

No. 724,564.

PATENTED APR. 7, 1903.

C. H. FOX.
STEAM GENERATOR.
APPLICATION FILED APR. 14, 1902.

NO MODEL.

Fig. 1

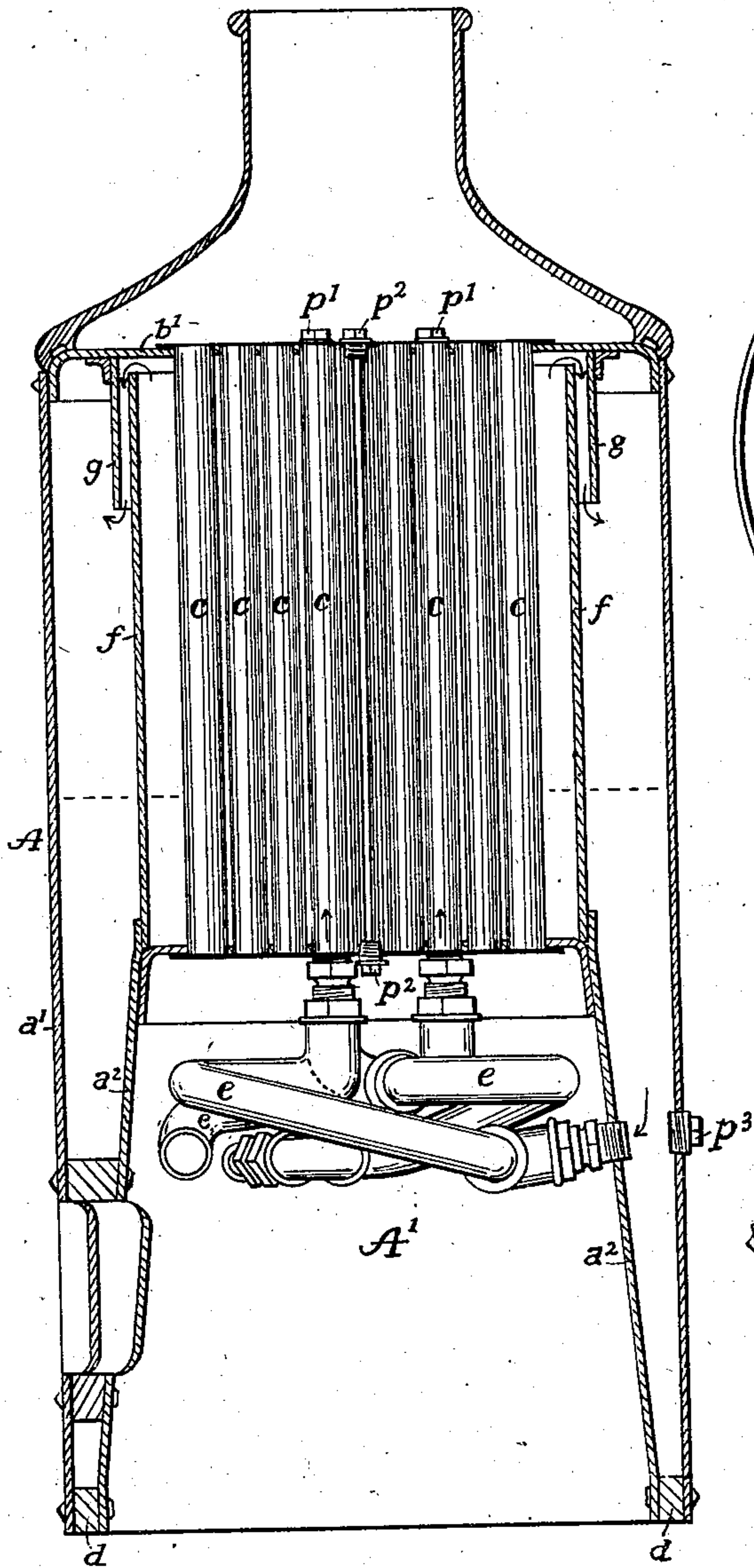


Fig. 2

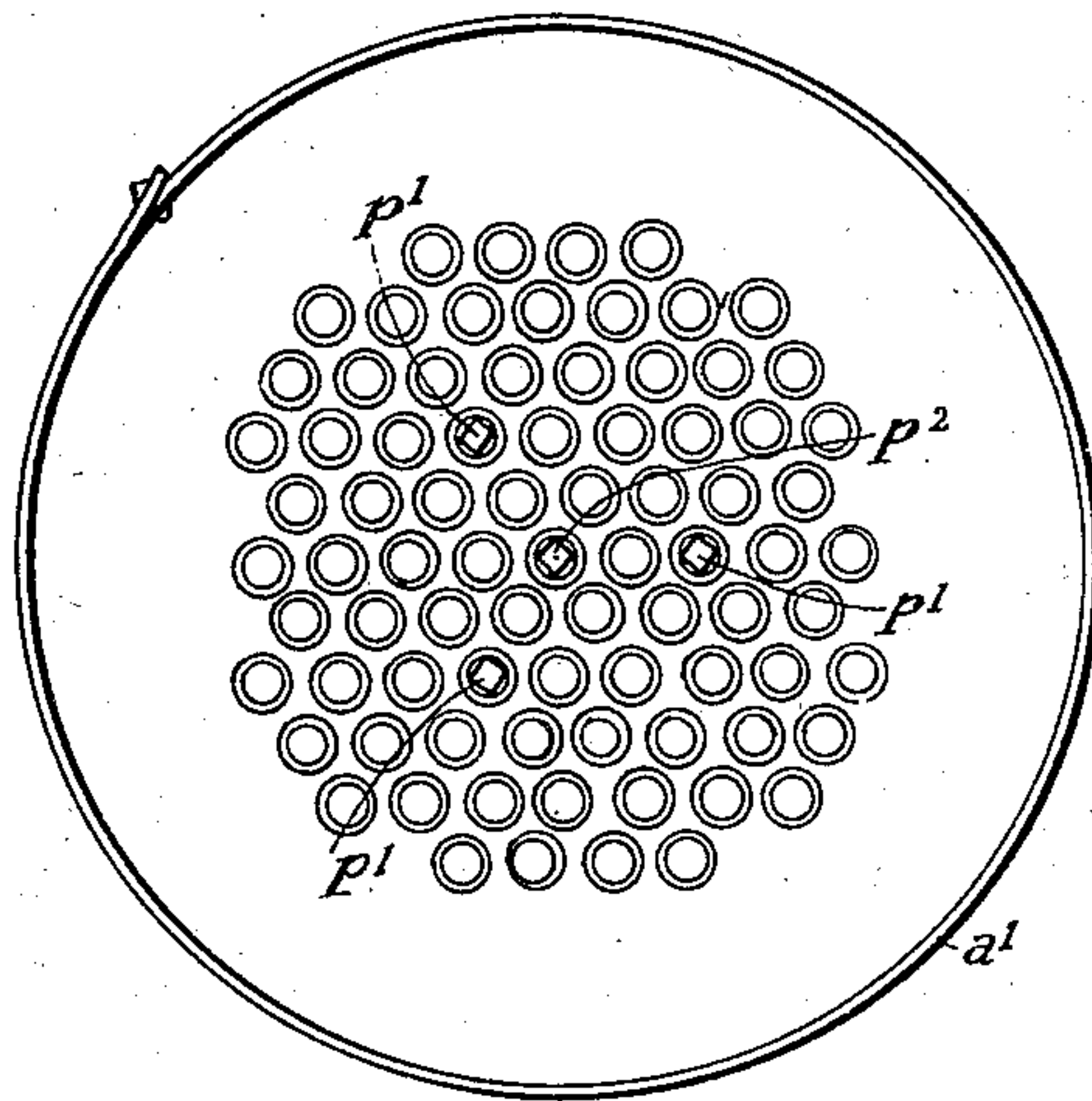
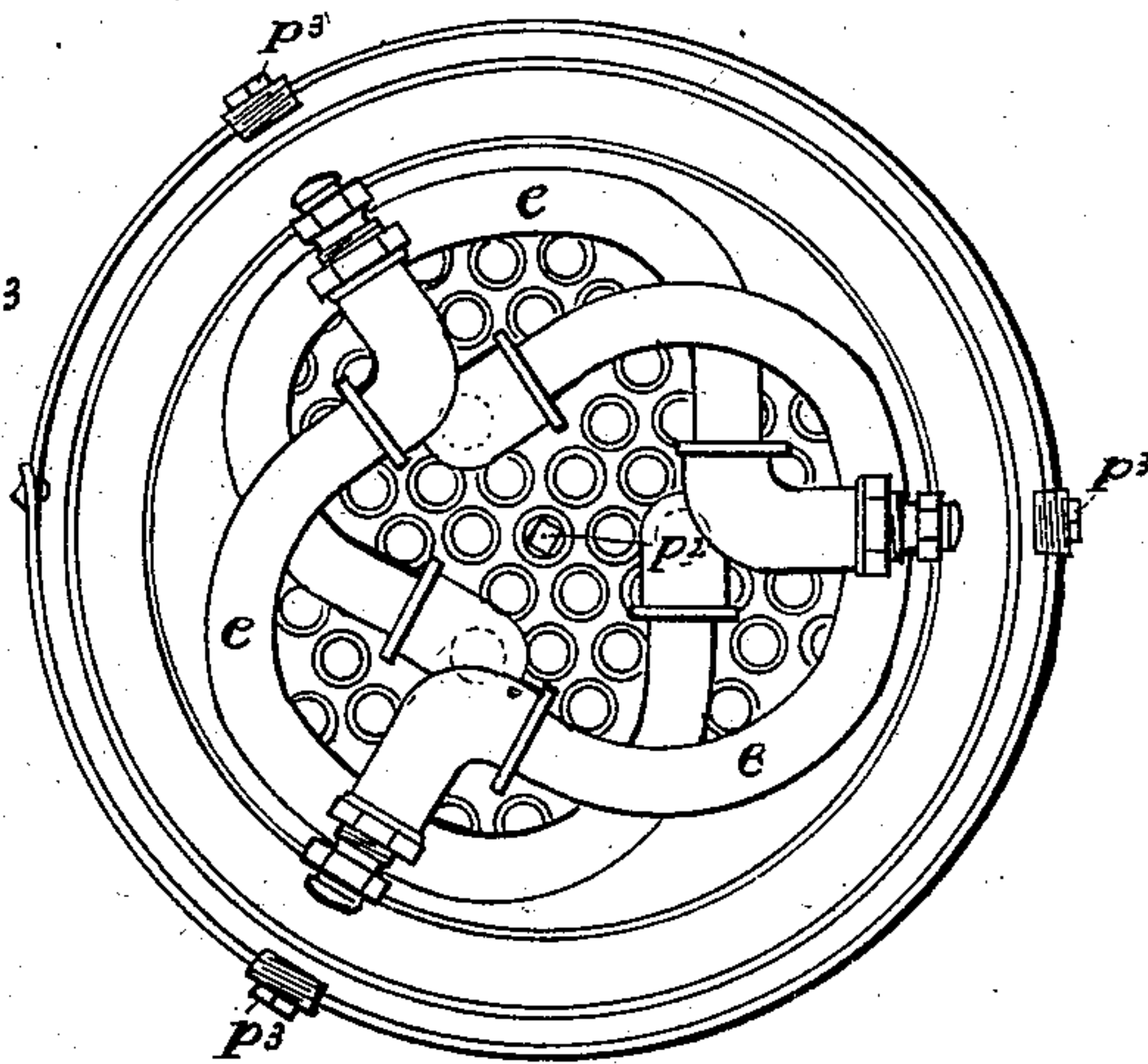


Fig. 3



Witnesses.
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UNITED STATES PATENT OFFICE.

CHARLES H. FOX, OF CINCINNATI, OHIO.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 724,564, dated April 7, 1903.

Application filed April 14, 1902. Serial No. 102,818. (No model.)

To all whom it may concern:

Be it known that I, CHARLES H. FOX, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented new and useful Improvements in Steam-Generators, of which the following is a specification.

My invention relates to steam-generators of the vertical type embodying a concentric water-jacketed fire-box and vertical smoke-flues, thence through the water and steam-space to the smoke-stack, and is intended to obviate some of the disadvantages attending the ordinary constructions of this type and produce a generator of high efficiency, economical construction, minimum weight, and great durability, especially adapted to a wide range of modern usefulness—such, for example, as use in steam fire-engines, automobiles, yachts, and other portable structures, besides the more ordinary uses of such generators.

To these ends my invention consists in the generator or “boiler” embodying the several novel features hereinafter pointed out and claimed, which may be used separately or in combination to attain the advantages set forth.

A structure embodying the several features constituting my improvements in preferred form is illustrated in the accompanying drawings, in which—

Figure 1 is an axial section in elevation of a generator constructed according to my improvement. Figs. 2 and 3 are top and bottom plan views, respectively, showing the relative tube arrangement and the construction of the lower “feeder” or circulating-tubes.

Referring now to the drawings attached to and forming part of this specification, the generator A consists of a cylindrical outer shell a' , having an upper tube-head b' , perforated for smoke-flues c , a circular fire-box shell a^2 , arranged concentrically within the shell a' and connected therewith at the bottom by the ring d in the usual manner, and having a crown-sheet or tube-head, perforated for the tubes c , correspondingly with the upper or main tube-head b' . These parts, with the tubes or smoke-flues c , uniting the tube-heads b' b^2 , constitute the ordinary generator of this type to which my improvements are applied, as now to be described.

First. The side wall or shell a^2 of the fire-box A', I form in conical shape to give a slanting inner surface and secure a relatively larger grate area, with the result also of providing a relatively enlarged annular water and steam area between the system of smoke-flues and the outer shell a' . The smoke-flues are thus relatively confined to a central space in relation to the upper tube-head, which affords better opportunity for the expansion of the tube system by reason of the resiliency of the top head without impairing the tube-joints. I am thus enabled, if desired, to employ copper or brass smoke-flues, with the advantages of their greater heat conductivity, notwithstanding their higher rate of expansion in connection with sheet-iron or sheet-steel shells. To the same end also and in view of the function of the tubes as ties or stay-braces I may employ a top head of thinner and more resilient sheet metal, thus providing most perfectly against the evils of expansion and contraction.

Second. To increase the circulating capacity, I extend the fire-box chamber A' somewhat higher than usual and employ in the upper part of the space thus afforded a system of circulating-tubes, as many as may be conveniently disposed, entering the water-space of the generator vertically through the crown-sheet b^2 and connecting laterally with the annular water-jacket through the fire-box shell a^2 below. The detail construction and fitting of these are such as is commonly practiced, excepting that the receiving and discharge terminals of each are connected by a tube e , bent to a “horseshoe” curve and disposed with an upward slant, the several tubes being thus enabled to pass and overlap each other in relative position without interference, the fittings and connections being such as to allow the ready removal or replacing of any one without disturbance of the others. The vertical discharge ends of the system are preferably arranged near the center of the system of smoke-flues c for reasons to be explained.

Third. In connection with these features of structure I employ what may be termed a “dam”—a cylindrical partition f , connecting with the fire-box wall a^2 and extending upward nearly (but not quite) to the main tube-head b' —completely surrounding the system of smoke-flues c and interposed between them

and the outer shell a' . This dam or annular partition f is of light material and practically extends the water-jacket of the fire-box to near the top of the boiler. In connection with said dam f I employ a short annular shield g , depending from the main tube-head b' a little outside of the dam f , as shown.

The purpose of these constructions and the mode of operation may now be explained. The system of circulating or feed tubes e under the influence of heat draw the cooler water from the water-jacket surrounding the fire-box and discharge the same upwardly between and centrally in relation to the system of smoke-flues c . The violent ebullition caused by the intense heat to which the circulating-tubes are exposed is continued by the heated tubes c , and the steam and entrained water are carried upward against the main tube-head b' and find exit radially outward only over the top of the dam f and are thence deflected downward by the shield g , and then the circuit is established upward in the central part of the boiler and downward at the outer portion, assisted by the natural effect of radiation and exposure of the outer surfaces of the boiler to the cooling effects of the atmosphere; but it will be observed also that the promotion of circulation centrally amid the nest of tubes carries the entrained water to the upper tube-head, and by its dispersion outward it is thus brought in contact with the upper tube-joints and protects them against overheating. It will also be observed that by the deflecting function of the shield g in relation to the overflow from the dam f the entrained water falls directly downward adjacent to the outer side of the dam f , while the steam is permitted to escape to the annular outer space between the shield g and the outer shell a' , from which space dry steam for use may be taken. While in use the water within the dam f will under the influences before described stand at a higher level than that without, thus further protecting the flue system, while giving at the same time an increased steam-space without and also increasing the evaporative efficiency.

For convenience of cleansing, plugs p' are inserted in the upper tube-head opposite the discharge-orifices of the circulating-tubes e , and a central flue of the system may be omitted and plug p^2 p^2 inserted in the upper tube-head b' and fire-box crown-sheet b^2 to facilitate the introduction of a hose-nozzle for cleaning purposes. Like plugs p^3 may be inserted through the outer shell a' , opposite the receiving ends of the circulating-tubes e . Suitable "manholes" may be provided for access to the water-jackets in the usual manner and may be carried also through the annular dam, with suitable closures to reach the crown-sheet.

It will thus be seen that the structure de-

scribed constitutes a generator of extreme simplicity of construction, providing for the conservation of heat to the best advantage, the freest circulation of water from within outward, and affording the best possible protection to the flues and joints, with the greatest facility of removal and replacing of the circulating-tubes most exposed to the direct heat of the fuel employed for combustion. The structure is at the same time relatively light, compact, and well adapted to various modern uses.

I claim as my invention and desire to secure by Letters Patent of the United States—

1. On a steam-generator of the character indicated the combination of a system of circulating-tubes connecting the crown-sheet of the fire-box with the water-jacket surrounding the same and an annular dam or partition surrounding the smoke-flues extending above the fire-box and terminating substantially a short distance below the upper tube-head, substantially as set forth.

2. On a steam-generator of the character indicated the combination of a system of circulating-tubes connecting the crown-sheet of the fire-box with the water-jacket surrounding the same and an annular dam or partition surrounding the smoke-flues extending above the fire-box and terminating substantially a short distance below the upper tube-head, and a concentric shield or "deflector" depending from the upper tube-head and inclosing the upper end of said dam, substantially as set forth.

3. The combination in a steam-generator of the character indicated, of the conical fire-box; and the system of substantially horizontal, curved circulating-tubes connecting with the crown-sheet of the fire-box said tubes arranged in concentric overlapping series, substantially as set forth.

4. On a steam-generator of the character indicated, a conical fire-box extending abnormally upward, in combination with a series of substantially horizontally disposed, curved tubes seated in the contracted upper space thus afforded and entering the fire-box crown-sheet vertically and the conical side wall laterally substantially as and for the purpose set forth.

5. On a steam-generator of the character indicated, in combination with the circulating-tubes entering the crown-sheet of the fire-box, the apertures and plugs correspondingly arranged in the upper tube-head, as and for the purpose set forth.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

CHARLES H. FOX.

Witnesses:

LEWIS M. HOSEA,
CHAS. HERBERT JONES.