(No Model.) 4 Sheets—Sheet 1.

I. McK. CHASE.

MULTIPLE STEAM GENERATOR.

No. 363,802. Patented May 31, 1887.

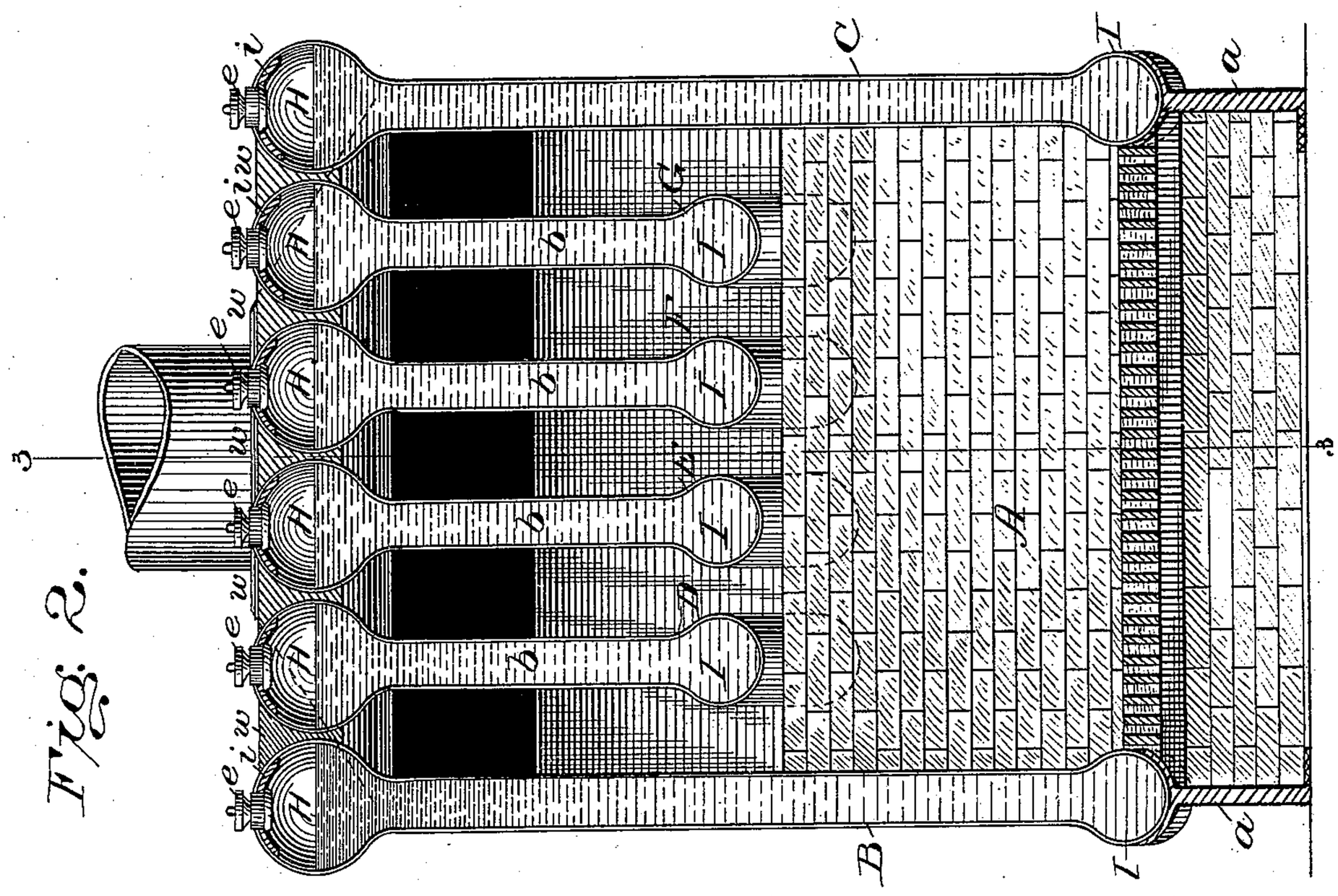

Fig. 2.

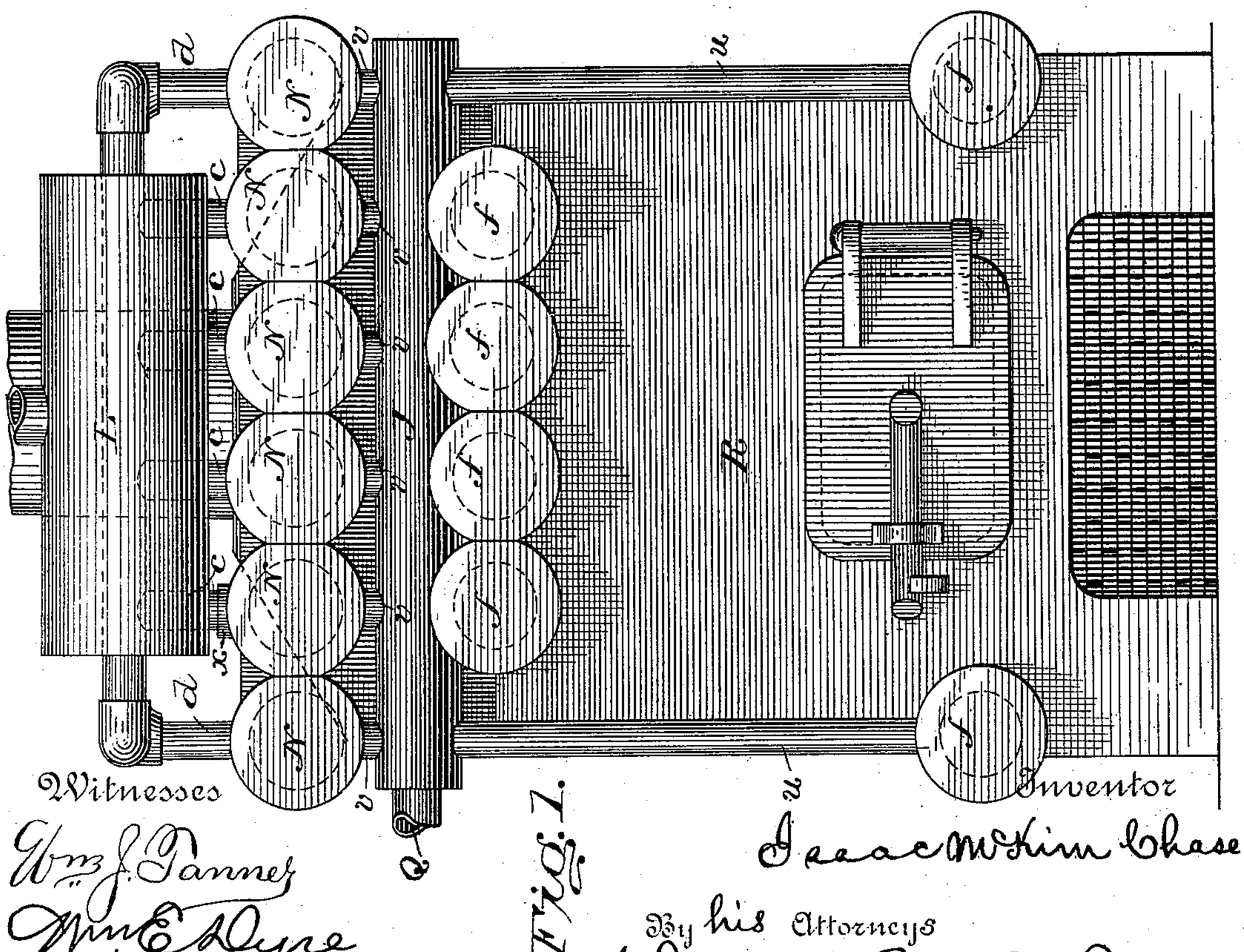

Fig. 1.

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MULTIPLE STEAM GENERATOR.

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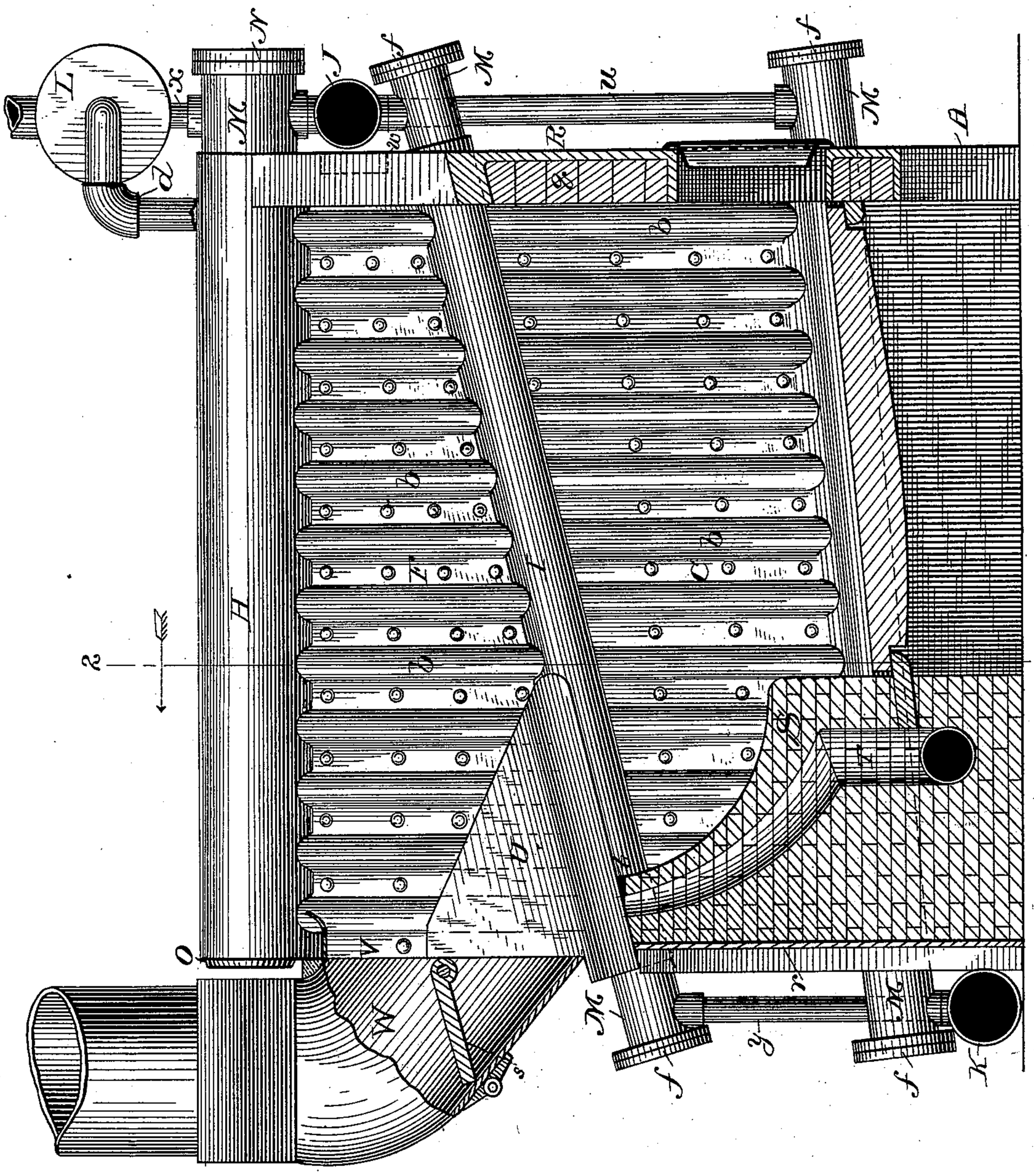

Fig. 1.

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MULTIPLE STEAM GENERATOR.

No. 363,802. Patented May 31, 1887.

Fig. 4.

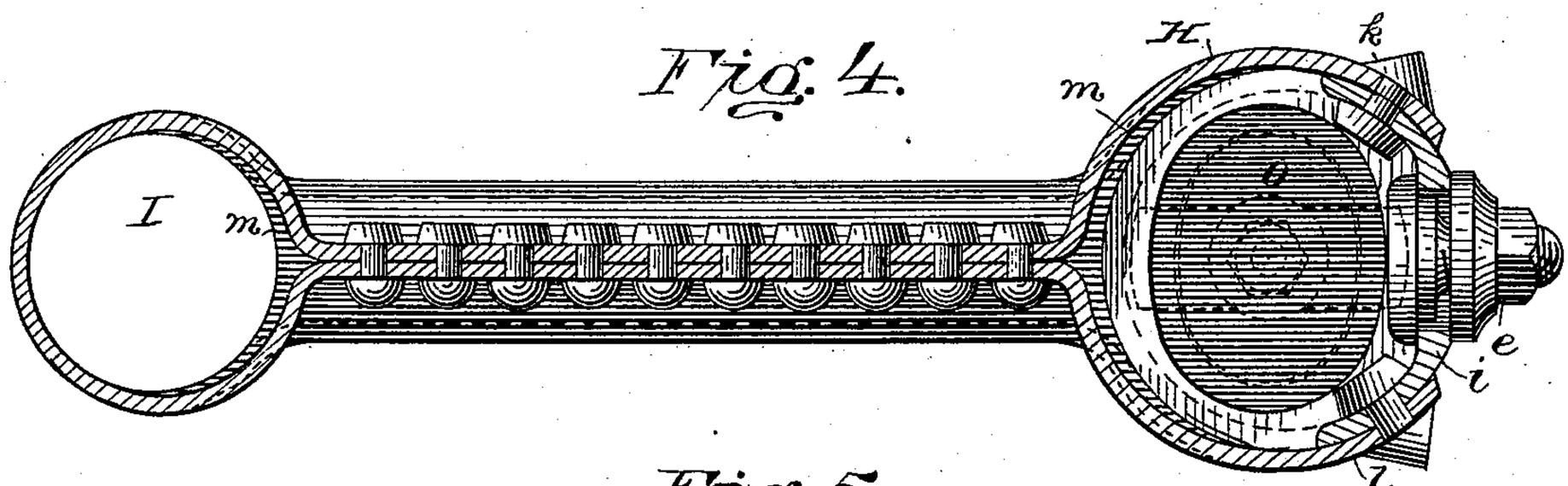


Fig. 5.

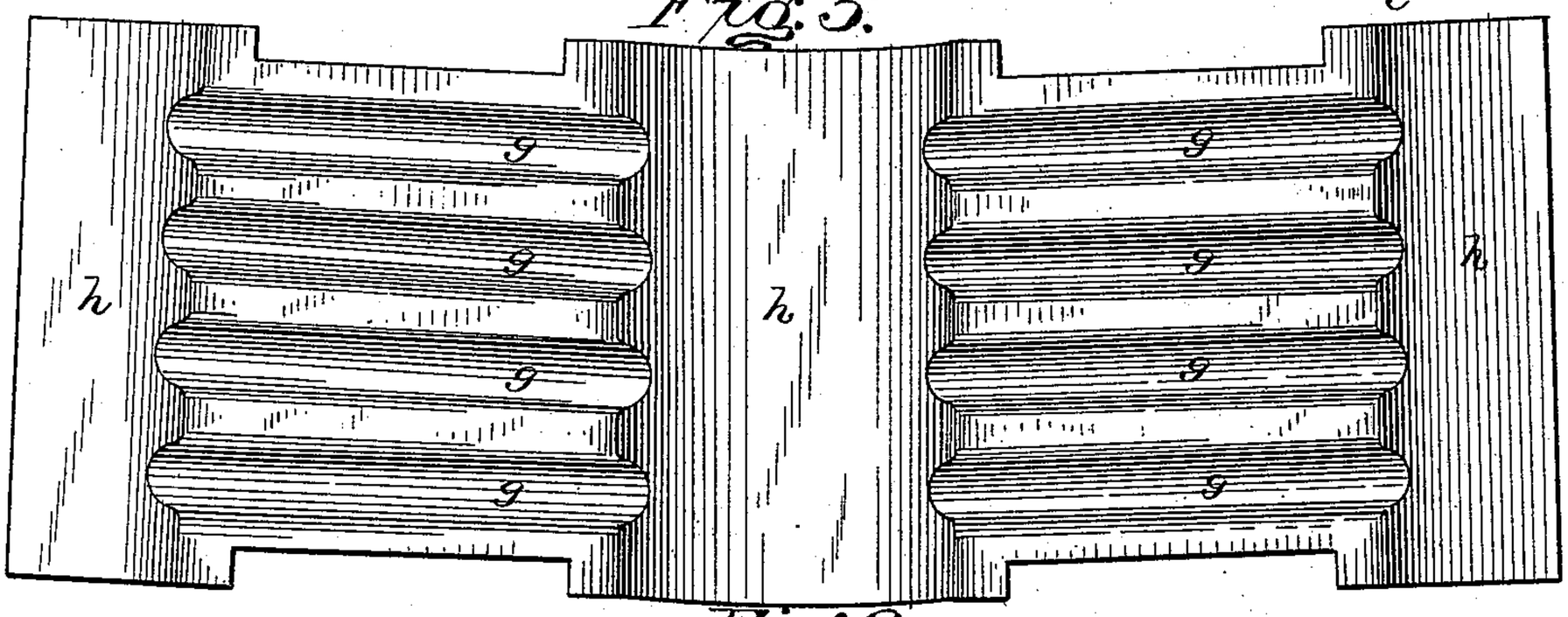


Fig. 6.

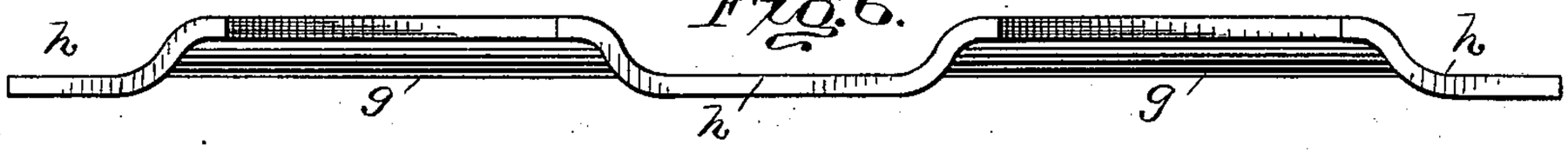
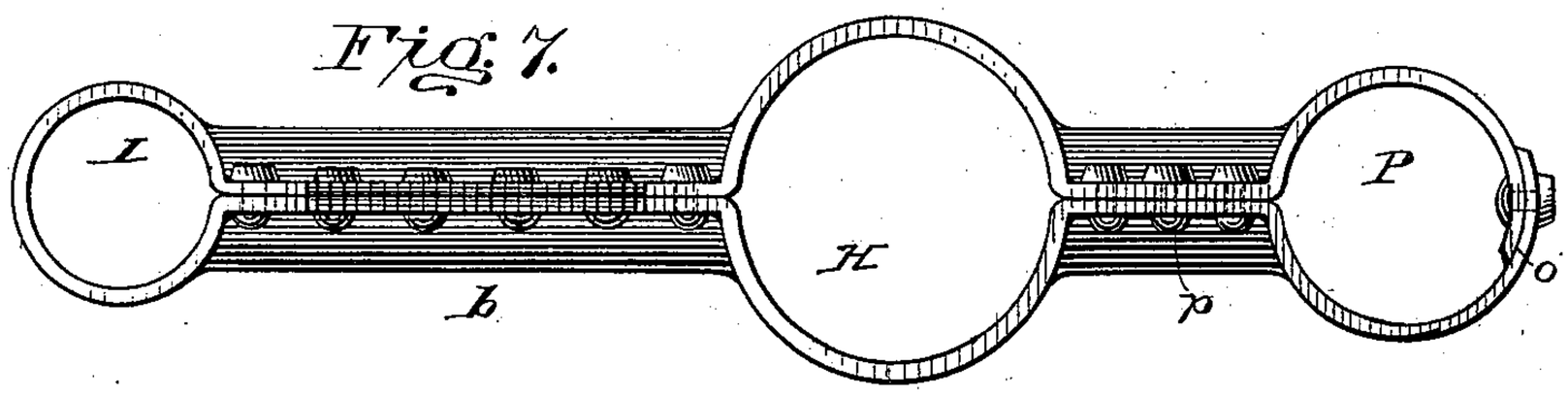


Fig. 7.



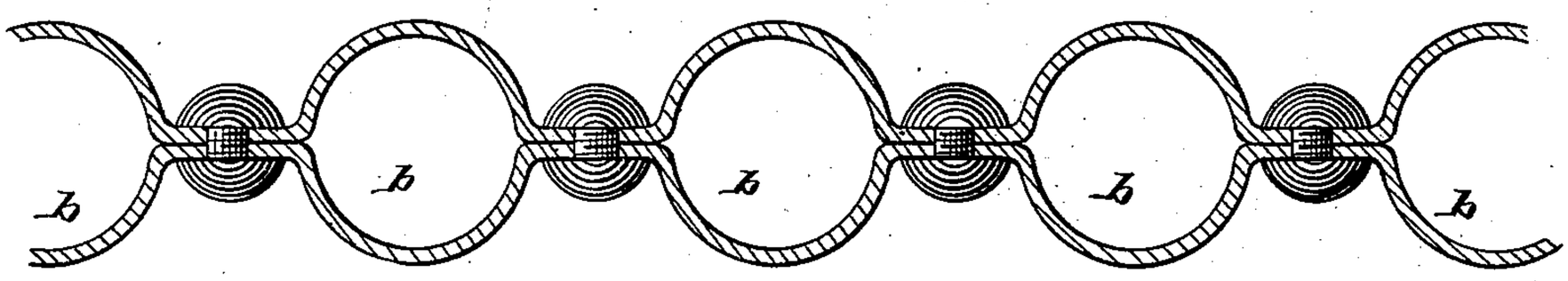


Fig. 8.

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MULTIPLE STEAM GENERATOR.

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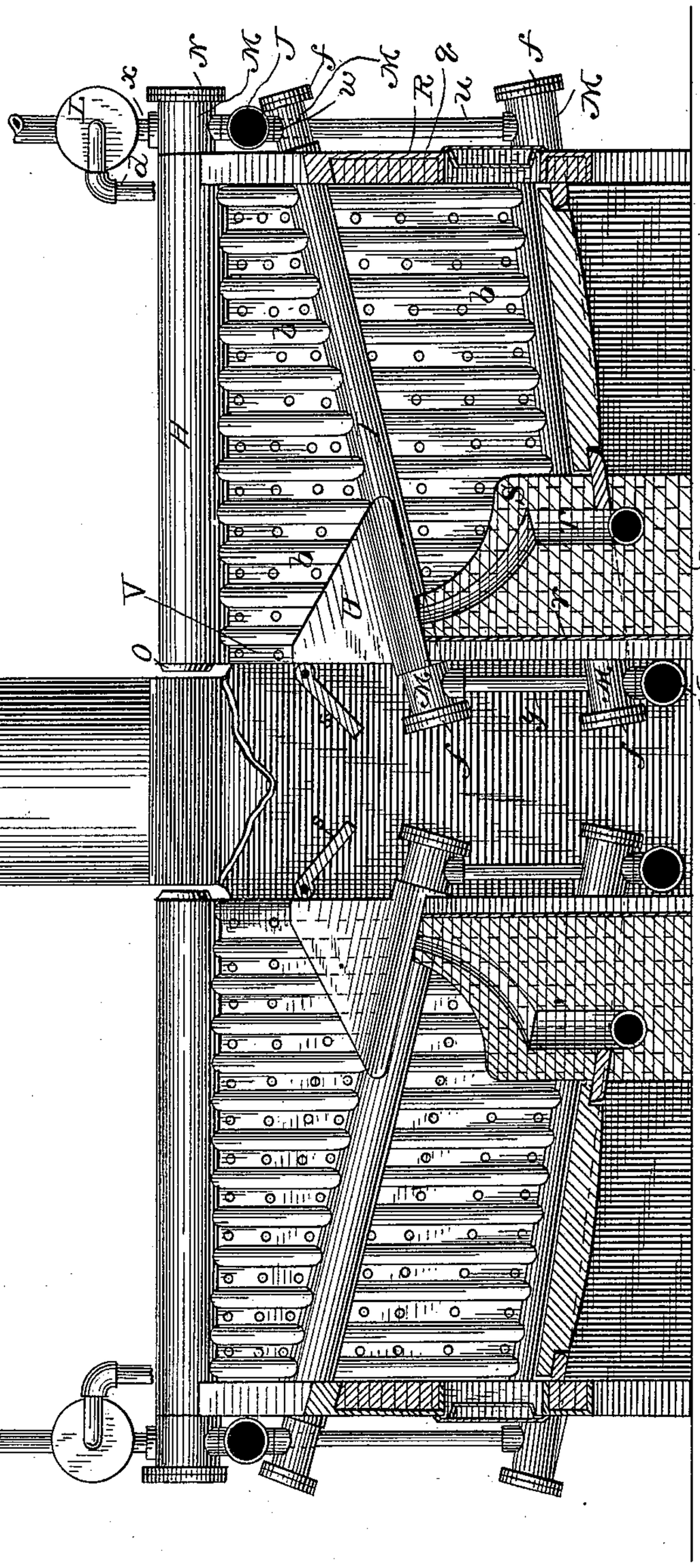

Fig. 9.

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UNITED STATES PATENT OFFICE.

ISAAC McKIM CHASE, OF WASHINGTON, DISTRICT OF COLUMBIA.

MULTIPLE STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 363,802, dated May 31, 1887.

Application filed March 19, 1887. Serial No. 231,579. (No model.)

To all whom it may concern:

Be it known that I, ISAAC MCKIM CHASE, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Multiple Steam-Generators; and I do hereby 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.

My invention relates to steam-generators, and has for its object the construction of a generator in which steam can be raised very rapidly, a high degree of pressure carried, the maximum of heating-surface obtained, and the number of joints subject to leakage reduced to the minimum.

In the generation of steam only the sensible heat of the steam is available for producing external work, the latent heat being required for the internal molecular work, and while so employed is not available for any other work, and as the latent heat decreases and the sensible heat increases with the increase of pressure it is more economical to work steam at a high degree of pressure than at a low degree. Many generators have been devised for carrying steam of high pressure; but they have generally been a complication of coils or pipes and manifolds. The measure of the force of the circulation of the water in a boiler is the "head," or the difference in the weight in the ascending and the descending columns of water. In the coil or circuitous pipe system the circulation of the water is seriously impaired by the friction produced by the sides of the pipes, and in some instances the friction is so great that the head is overcome and it becomes necessary to force the circulation with a pump.

When a globule of steam is formed, the quicker it leaves the water the more rapid will be the circulation and the faster will steam be generated, and for every degree the globules are required to depart from a perpendicular path to reach the steam-space the circulation is correspondingly impaired.

In the cylindrical marine boiler with internal furnaces the practical limit of thickness of metal has been reached both in shells and furnaces. In the transmission of heat through metal plates time is an important factor. If the plate is thick, the temperature of the two sides may vary considerably, owing to the time required for the heat to pass through the metal, and as a consequence it has been found in practice with very thick furnaces that the metal wastes away rapidly.

By my invention a steam-generator of great structural strength is produced, and which can be made a safety-boiler by proportioning the volume or capacity of the section to the thickness of metal and the pressure of steam required, and in which a natural and free circulation of the water is effected.

The invention will be hereinafter described, and particularly pointed out in the claims.

In the accompanying drawings, which form a part of this specification, Figure 1 represents a front elevation; Fig. 2, a vertical transverse section on the line 2 2 of Fig. 3; Fig. 3, a longitudinal section on the line 3 3 of Fig. 2. Fig. 4 is an enlarged end view of one of the inner sections of the generator. Fig. 5 is a plan of a blank for forming a section. Fig. 6 is an edge view of the blank. Fig. 7 is an end view of a section, showing a modified construction. Fig. 8 is a longitudinal section, on an enlarged scale, through one of the sections of the generator, between the manifolds; and Fig. 9 is a longitudinal section through two generators set end to end.

Reference being had to the drawings and the letters marked thereon, A represents a furnace provided with grate-bars of usual construction. B C represent the outside sections, which at their lower ends rest upon iron supports *a*, and form the sides of the furnace. D, E, F, and G are the intermediate sections, which are suspended directly over the furnace.

Each of the several sections is composed of a series of vertical tubes, *b*, which communicate with a manifold, H, at their upper ends, and a similar manifold, I, at their lower ends. The several sections constituting the generator are connected by a transverse feed-reservoir, J, at their front ends, and by a mud-drum, K, at their rear ends. From the upper manifold H of each of the intermediate sections a pipe, *c*, connects with the steam-drum L, and the outer sections are connected to the drum by pipes *d d*. In the upper manifold H, and

immediately over each vertical tube *b*, is formed a hand-hole, *e*, for cleaning said vertical tubes, and on the ends of the lower manifolds, I, are detachably secured heads *f*, for cleaning said manifolds.

Each section of the generator is formed of one continuous sheet of metal, such as shown in the blank in Fig. 5, which is made by heating or not heating a sheet of metal, (as steel, iron, or copper may be used,) placing it upon a suitable form, and by the use of dies or swages the corrugations *g* and the longitudinal indentations *h* are formed. The blank is then bent over a mandrel at its central indentation, *h*, and the lower manifold, I, formed, as shown in Fig. 4. At the free ends of the section a casting, *i*, having the hand-holes *e*, is inserted, and to which said ends are riveted, as shown at *k l* in Fig. 4. A "chock," *m*, is also inserted at the ends of the manifolds to form a circle to receive the ends of the cast-metal pipe-section M, and the chock is then properly calked after said sections have been secured to the manifolds. The front end of each of the manifolds H is closed by a head, N, and in the rear end of each is set a hand-hole plate, O. The sections forming the generator are riveted between each of the vertical tubes *b*, in the usual manner, as shown in Figs. 3 and 8.

In the modified construction shown in Fig. 7 the casting *i* of Fig. 4 is omitted, and a common lap joint or seam, *o*, is formed in the upper manifold P. In this construction it will be observed that an additional set of vertical tubes, *p*, and the manifold P are provided, the object of which is to provide additional water-space for marine boilers, which are subject to the effects of the rolling of the vessel, and consequent abnormal displacement of the water in the boiler. As another precautionary measure, to keep the water at the same level in the several sections constituting the generator, the feed-pipe Q is enlarged and forms a reservoir, J, affording a head to the water in the section, and serves to supply all of the sections regularly, irrespective of the differences in evaporation due to the fact that some of the sections are exposed to more intense heat than others, and consequently require a greater supply of water.

The sections B, C, D, E, F, and G having been formed as described, they are set in position upon a front, R, which is a casting lined with fire-brick, as shown at *q* in Fig. 3, and a rear casting, *r*. The bridge-wall S is then built, and has an air-duct, T, formed in it, which is provided with a suitable damper or valve. (Not shown.) Above the front R the space is filled with fire-clay, with a piece of sheet metal in front of it, and the spandrels between the manifolds H are filled with a suitable refractory material, *w;* also, at the rear end of the furnace, the space above the masonry is filled with molded fire-clay, forming a baffle-plate, U, which extends up and forms the lower wall of the calorimeter or throat V of the furnace leading to the uptake W. The throat is also provided with a damper, *s*, to regulate the draft of the furnace.

Air entering the duct T is discharged through an expanded orifice, *t*, on the under side of the baffle-plate U, passes forward and mingles with the gases emanating from the burning fuel, and supplies additional oxygen to the gases to complete their combustion. It will be observed that air entering through the duct T is heated before it enters the furnace, and is discharged in a thin sheet or stratum over the bed of burning fuel, thereby becoming thoroughly mixed with the gases before they pass through the throat V of the furnace to the uptake. The baffle-plate U may be extended farther forward in the furnace, as circumstances require.

The manifolds I of the outer sections, B C, are connected to the reservoir J by pipes *u* and to the manifolds H by pipes *v*, to supply them with water and to keep up a circulation within said section, and the rear ends of said manifolds are connected to the mud-drum K by pipes *y*. The steam-drum L is provided with a pipe, *x*, for discharging water of condensation, which flows into one of the manifolds H.

In Fig. 9 two generators are shown connected to one uptake. It is obvious the generators may be multiplied according to the purposes to which they are to be applied and the quantity of steam required for the work to be done. One great advantage of this construction is that any one of a set of generators can be shut off from the others and be repaired while all of the other generators constituting the set are in use. This can be accomplished by simply closing the throat V of the furnace of the generator requiring repairs by the use of the damper *s*. It will also be observed that in the generator shown there are no sharp angles; that where globules of steam are formed in the section they pass directly up through the body of water into the steam-space of the upper manifold unobstructed; that any one of the vertical tubes *b* may be inspected or cleaned through its hand-hole *e* and the manifolds by the removal of the heads N or *f*. The sections may be made of steel, iron, copper, or any other metal having sufficient tensile strength to bear a high degree of pressure of steam. Steel, however, is preferred. There are no joints or seams exposed to the heat of the furnace. Each section being composed of one continuous sheet of metal of the same thickness throughout, there are no variations in the expansion and contraction of the metal. Consequently no unequal strains are brought to bear upon the generator.

Having thus fully described my invention, what I claim is—

1. A blank for boiler-sections made of sheet or plate metal, having longitudinal indenta-

tions and transverse corrugations connecting with said indentations formed in it, substantially as described.

2. A boiler-section constructed of sheet or plate metal, having its manifolds and connecting-tubes formed integral, substantially as described.

3. A boiler-section having an upper horizontal manifold and a lower inclined manifold, with intermediate connecting-tubes formed of sheet or plate metal, the tubes and the manifolds being integral, substantially as described.

4. A boiler-section having its manifolds and connecting-tubes formed of one continuous sheet or plate of rolled metal, substantially as described.

5. A boiler-section constructed of sheet or plate metal, having its manifolds and connecting-tubes formed integral, in combination with a separate plate of metal secured to the ends of the sheet forming the section and in the upper manifold, and provided with a series of apertures over the connecting-tubes and detachable covers for said apertures, substantially as described.

6. A steam-generator composed of sections of different areas of heating-surface and provided with upper and lower manifolds, in combination with a feed-water reservoir connected to both of said manifolds in each section, substantially as described.

7. A steam-generator composed of sections of different areas of heating-surface and provided with upper and lower manifolds, the outer sections forming the sides of the furnace and the intermediate sections suspended over the grate-surface, in combination with a feed-water reservoir connected to both manifolds of each section and a steam-drum in communication with each section by a separate pipe, substantially as described.

8. A steam-generator composed of sections, the outer sections forming the sides of the furnace, in combination with a hollow bridge-wall, a baffle-plate forming the lower wall of the throat of the furnace, and an air-distributing orifice under the baffle-plate, substantially as described.

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

ISAAC McKIM CHASE.

Witnesses:
SAML. C. MILLS,
GEO. W. WELLS.