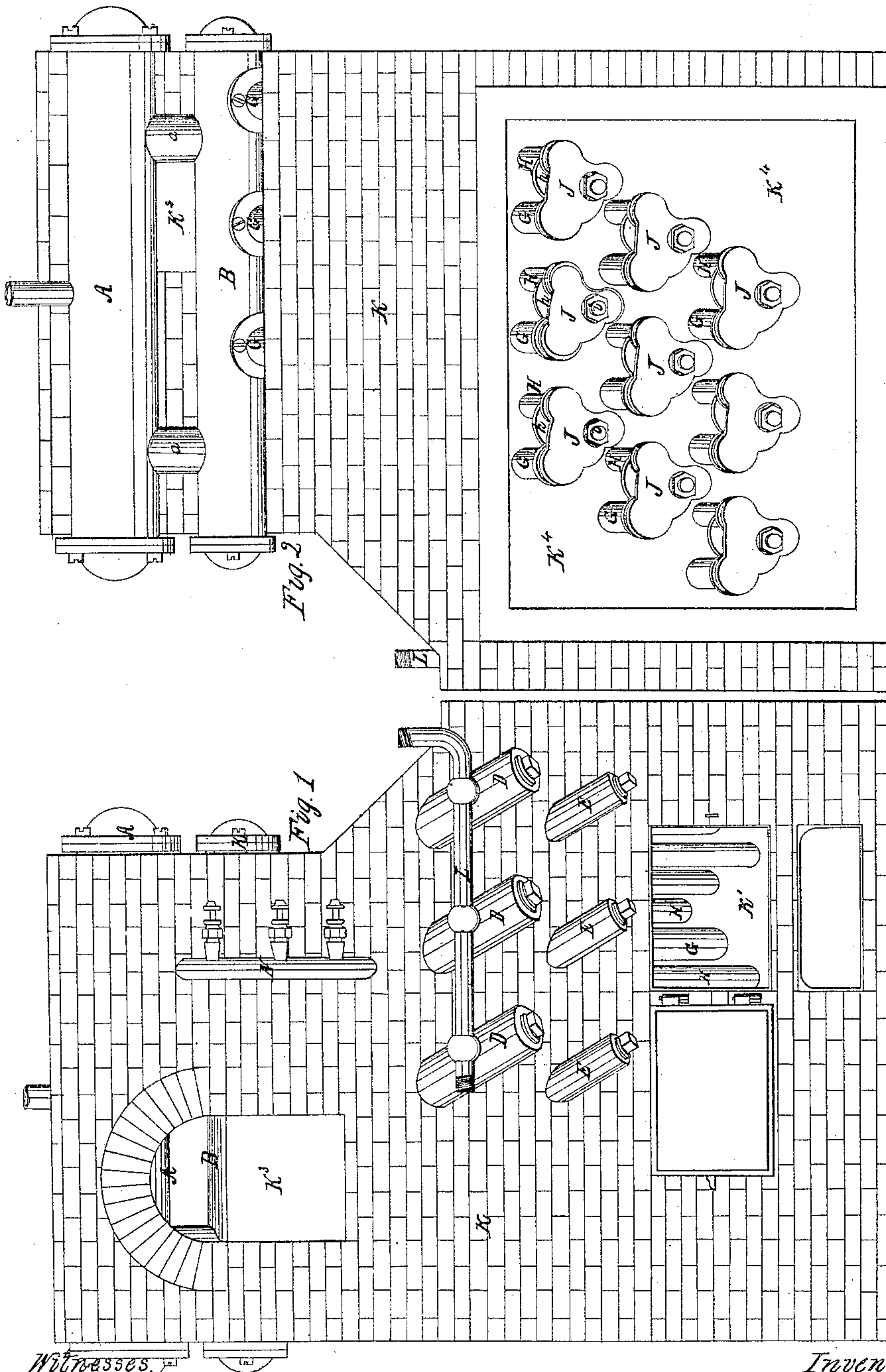


H. FEYH.  
STEAM GENERATOR.

No. 65,479.

Patented June 4, 1867.



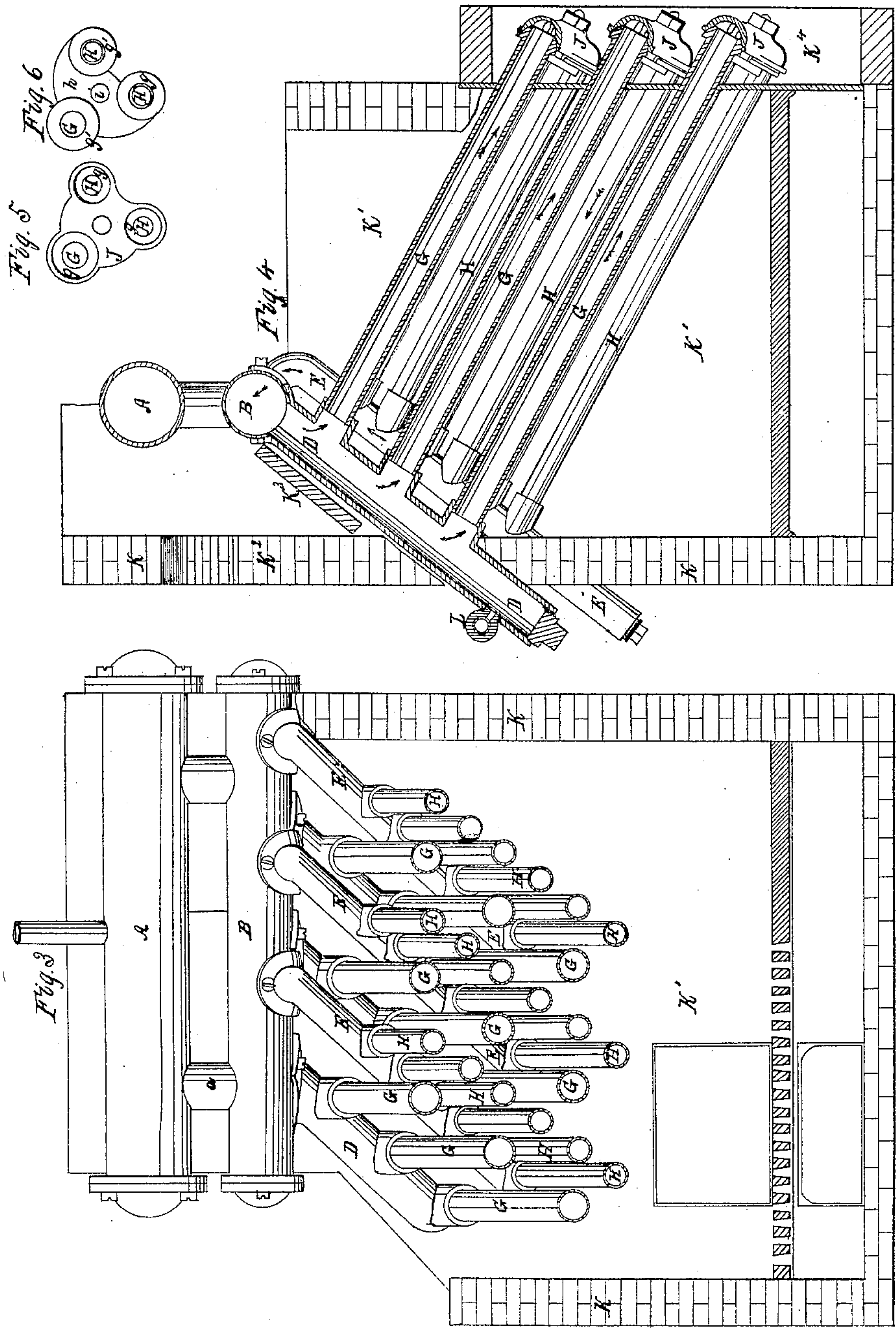
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# United States Patent Office.

HENRY FEYH, OF COLUMBUS, OHIO, ASSIGNOR TO HIMSELF, GEORGE T. EMERY, AND WILLIAM B. HAWKES, OF THE SAME PLACE.

*Letters Patent No. 65,479, dated June 4, 1867.*

## IMPROVEMENT IN STEAM GENERATORS.

*The Schedule referred to in these Letters Patent and making part of the same.*

### TO WHOM IT MAY CONCERN:

Be it known that I, HENRY FEYH, of Columbus, in the county of Franklin, State of Ohio, have invented a new and improved Water-Circulating Steam Boiler; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawing, making part of this specification, in which—

Figure 1, sheet 1, is an elevation of the front side of the improved steam boiler.

Figure 2, sheet 1, is an elevation of the rear side of the boiler, showing the connecting-boxes on the ends of the inclined large and small pipes.

Figure 3, sheet 2, is a transverse section, taken in a vertical plane through the boiler.

Figure 4 is a longitudinal section, taken vertically through the boiler.

Figures 5 and 6 show the mode of connecting the ends of inclined pipes together to provide for expansion and contraction.

Similar letters of reference indicate corresponding parts in the several figures.

The object of this invention is to more effectually carry into effect the principle set forth in my Letters Patent numbered respectively 60,496 and 60,870, of producing a rapid circulation and evaporation of water in steam generators, by having chambers of different capacities connected together and exposed to the heat of a furnace in such manner that the difference in temperature and evaporative qualities of these chambers shall cause a continual and forced flow of the water through them. In the specifications of said Letters Patent, the forced circulation of the water was produced by means of large and small pipes arranged within the fire space, and connected to a water-chamber surrounding said space. By these arrangements, water was conveyed from the boiler proper through the largest pipes, and thence into the smallest pipes, in which latter, steam was rapidly generated and conducted into the steam space above the water in the boilers.

The nature of my invention consists mainly in constructing a steam generator, operating upon the principle above set forth, entirely of tubes or cylinders of different diameters, which are connected together in such manner that when supplied with water and exposed to heat, the water will be caused to circulate freely and uninterruptedly through them, and thus create a rapid evaporation or generation of steam. And in conjunction with such arrangement, it further consists in having the several tubes composing the generator so connected and arranged within a furnace that access can be had to each tube for cleaning it from the outside of the furnace: at the same time this generator will admit of being increased in capacity to any desired extent, without diminishing its strength, as will be hereinafter described. It also consists in the use of a steam superheating chamber; in conjunction with a steam generator, in which a forced circulation of the water is produced by exposing connected pipes of different capacities to the heat of the fire-box, as will be hereinafter described.

To enable others skilled in the art to understand my invention, I will describe its construction and operation.

In the accompanying drawings, A represents a horizontal steam-chamber or superheater, which is made of cylindrical form, and closed at its extremities by means of heads: so that by the removal of one or both of these heads access can be had to the interior of the cylinder. B represents a horizontal steam and water-chamber or receiver, of cylindrical form, and having removable heads, like cylinder A. The cylinder B, which may be arranged beneath the cylinder A, as shown, is connected to the latter by means of one or more steam ways *a a*, so that as rapidly as steam is formed in the lower cylinder B, it will be carried off and superheated in the upper cylinder. D D represent a number of inclined water-chambers, of cylindrical form, which are connected in a suitable manner to the lower side of the cylinder B, and arranged at proper distances apart, so as to form a number of water-legs, as shown in figs. 3 and 4. E E represent a number of inclined chambers or pipes of less capacity and diameter than the pipes D, and more directly exposed to the heat of the furnace. These pipes E are secured in a suitable manner to the cylinder B, so as to communicate therewith above the water line, and they are inclined in the same direction as the pipes D D, but in a different plane, as shown in figs. 3 and 4. G G represent inclined tubes, which are secured, at suitable distances apart, to the inclined pipes D D, one below the other, as shown in figs. 3 and 4; and H H represent inclined tubes, which are secured



at suitable distances apart to the inclined pipes E, one below the other, and which communicate at their lower ends with the larger pipes G G, by means of three-way couplings J.

It will be seen by reference to figs 3 and 4, that each one of the inclined pipes D has three inclined pipes or tubes of smaller diameter suitably secured to it, and that each one of the pipes E has six smaller pipes H H secured to it at regular intervals apart. The object is to have the pipes H collectively equal, or nearly so, in capacity to the pipes G G when taken collectively; or, in other words, it is desired to have the system of pipes of smaller diameter equal, or nearly so, to the system of pipes of greater diameter, both of which systems of pipes communicate with the steam and water-cylinder B. It is also desirable to have the inclined pipes G and H communicate at their lower ends in triples, as shown in figs. 2 and 4; one of the larger pipes, G, communicating with two of the smaller pipes H, so that the capacity of the pipes through which the ascending currents pass shall be commensurate with those through which the descending currents pass. By this arrangement the water will not be retarded in its circulation, but will be allowed to flow freely and continually through the two systems or banks of pipes from the chamber B, back into this chamber again. This generator is supported in a suitable manner, with a furnace, K, consisting of a fire-chamber, K<sup>1</sup>, escape flue K<sup>2</sup>, deflecting-plate K<sup>3</sup>, and an apartment, K<sup>4</sup>, in which latter the couplings of the pipes G and H are exposed, as shown in figs. 2 and 4.

The furnace may be constructed of brick, of any suitable form and capacity which will best expose the steam generator to the action of the fire, and admit of access to the ends of the pipes or cylinders composing this generator. The drawings represent the upper portion of the furnace open, but in practice this is not designed to be so, as the entire generator, with the exception of the extremities of its pipes and cylinders, will be enclosed, and subjected to the heat.

The deflecting-plate K<sup>3</sup> is arranged in an inclined plane, between the upper parts of the inclined pipes D and the exit flue K<sup>2</sup>, for the purpose of directing the heated products of combustion upward, and exposing the two horizontal cylinders A B to as much heat as possible. If desirable, a deflecting-plate may be interposed between the two rows of inclined pipes D and E, for the purpose of subjecting the pipes E to a more intense heat than the pipes D. The divisional plate which separates the chamber K<sup>4</sup> from the fire-chamber serves as a support for sustaining the lower ends of the large and small pipes or tubes G and H, and through this plate these tubes pass, as shown in figs. 2 and 4. The lower ends of the tubes G and H are connected together in triples, as above described, by means of three-way coupling-boxes J, which have concave sockets *g g g* formed in them for receiving enlargement *g' g' g'* of a corresponding shape and size, which are formed on the ends of the said pipes. By means of cross-heads *h*, and screw-bolts and nuts *i*, the coupling-boxes are secured firmly and tightly against the ends of the tubes, as shown in figs. 2 and 4. The object of thus applying the couplings J to the pipes G H is to secure perfectly tight joints, and at the same time provide for expansion and contraction of the parts, by having a kind of ball-and-socket joint for each pipe, which will allow of slight movement without causing leakage.

The pipe L, which is connected to the pipes D, outside of the furnace wall, is designed as a feed pipe for supplying water to the generator, and the cocks *p*, on vertical pipe M, are designed for gauge or try-cocks, for determining the quantity of water in the generator.

The generator should be filled with water to a point which is just below the upper ends of pipes E, and when this is done and heat is applied in the furnace, the water in the pipes G H, which are most exposed to the heat, will rise, while that which is in the pipes D D, which are least exposed to the heat, will descend and supply its place, thus creating a circulation, as indicated by the arrows in fig. 4. The large pipes D being less exposed to heat than the pipes G and H, the temperature of water in them will be lower than that of the water in the pipes E G H, consequently there will be a forced circulation of water in the generator, and the largest pipes will be constantly acting as feeder for the smaller pipes, within which latter steam is rapidly generated and conveyed directly into the steam-chambers, above the water level.

By the arrangement which I have shown there are three descending currents flowing rapidly from each one of the pipes D, through pipes which extend downward; and from the ends of these latter the water is divided into six ascending currents, entering each one of the pipes E at different points below its upper ends.

In applying the banks of the large and small pipes G and H to their respective pipes D and E, regard is had to the best mode of exposing them to the fire, so that the heated products of combustion shall circulate around and between all of them, so that all shall be exposed to heat. It is desirable to have such banks or series of pipes exposed to the ascending currents of heat; and for this purpose the smallest pipes H are arranged in inclined planes between the plane of the larger pipes G, as shown in fig. 3.

It will be seen by reference to the drawings, figs. 1, 2, and 4, that the lower ends of the pipes D and E, and the lower ends of the pipes G and H, are exposed in such manner that access can be had to them from without the furnace for cleaning and for other purposes.

The invention herein described is not confined to any definite number or size of pipes, tubes, or cylinders, as one of the great advantages of my invention is that I am enabled to increase the number of tubes indefinitely without diminishing the strength of the generator. Another advantage is that there can be no accumulation or trapping of steam in any of the pipes, as the forced currents of water will carry along with them the steam as rapidly as it is generated, and deliver this steam into the steam-chamber above the water level.

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

1. The arrangement of inclined pipes or cylinders, of different diameters or capacities, communicating as described, for the purpose of producing a forced circulation of water in all parts when exposed to the action of heat, substantially in the manner described and shown.

2. The arrangement of pipes G and H with pipes D and E, the ends of said pipes projecting outside of the furnace walls, substantially as and for the purpose described.



3. The arrangement of ball-couplings J and pipes G G H, said pipes being of different diameters, and in communication with one another by means of the chamber on which the ball-joint seats for the pipes are formed, substantially as and for the purposes herein described.

4. A steam superheater, A, in conjunction with a steam generator, operating upon the principle substantially as specified.

5. A steam-receiving chamber, B, in combination with a series of pipes of different diameters, connected together at their ends, and arranged substantially as described.

6. The combination of pipes G and H with pipes D E, substantially in the manner and for the purpose described.

HENRY FEYH.

Witnesses:

M. C. LOOKER,

GEO. T. EMERY.