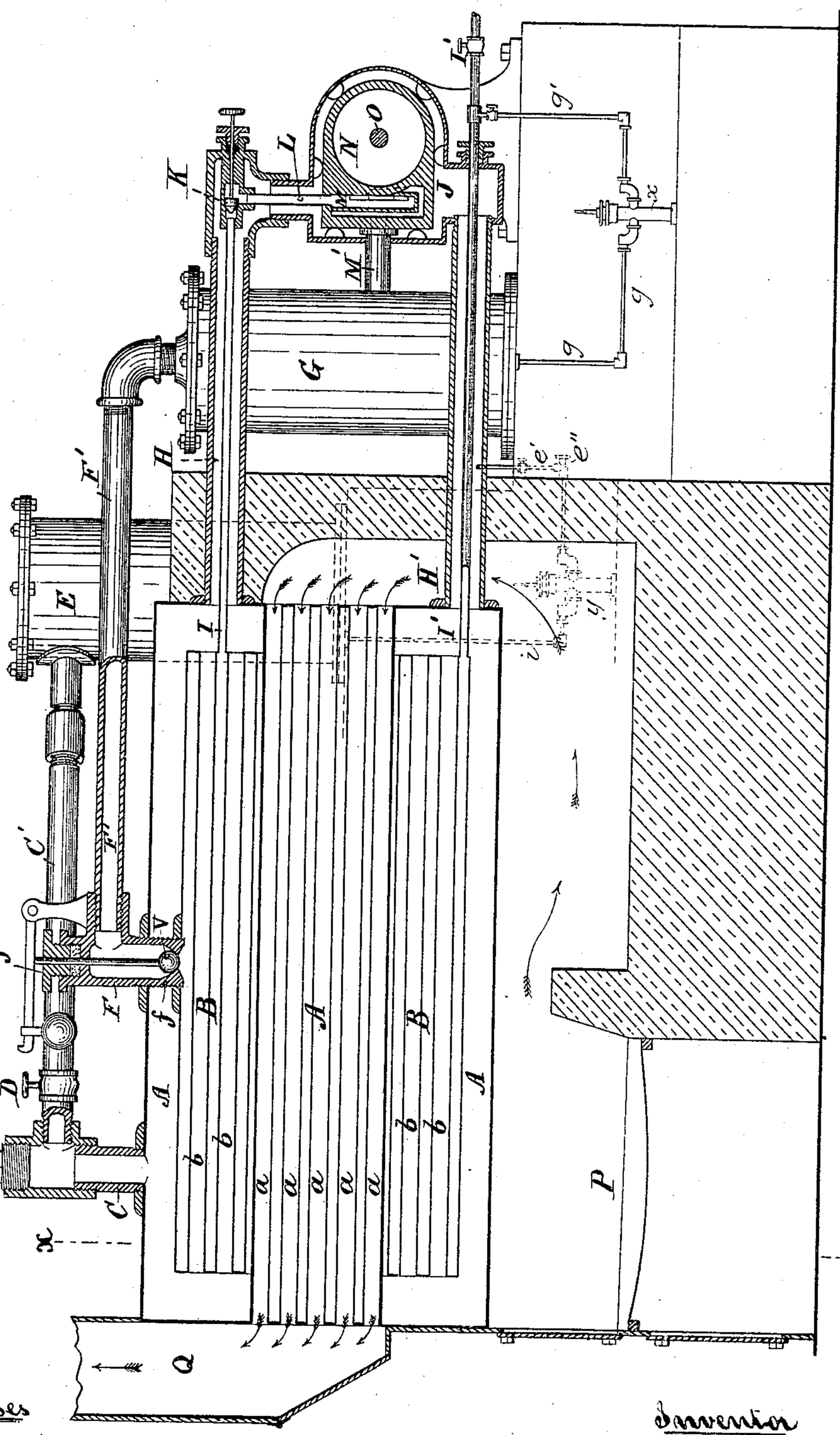
(No Model.)

2 Sheets—Sheet 1.

M. CHASE.

VAPOR GENERATOR.

No. 326,478. Patented Sept. 15, 1885.



Witnesses
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Inventor
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Attorney.

(No Model.)

2 Sheets—Sheet 2.

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FIG. 2.

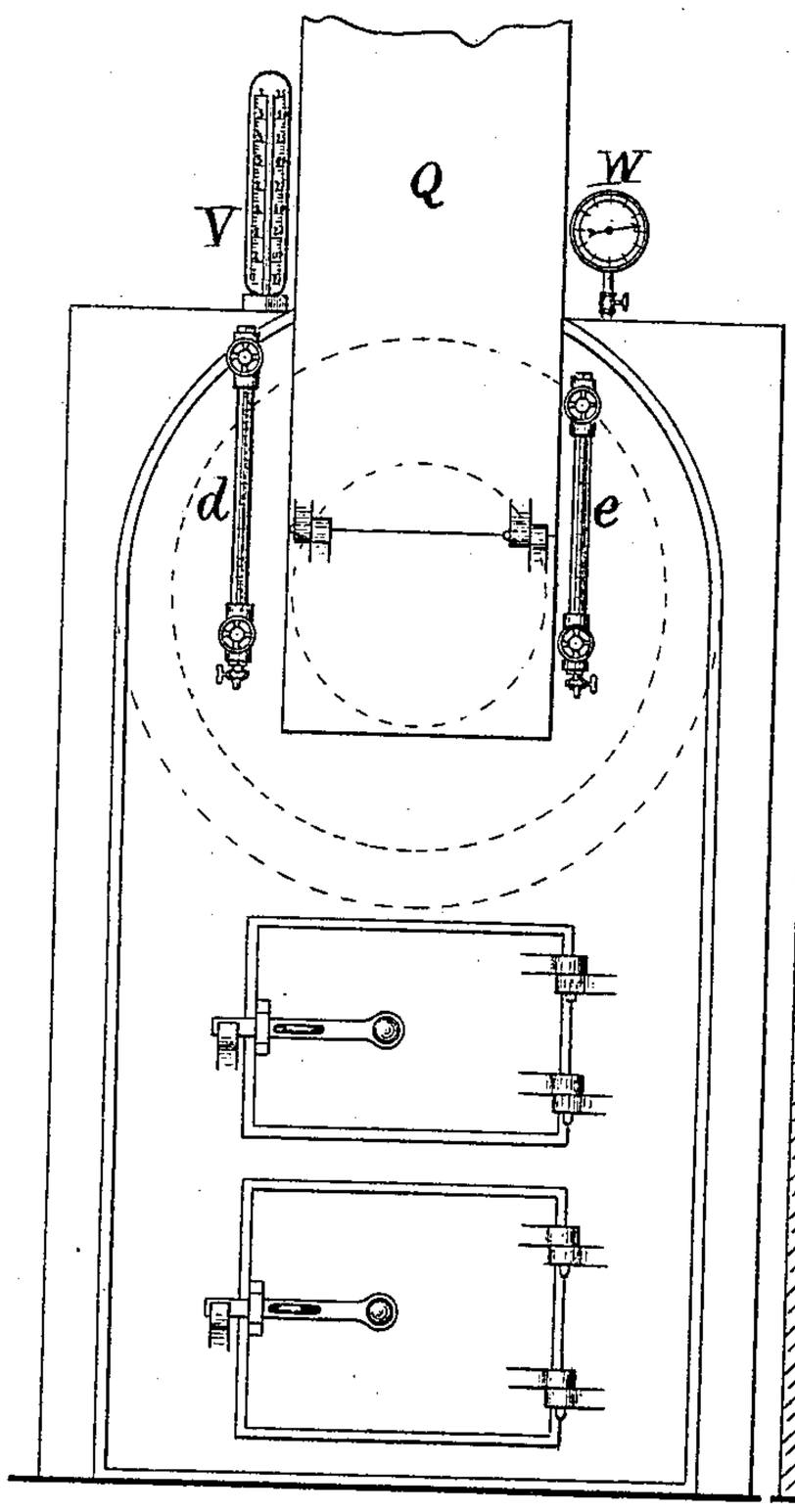


FIG. 3.

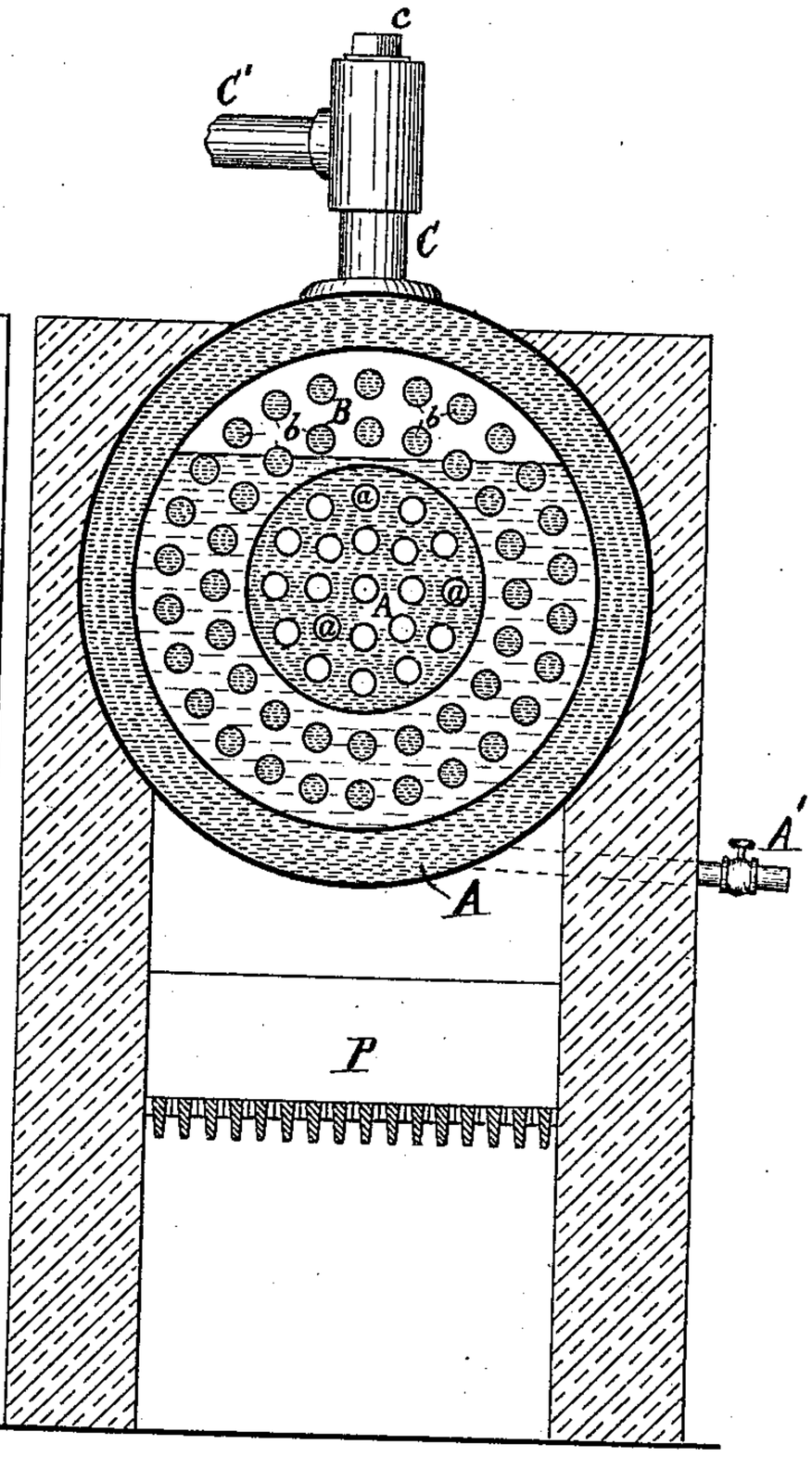


FIG. 4.

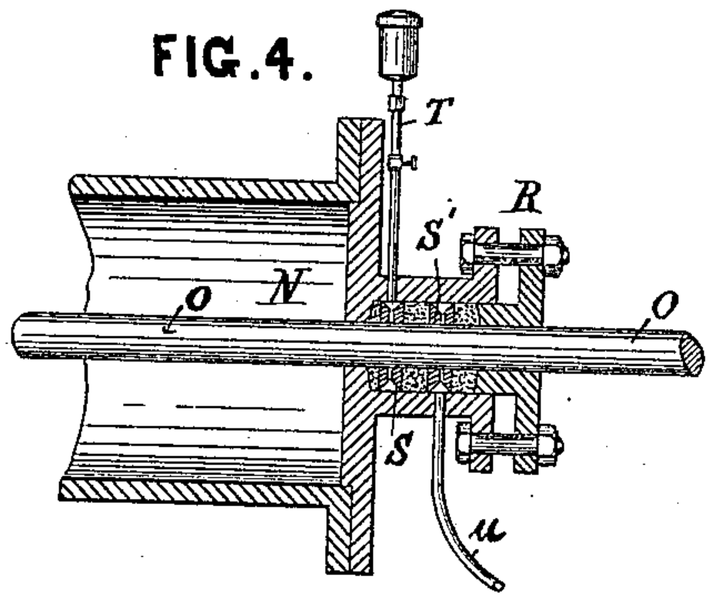
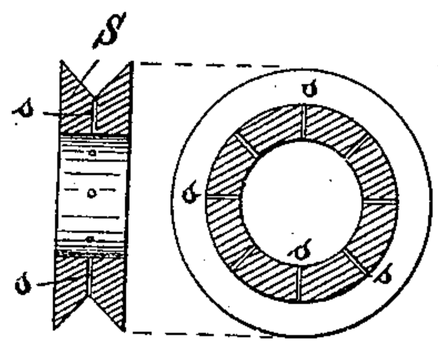


FIG. 5.



Witnesses

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UNITED STATES PATENT OFFICE.

MILTON CHASE, OF HAVERHILL, ASSIGNOR OF ONE-HALF TO HORACE CHASE, OF BOSTON, MASSACHUSETTS.

VAPOR-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 326,478, dated September 15, 1885.

Application filed May 3, 1884. (No model.)

To all whom it may concern:

Be it known that I, MILTON CHASE, a citizen of the United States, residing at Haverhill, in the county of Essex and State of Massachusetts, have invented a new and useful Improvement in Vapor-Generators, of which the following is a specification.

My invention relates to an improved method and means for generating vapor or gas for the development of power; and it is intended to utilize any of the chemicals or volatile liquids which boil at a comparatively low temperature, as hereinafter fully set forth.

I am aware that attempts have been made to utilize certain chemicals for the production of power; but the inflammable character of most of them and the difficulty of maintaining a continuous or uniform pressure have been serious obstacles to their adoption.

The method usually employed for utilizing volatile liquids for the development of power consists in the use of the exhaust-steam from a steam-engine; but this has proved unsatisfactory in practice. Another method consists in taking steam directly from the boiler and using such steam for heating another boiler containing the volatile liquid.

My invention consists, first, in a method of applying heat to the volatile liquid, which I accomplish by inclosing the boiler containing such liquid in another boiler of larger dimensions and filling the space between the two with a chemical solution or other liquid, which boils at the temperature which is sufficient to generate the amount of working-pressure I wish to obtain from the volatile liquid. By this means it is impossible to overheat the volatile liquid, and so any liability to set it on fire is avoided, the outer boiler being connected by a safety-pipe to a condenser, which prevents any excess of pressure or heat in the boiler.

My invention further consists in the construction of the boilers and their connections with the engine-cylinder by means of the feed-pipe and circulating-pipes, which are so arranged and combined as to prevent condensation of the vapor and consequent loss of power.

The invention further consists in certain details of construction, more fully hereinafter set forth.

Referring to the accompanying drawings, Figure 1 is a vertical longitudinal section of an apparatus embodying my invention. Fig. 2 is a front elevation. Fig. 3 is a vertical transverse section on the line *x x* of Fig. 1. Fig. 4 is a longitudinal section of the stuffing-box and the "cages" or rings, and Fig. 5 shows a transverse and a vertical section of the cages or rings on an enlarged scale.

A represents the larger or exterior boiler, in which is placed a solution which boils at a sufficiently high temperature to generate the requisite amount of working-pressure from the volatile liquid. Of the chemical employed for this purpose the following I consider the most effective, viz: nitrate of ammonia, which increases the boiling-point of water from 1° centigrade to 388° Fahrenheit in a saturated solution, ten parts elevating the temperature 1° centigrade, and 20.84 parts form a saturated solution; acetate of potash ranges from 1° centigrade to 368° Fahrenheit, ten and one-half parts to seven hundred and ninety-eight parts saturated solution; nitrate of lime, 1° centigrade to 334° Fahrenheit, fifteen parts to three hundred and sixty-two parts; acetate of soda, from 1° centigrade to 292° Fahrenheit, ten parts to two hundred and nine parts; chloride of ammonium elevates from 1° centigrade to 69° Fahrenheit, eight parts to two hundred and nine parts; phosphate of soda, 1° centigrade to 232° Fahrenheit, eleven parts to one hundred and twelve parts.

Within the boiler A is inclosed a smaller boiler, B, which contains any suitable volatile liquid, of which the following may be mentioned as applicable: aldehyde, which boils at about 68° Fahrenheit; ether, which boils at about 95° Fahrenheit; bisulphide of carbon, which boils at about 110° to 119° Fahrenheit; acetone, which boils at about 133° Fahrenheit; ammonia, which boils at about 140° Fahrenheit; chloroform, which boils at about 142° Fahrenheit.

The contents of boiler A are drawn off through pipe A′.

Both boilers are provided with internal tubes. *a a* are the tubes in boiler A through which the products of combustion pass, and *b b* are the tubes in boiler B through which the solution passes from boiler A and circu-

lates to generate the vapor from the contents of boiler B.

C is a pipe attached to the top of boiler A and connects with the pipe C′, leading to a condenser, E. The object of this arrangement is to prevent any increase of temperature above the boiling-point of the liquid contained in boiler A.

The temperature of the contents of boiler A may be lowered to adapt the same to the working-pressure of the contents of boiler B by means of a vacuum created in the condenser connected with boiler A. This vacuum is caused by means of a pump, *y*, arranged below the condenser E, and connected with the same by means of a pipe, *i*. Attached to the pump *y* is also a pipe, *i′*, connecting with the circulating-pipe H′, for the purpose of returning the condensed vapor of chemicals contained in the boiler A. A valve, *i″*, connected with the pipe *i′* allows the air to escape to the atmosphere.

D is a stop-valve for regulating the opening in pipe C C′. The upper end of pipe C may have an opening provided with a screw-plug, *c*, for the introduction of the proper solution to the boiler A before any power is generated.

To the upper part of boiler B, and passing through the shell of boiler A, is a pipe, F, to which is connected a pipe, F′, leading to a condenser, G. At the upper end of pipe F is a safety-valve, *f*, the stem of which passes through a stuffing-box, *f′*. The object of this arrangement is to prevent any escape of vapor generated in boiler B to the atmosphere, and thus prevent any waste as well as avoiding any deleterious effects resulting from such escape, such as danger of inhalation or liability of combustion.

The condensed vapor in condenser G is returned to the boiler B through pipe I′ by means of a pump, *x*, connected by a pipe, *g*, to the bottom of condenser G. The pump *x* is also connected by the pipe *g′* to the supply-pipe I′, which passes through the circulating-pipe H′, whereby the liquid is heated as it passes through the said pipe to the boiler B. The pipe *g′* is provided with a suitable valve for the purpose of regulating or stopping the flow of the liquid contents of condenser G.

H H′ are pipes connected to boiler A, the pipe H leading to the cylinder-jacket J, through which latter the liquid circulates and is returned to boiler A through the pipe H′. This arrangement is for the purpose of preventing condensation of the vapor which is conducted to the valve-chest M, the latter being connected to the condenser G by the pipe M′.

I is a pipe connecting with boiler B, and, passing through pipe H, enters the valve-chest M of cylinder N, and is provided with a regulating-valve, K.

The pipe I conducts the vapor from boiler B to the steam-chest M, serving as the motive power, and is then reconducted to the condenser G, from whence it is returned to boiler B. The boiler B is supplied through pipe I′ from any suitable source.

P in Fig. 3 represents the position of the furnace, and Q, Fig. 2, the exit-flue.

Fig. 4 represents, on a somewhat enlarged scale, the end of cylinder N, provided with a stuffing-box, R, through which the piston-rod O passes.

Between the layers of the packing in the stuffing-box are placed two metallic rings or cages, S S′, each formed with a groove in the perimeter, and having radial openings or passages *s s* (see Fig. 5) extending from the center to the bottom of the groove, thereby furnishing a means of supplying a lubricant through a supply-pipe, T, to the piston-rod, as in the ring S. The passages *s* in the ring S′ serve to conduct any leakage from the cylinder N to and through the pipe *u*, which is to be connected with the condenser G, by which means all leakage of vapor or its condensation is prevented from escaping to the atmosphere. More than two of these conducting-rings may be used, if necessary.

A thermometer is connected with the boiler A, as shown at V, Fig. 2, and W is a pressure-indicator connected with the boiler B.

d and *e* are glass gages connected, respectively, with the boilers A and B.

The diameter of the central opening of the boiler B is about one-half of that of the shell, and when in use the said boiler is filled about two-thirds with the volatile liquid.

The boiler A is nearly filled with any solution of chemical salts more or less saturated to increase or diminish the boiling-point to correspond to the working-pressure of whatever liquid the boiler B contains, and so long as the safety-pipe is open to the condenser the pressure and temperature cannot increase above a certain point, and consequently must be uniform throughout the boiler, which renders the action perfectly safe and reliable.

What I claim as my invention is—

1. An apparatus for generating vapor or gas for the development of power, consisting of an inner smaller boiler for containing a volatile liquid and inclosed within a larger boiler containing a chemical solution, each boiler being connected to separate condensers and provided with suitable connections, substantially as set forth.

2. The boiler B, provided with a series of longitudinal tubes, *b*, through which circulate the contents of boiler A, in combination with and inclosed within boiler A, provided with longitudinal tubes at its central portion, through which pass the products of combustion from the furnace, substantially as set forth.

3. The combination, with the interior boiler, B, of the exterior boiler, A, provided with tube C, the pipe C′, having a valve, D, and the condenser E, as set forth.

4. The combination, with the boiler B, of the pipes H H′, the pipes I I′, provided each with a valve, the pipe L, valve-chest M, cyl-

inder N, and jacket J, substantially as set forth.

5. In a vapor-generator, the cage or ring S, constructed with a groove in its periphery, and passages S, leading from the groove to the center of the ring, in combination with the cylinder N, stuffing-box R, piston-rod O, lubricant-supply pipe T, the condenser G, and pipe *u*, substantially as and for the purpose specified.

6. In a vapor-generator, the cage or ring S′, constructed with a peripheral groove and radial passages *s*, in combination with the cylinder N, stuffing-box R, piston-rod O, discharge-pipe *u*, and condenser G, as and for the purpose set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

MILTON CHASE.

Witnesses:
J. H. ADAMS,
E. PLANTA.