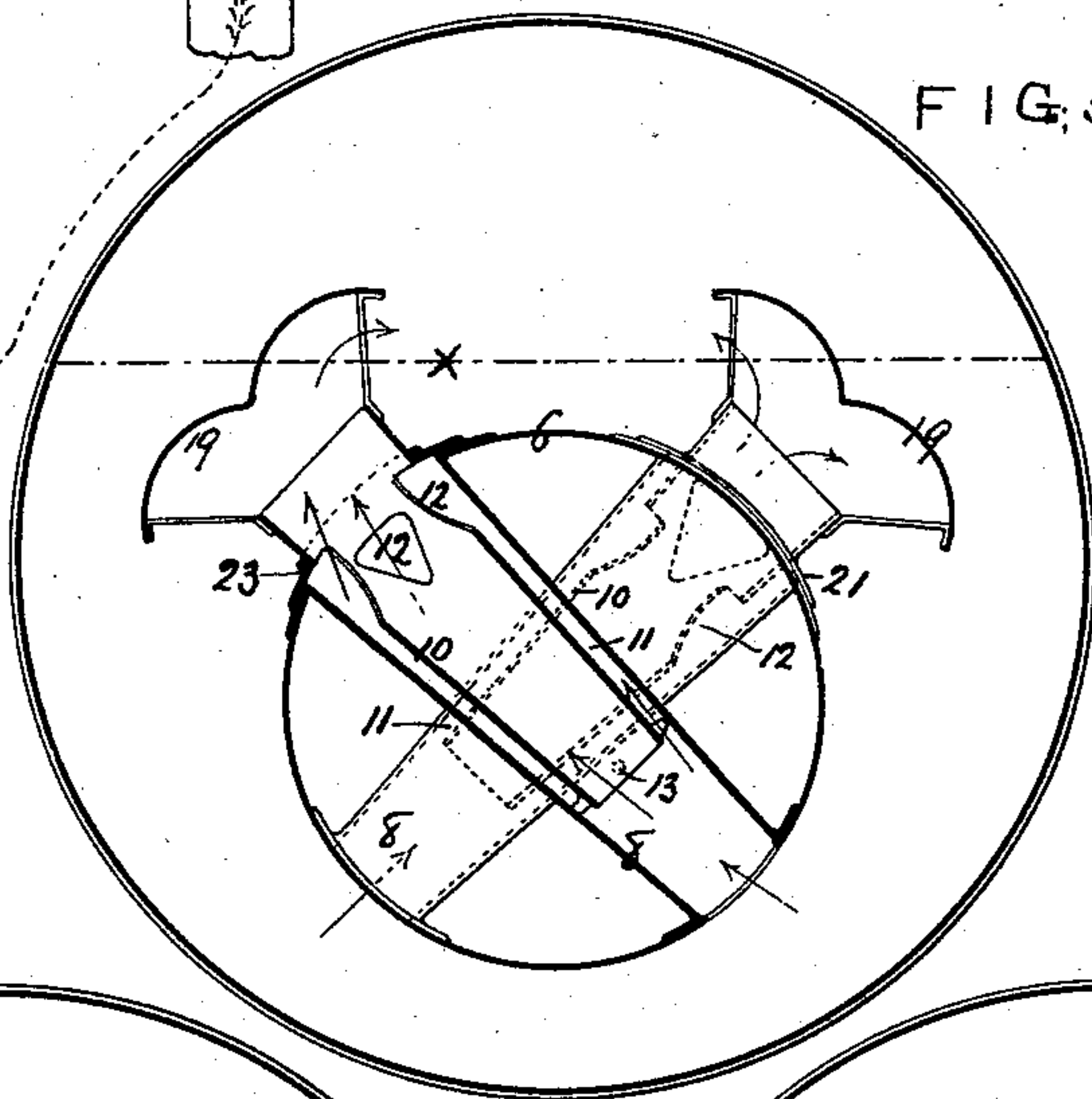
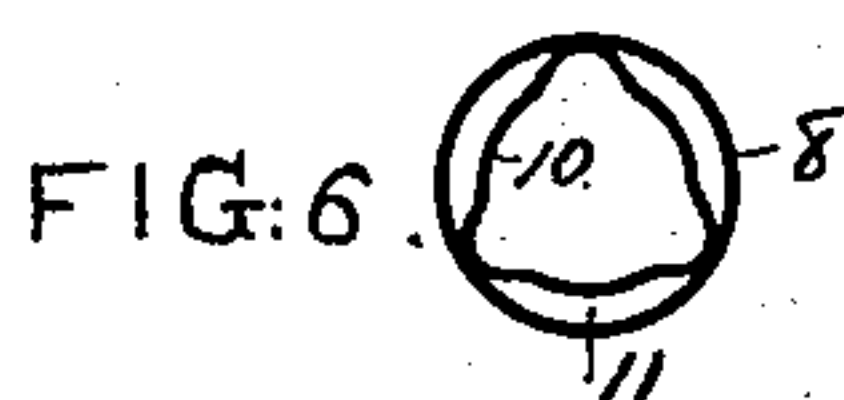


FIG. 3.

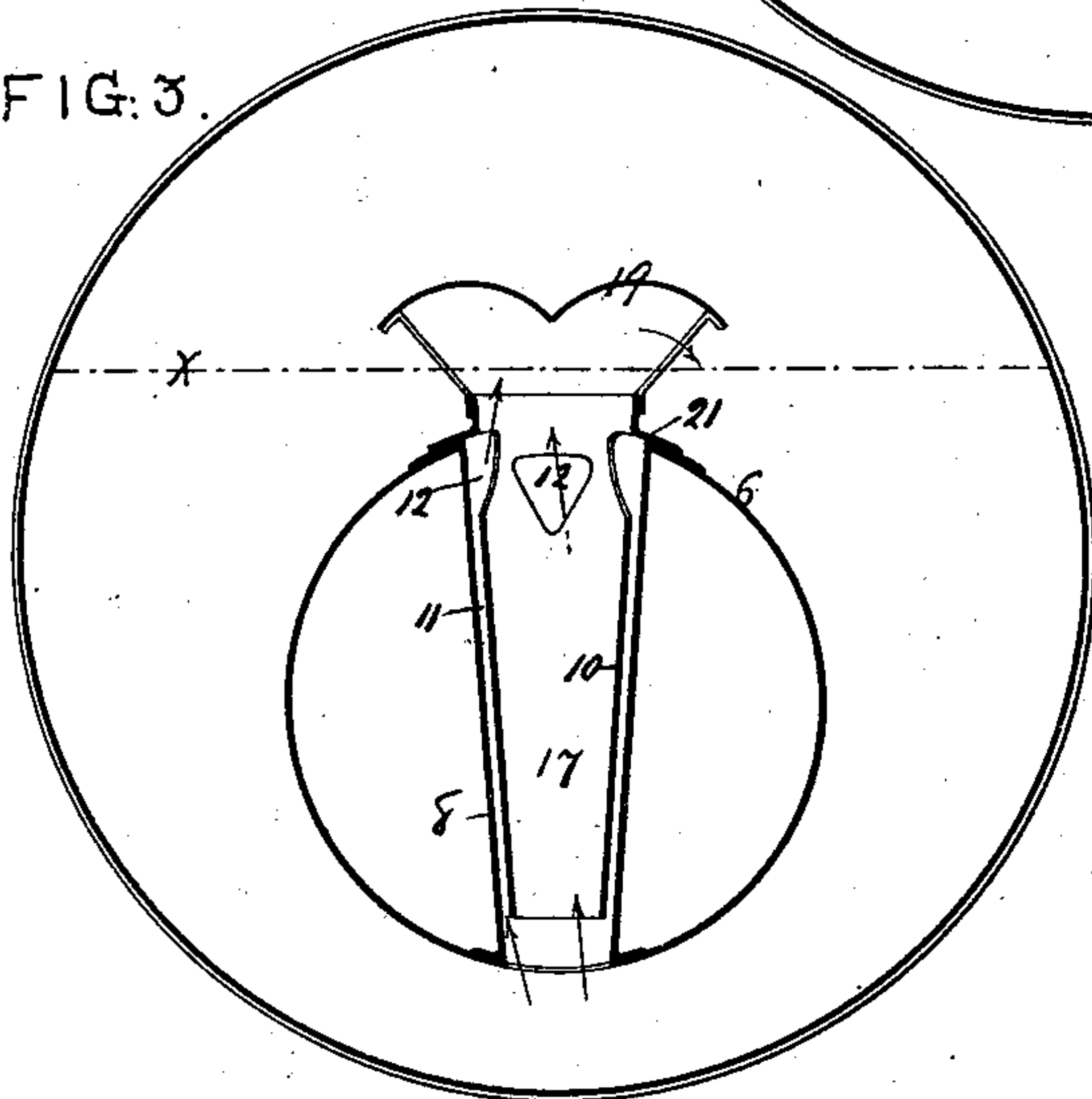
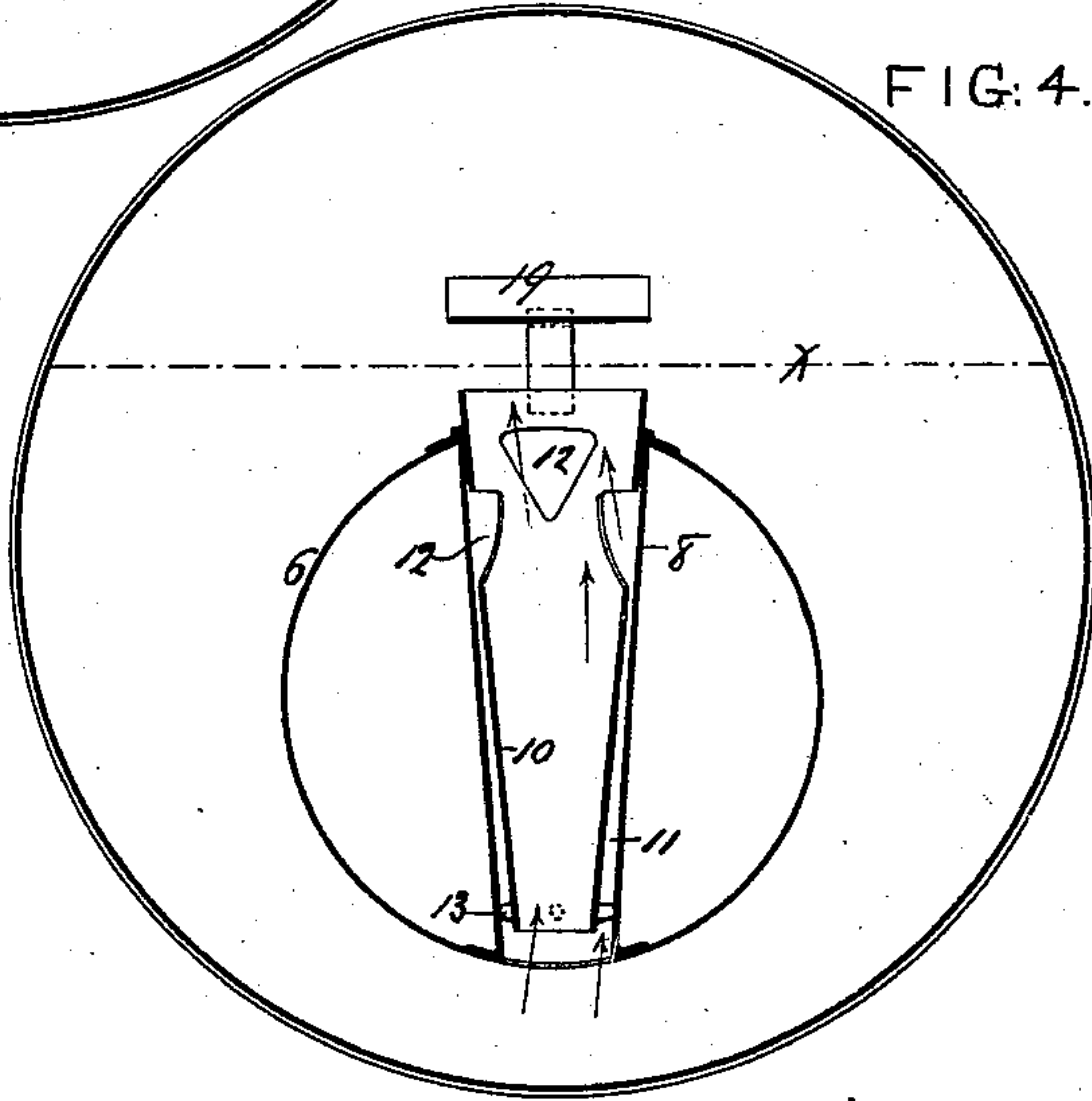


FIG: 4.



Witnesses:

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John Revell

Inventor:

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By his Attorneys  
Horton and Horton



# UNITED STATES PATENT OFFICE.

ROBERT GEORGE RUFFLES, OF LONDON, ENGLAND.

## STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 507,169, dated October 24, 1893.

Application filed June 20, 1890. Serial No. 356,071. (No model.) Patented in England May 7, 1890, No. 7,121.

*To all whom it may concern:*

Be it known that I, ROBERT GEORGE RUFFLES, engineer, a subject of the Queen of Great Britain and Ireland, and a resident of Pimlico, in the county of Middlesex, England, have invented certain Improvements in or Applicable to Steam-Generators, (for which I have applied for British Letters Patent No. 7,121, dated the 7th day of May, 1890,) of which the following is a specification.

This invention relates to certain improvements in or applicable to steam generators, and by means of which the circulation of the water will be rendered extremely active and the generation of steam will be materially facilitated. The invention is equally applicable in facilitating the circulation and ebullition of other liquids in analogous apparatus.

The invention consists in applying to steam generators or boilers or other apparatus in which the generation of steam or the ebullition of a liquid is required to be effected, a tubular arrangement of the nature hereinafter described, through which the water or liquid is caused to circulate, and wherein the main body of the water circulating therein is caused to be surrounded or partially surrounded by a tubular film of such water in communication at lower and upper parts of the film-containing chamber with the surrounding body of water, and wherein such film of water is caused to be subjected to the full steam generating or evaporating effect of the fire; which arrangement is resultant in causing an exceedingly rapid circulation of the said film of water and conversion thereof into steam, which continuously escaping into the said surrounded body of water at the said upper communication therewith, is effective in inducing a rapid and continuous circulation of the water both through the inner tube and into the main water space and also through the film-containing chamber.

On the accompanying drawings, Figures 1, and 2, represent sectional elevations illustrating the application of the invention to a vertical boiler or the like, and Figs. 3, 4, and 5, represent like views illustrating the application of the invention to the water tubes of a flued horizontal boiler. Figs. 6 and 7 represent sectional views of modifications.

Like index figures indicate like parts wherever they are repeated on the drawings.

6, represents the crown or top of a fire box, 7, see Fig. 1, or it may be the bottom of a water container, 18, intended to be placed or situated above a fire box or combustion chamber, 7, see Fig. 2.

8, represents an open topped tube which depends from and may be flanged and bolted or otherwise suitably secured to the plate, 6, and may be closed at its bottom see Fig. 2, if fed in the manner hereinafter described with reference to this figure, or may be connected at such part with an under pipe, 9, see Fig. 1, if fed in the manner hereinafter described with reference to this figure.

10, represents an open tube which depends within the tube, 8, preferably for the full length thereof or nearly so, and may be adapted to fit more or less snugly into the top end of such tube, see Fig. 1, or may be flanged and bolted or otherwise suitably secured to the plate, 6, see Fig. 2. The tube, 10, is placed concentrically within the tube, 8, so as to form between the two an annular space, 11.

At a part immediately adjacent to its top connection with the tube, 8, the tube, 10, is formed with through apertures, 12, of any suitable shape, size and disposition, or it may be slit and indented or otherwise equivalently formed or adapted so as to provide at such part means of communication between the top and upper part of the annular chamber, 11, and the interior of the tube, 10. The lower part of the tube, 10, may be kept concentric with the tube, 8, by projecting studs, 13, or in any other suitable manner. The bottom part of the annular chamber, 11, freely communicates with the mainway of the tube, 10, through suitably formed openings, 14, or it may be quite open at such part as in the modifications illustrated in Figs. 3 to 5.

The tube, 10, may terminate immediately above the plate, 6, see the dotted line, *a*, if the tubes 8, 10, be fed in a manner analogous to that represented in Fig. 1, or it may be continued above the plate, 6, for a short distance, see the dotted line *b*, or it may terminate just below the water level, and it may be left erect and provided with a dash-plate 19, as also shown in dotted lines or it may be bent over



and terminate partly above and partly below the water-line,  $x$ , see Fig. 1, or it may be continued above the water line see Fig. 2.

The tubes, 8, and 10, may be fed by an under feeding pipe, 9, see Fig. 1, or by an inner open tube, 15, inserted through the tube, 10, with its upper end extending into the main water space, 20, and its lower end freely communicating with the surrounding concentric annular chambers, 16, and, 11, see Fig. 2. The plate, 6, may be fitted with any required series of such improved attachments, and the pipes, 9, feeding such series may lead from under mains supplied by other pipes leading preferably from the bottom of the boiler or water container.

The tubes, 8, and, 10, and the intervening chamber, 11, may be of a conical formation (as hereinafter described) instead of a parallel sided formation as hereinbefore described.

In the modifications represented in Figs. 3, to, 5, the invention is represented as applied to water tubes, 8, of flued boilers, to which it is equally applicable whether such tubes be of a parallel sided or of a conical formation. In such an application, such water tubes, 8, act as the aforesaid tubes, 8, and the inner tubes 10, are applied thereto, as aforesaid, so as to divide off from the main throughway, 17, a surrounding annular chamber, 11, of any desired longitudinal extent in communication at its upper and lower parts with such main throughway as aforesaid.

In Fig. 3, the tube, 10, is shown as made with a flange, 21, bolted to the flue, 6, and the chamber, 11, is shown as of a parallel sided formation.

In Fig. 4, the tube, 10, is shown as slipped tightly into the tube, 8, and the chamber, 11, is shown as of a tapering formation narrowing toward the top.

In Fig. 5, the tube, 10, in section, is shown as fitting into a ring, 23, bolted to the flue, and in dotted lines as in the modification represented in Fig. 3.

In the foregoing modifications, the chamber, 11, and film of water are shown as entirely surrounding the main body of water circulating through the tube, 10, but in the modification represented in Figs. 6, and 7, the chamber, 11, is shown as subdivided so that the film of water partially surrounds the said body of water, and this subdivision of the chamber, 11, may be effected either by using a plain cylindrical or tapering tube, 8, and a fluted tube, 10, as represented in Fig. 6, or by using a fluted tube, 8, and a plain tube, 10, as represented in Fig. 7. In all such modifications, the rapid generation of steam from the film of water within the chamber, 11, exposed to the fire, and its escape into the water in the mainway of the inner tube, will cause a continuous circulation of the water both through such tube and the chamber, 11, as indicated by the several arrows.

I claim as my invention—

1. In combination, an inner open tube forming a mainway for the circulating water, and an outer tube exposed to the fire such tubes being so arranged as to inclose between them an annular chamber closed at the top except where it opens into the mainway through the inner tube whereby a rapid circulation upward through both tubes is secured, substantially as set forth.

2. In combination, an inner open tube forming a mainway for the circulating water, an outer tube exposed to the fire, such tubes being so arranged as to inclose between them an annular chamber and film of water in communication at its top and bottom with the mainway through the inner tube and operating as set forth, and an inner feeding pipe so arranged as to lead the water or liquid from one part of the generator to within such tubes at a position adjacent to the bottom communication of the annular chamber with the mainway through the inner tube, as set forth.

3. In combination, an inner open tube forming a mainway for the circulating water, an outer tube exposed to the fire, such tubes being so arranged as to inclose between them an annular chamber and film of water in communication at its top and bottom with the mainway through the inner tube and operating as set forth, and an outer feeding pipe so arranged as to lead the water or liquid from one part of the generator to within such tubes at a position adjacent to the bottom communication of the annular chamber with the mainway through the inner tube as set forth.

4. In combination, an inner open tube forming a mainway for the circulating water, and an outer tube exposed to the fire, such tubes being so arranged as to inclose between them an annularly disposed subdivided chamber and film of water in communication at its top and bottom with the mainway through the inner tube and operating as set forth.

5. In combination, an inner open tube forming a mainway for the circulating water, an outer tube exposed to the fire, such tubes being so arranged as to inclose between them an annularly disposed subdivided chamber and film of water in communication at its top and bottom with the mainway through the inner tube and operating as set forth, and an inner feeding pipe so arranged as to lead the water or liquid from one part of the generator to within such tubes at a position adjacent to the bottom communication of the annular chamber with the mainway through the inner tube, as set forth.

6. In combination, an inner open tube forming a mainway for the circulating water, an outer tube exposed to the fire, such tubes being so arranged as to inclose between them an annularly disposed subdivided chamber and film of water in communication at its top and bottom with the mainway through



the inner tube and operating as set forth, and  
an outer feeding pipe so arranged as to lead  
the water or liquid from one part of the gen-  
erator to within such tubes at a position ad-  
5 jacent to the bottom communication of the  
annular chamber with the mainway through  
the inner tube as set forth.

In testimony whereof I have signed my

name to this specification in the presence of  
two subscribing witnesses.

ROBERT GEORGE RUFFLES.

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