3 Sheets—Sheet 1.

R. E. ROGERS.

STEAM GENERATOR.

No. 81,212. Patented Aug. 18, 1868.

Fig. 1.

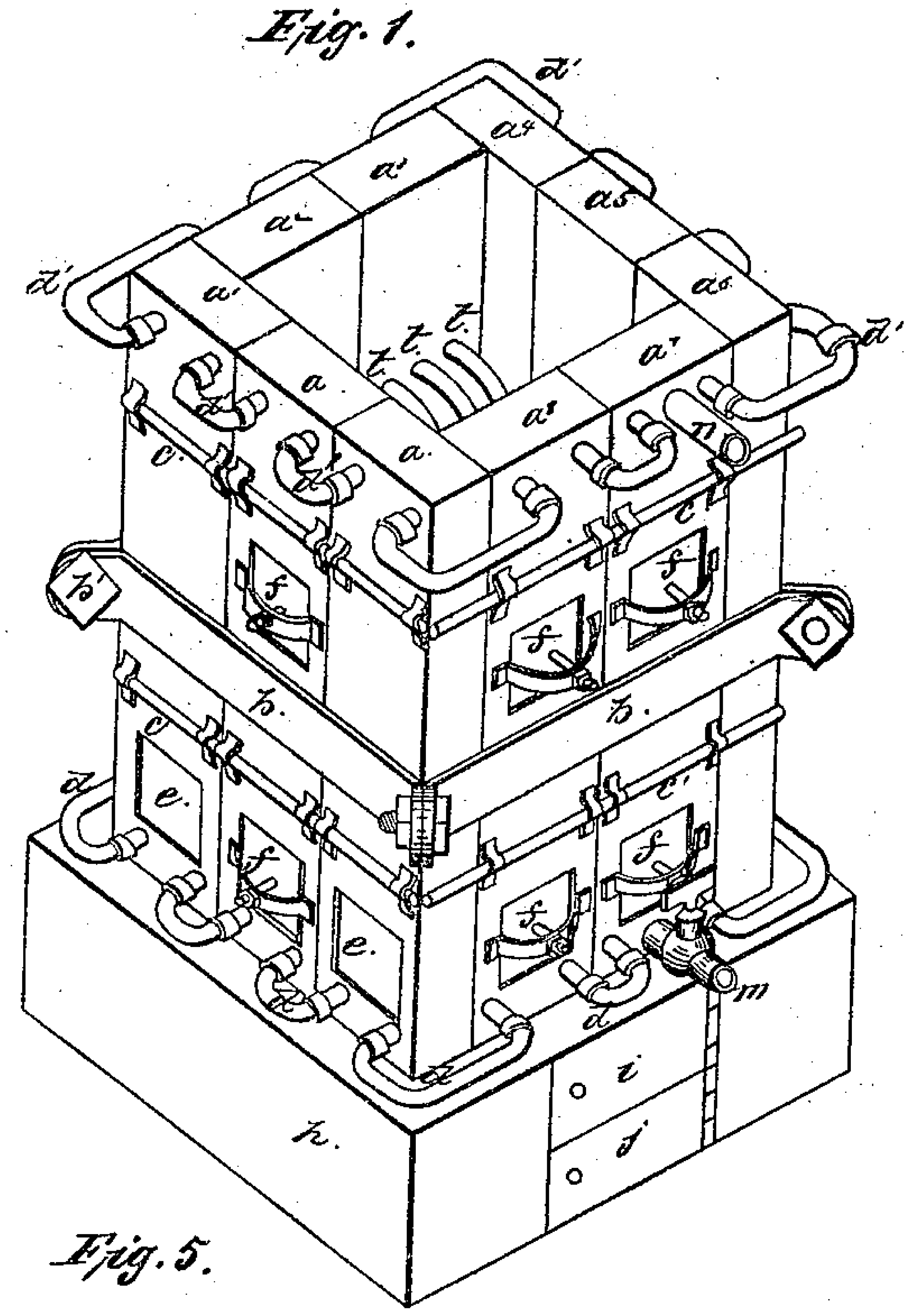


Fig. 5.

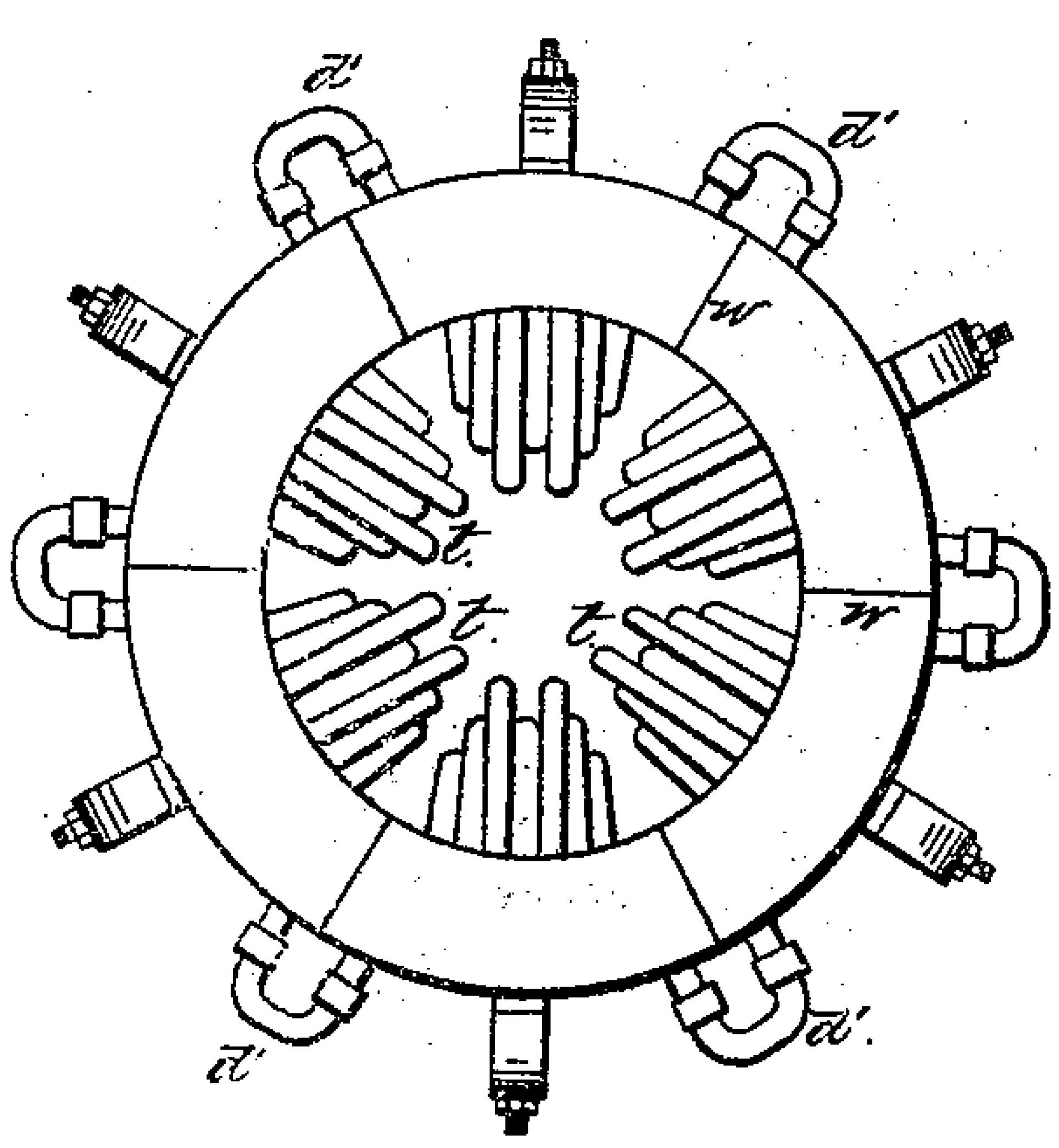
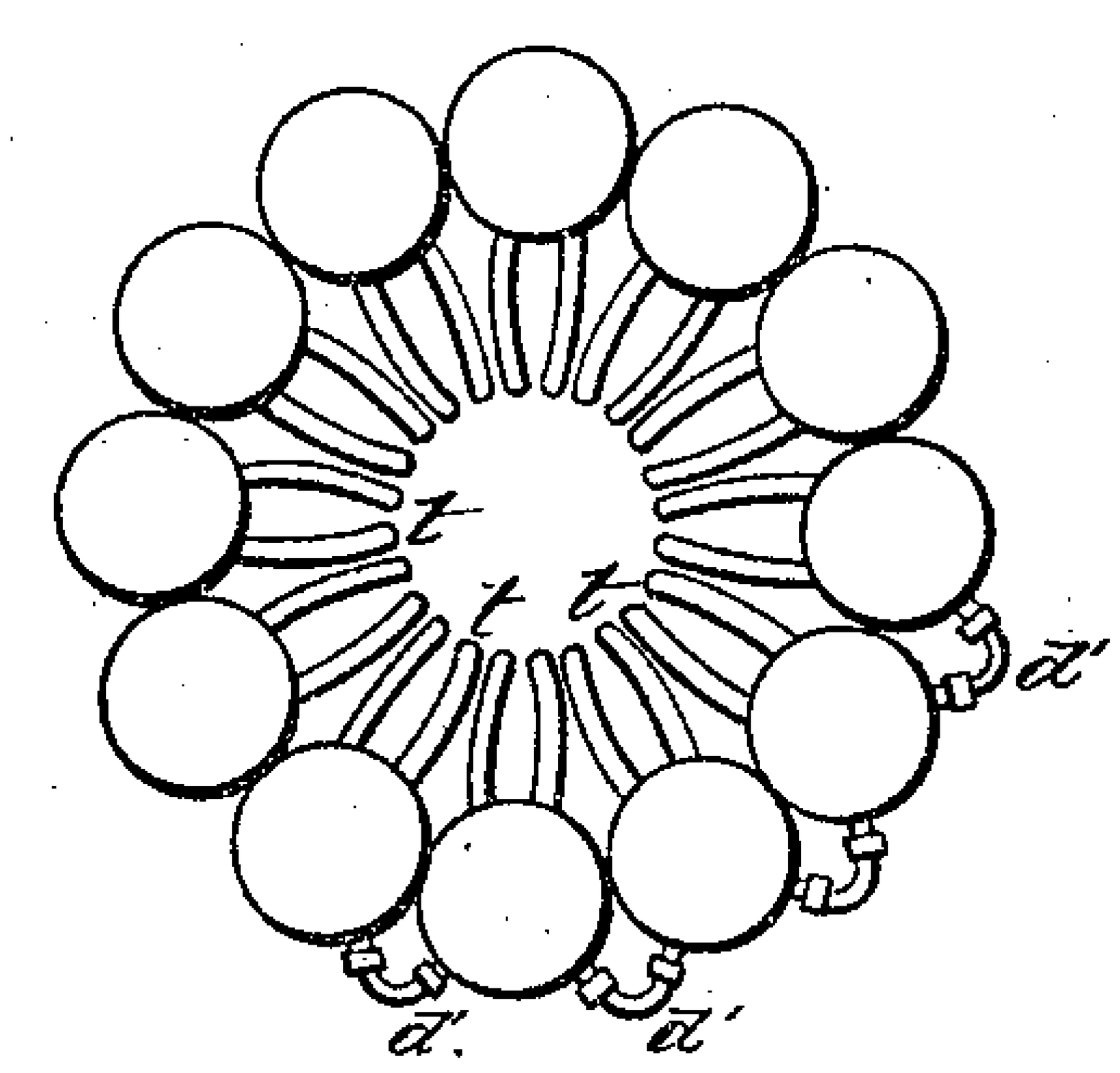


Fig. 6.



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R. E. ROGERS.

STEAM GENERATOR.

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Fig. 3.

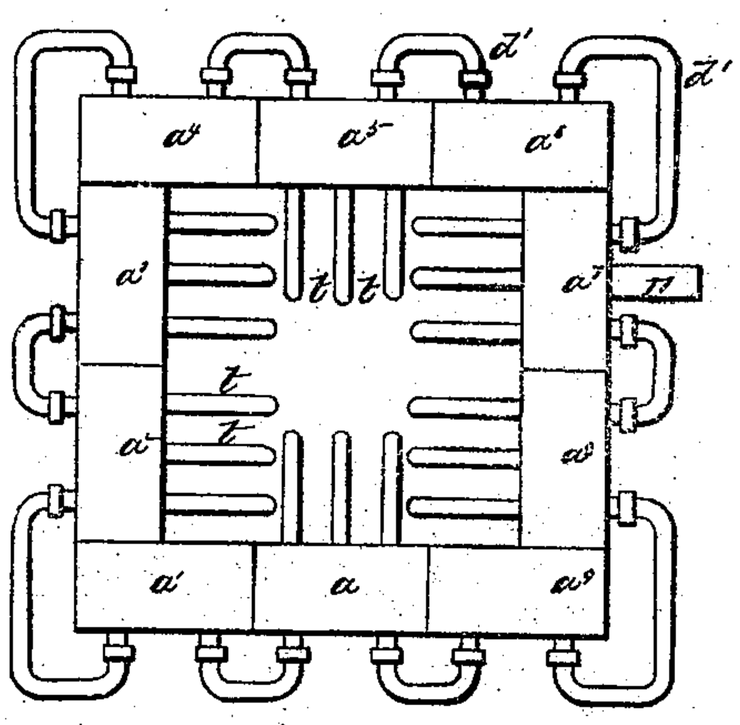


Fig. 2.

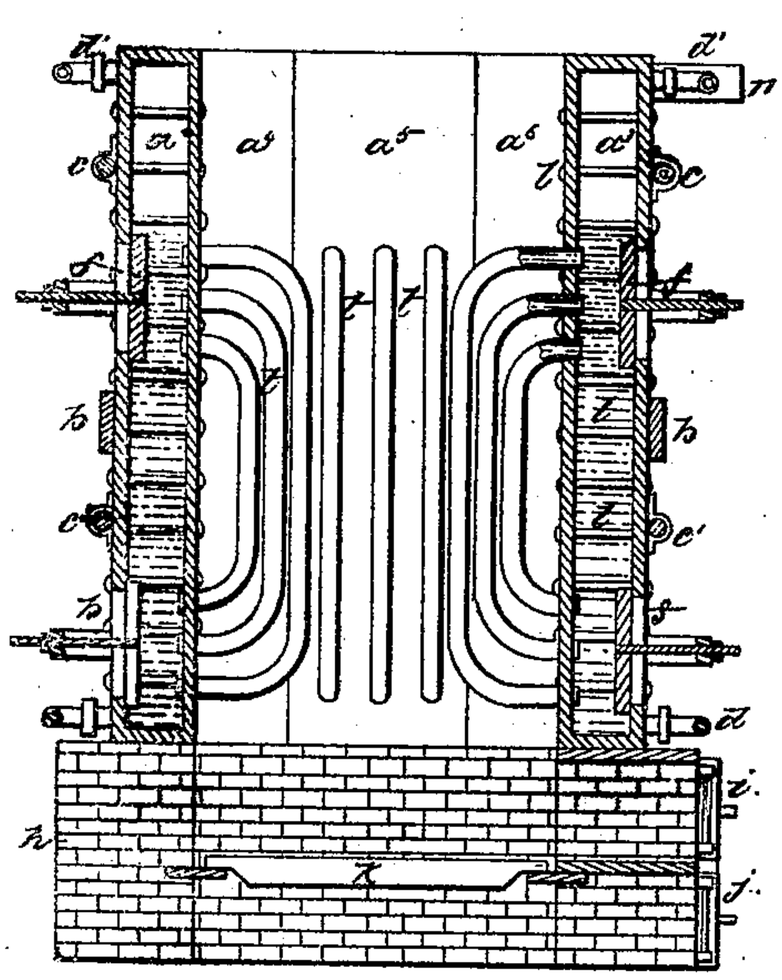
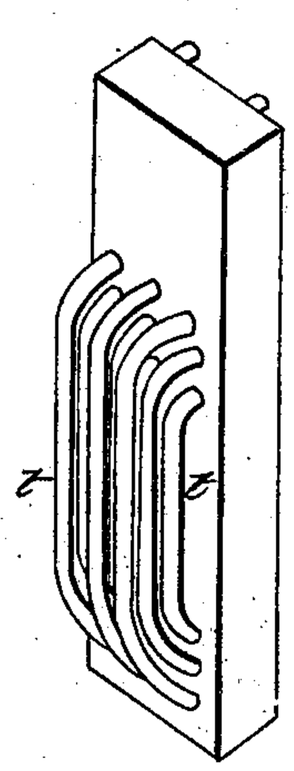


Fig. 4.



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3 Sheets—Sheet 3.

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STEAM GENERATOR.

No. 81,212. Patented Aug. 18, 1868.

Fig. 7.

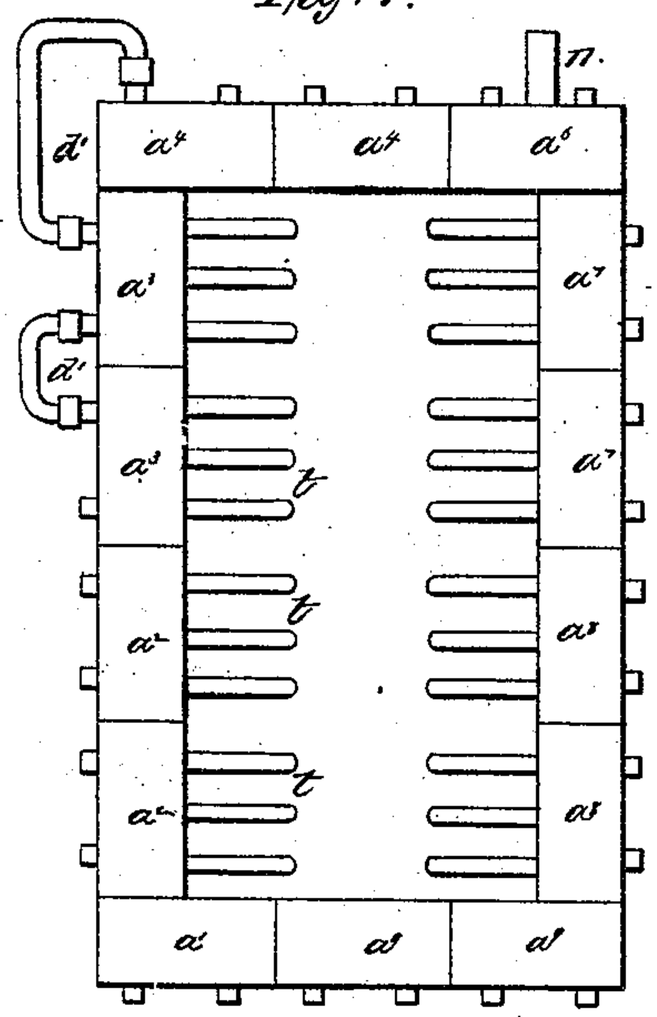
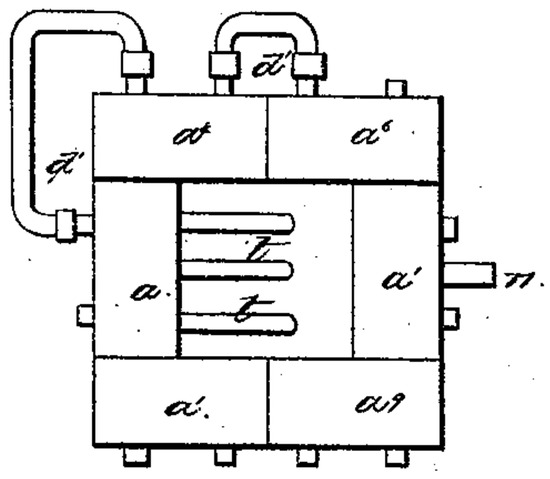


Fig. 8.



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United States Patent Office.

ROBERT E. ROGERS, OF PHILADELPHIA, PENNSYLVANIA.

Letters Patent No. 81,212, *dated August* 18, 1868.

IMPROVEMENT IN STEAM-GENERATORS.

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

TO ALL WHOM IT MAY CONCERN:

Be it known that I, ROBERT E. ROGERS, of the city of Philadelphia, and State of Pennsylvania, have invented new and useful Improvements in Steam-Boilers; and I do hereby declare that the following is a full and exact description of the construction and operation of the same, reference being had to the annexed drawing, forming part thereof, and to the letters of reference marked thereon.

In this invention, my object has been so to construct steam-boilers, on the principle of subdivision, as to reduce the risk of explosion, and to facilitate their transportation, inspection, cleansing, and repair, and at the same time to retain the best features of that class of boilers which are provided with external tubes for the circulation of water.

My invention consists in the construction of steam-boilers of separate elongated hollow sections or staves, set on end, and connected by tubes, for the free passage among the sections of water and steam, each section being provided with exterior tubes, for the circulation of the water within itself, and for increasing the heating-surface, the whole being capable of any desired increase of size, yet having a strength not dependent upon its aggregate size, as is the case with most boilers in common use, but upon the strength of the individual sections of which it is made up; and it further consists in the combination of blank sections or staves with those having circulation-tubes.

In the drawings—

Figure 1 is a perspective view of a boiler composed of a number of separate elongated rectangular hollow sections or staves, standing on end, and connected by exterior union-tubes at top, for the free passage of the steam, and at bottom, for the free passage of the water, some of the sections or staves being provided with tubes on that face of each section or stave next the fire, for the circulation of the water therein, the several sections or staves being arranged around a common fire, so as to constitute a rectangular fire-chamber or furnace-flue.

Figure 2 is a longitudinal vertical section of the same, three of the sections or staves, with their associated circulation-tubes, being shown in elevation.

Figure 3 is a plan or top view of the boiler represented in fig. 1.

Figure 4 is a perspective view of a single section or stave, showing the circulation-tubes attached thereto.

Figure 5 is a plan or top view of a boiler made up of separate sections or staves, each of which has the form of a segment of an annulus, each section or stave being provided with circulation-tubes on its inner face, that is, the face next the fire, the several sections being connected by exterior union-tubes, as shown, and so associated as to constitute a cylindrical fire-chamber or furnace-flue.

Figure 6 is a plan or top view of a boiler made up of a series of sections of cylindrical form, the several sections being provided with the circulation-tubes, the exterior union-tubes, and other parts shown, and associated so as to constitute a cylindrical fire-chamber or furnace-flue.

Figure 7 is a plan or top view of a boiler composed of sections or staves similar to those shown in figs. 1, 2, and 3, and arranged so that the plan of the aggregate boiler is oblong, the sections or staves forming the ends of the oblong being without circulation-tubes.

Figure 8 is a plan or top view of a boiler composed of sections or staves similar to those shown in figs. 1, 2, and 3, and arranged so that the plan of the aggregate boiler is square, only one of the sections or staves employed being provided with circulation-tubes.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and mode of operation.

Referring to the drawings, a a^1 a^2 a^3 a^4 a^5 a^6 a^7 a^8 a^9 represent the several sections or staves which compose the boiler shown in fig. 1. These sections are bound together by exterior bars, b, and bolts, b', and held in line by the auxiliary rods c c', as shown.

The several sections are connected together at bottom by union-tubes, d, for the free passage and inter-

change of the water throughout the system of sections, and at top by similar tubes, *d'*, for the free passage and distribution of the steam. *e f* are man-holes, which are of sufficient dimensions to facilitate the work of attaching the circulation-tubes, and of inspecting and cleansing the sections respectively.

The man-hole plates *f* are packed and secured in place by any of the usual modes. *m*, fig. 1, is the pipe for the introduction of water into the system of sections or staves. *n*, in figs. 1, 2, and 3, is the pipe for leading off the steam. *t*, in the several figures, represents the water or circulation-tubes, (as I term them,) which are designed to afford a large heating-surface, and to furnish the means of a rapid circulation of water from the lower to the upper portions of the sections to which they are secured. These circulation-tubes are connected by their lower extremities, near the bottom of their respective sections, and by their upper extremities at points along the length of the sections, more or less near the top of the same.

In figs. 1 and 2, *h* represents the pediment of masonry upon which the sections or staves stand, and *i* the fire-door; *j*, in fig. 2, the ash-pit, and *k* the grate-bars.

The yellow coloring in fig. 2 indicates the water at its usual relative height, and the blank spaces above said coloring indicate the steam-room. The lines *l*, in fig. 2, indicate interior stay-bars, to strengthen the sections or staves.

It will be seen that the several sections or staves, when arranged as represented in the drawings, constitute, for their height, the fire-chamber or furnace-flue. The flue thus formed may be connected in any manner desired with the chimney-stack.

In figs. 1 and 3, the sections a^1 a^4 a^6 and a^9, owing to their positions, are made without the circulation-tubes *t*. Under such circumstances, such blank sections or staves serve to complete the fire-chamber or furnace-flue, without the use of mason-work. They also increase the capacity of the aggregate boiler for water and steam, while at the same time they preserve the sectional or stave feature.

It is evident that the elongated sections or staves may have various forms, and may have any length desired. They may be rectangular, as shown in figs. 1, 2, 3, 4, 7, and 8, or segments of annuli, as shown in fig. 5, or circular, as shown in fig. 6, in transverse section, or of other desired elongatdd form.

They may be made of cast or wrought iron, or of steel or other suitable metal, and may have plane or corrugated sides. A supply-water pipe, a steam-pipe, a blow-off cock, a safety-valve, and any other of the usual appendages of boilers may, it is evident, be placed upon but a single section or stave of the group, or upon any number of them. Various simple means of binding the sections together may be used in place of the bands and bolts described; thus, lugs or ribs may be cast or riveted upon the sections, and held together by screw-nuts.

When the sections are of rectangular form, I prefer to make them twelve inches by eight inches, outside measurement, in the transverse section, and eight to ten feet long, having a thickness of wall of three-fourths of an inch to one inch, when constructed of cast iron, with stay-bars at intervals of six inches apart, except at the man-holes, where they are placed so as not to interfere with the apertures, as shown in fig. 2, extending transversely from one to the other of the broader faces.

I provide each such section or stave with nine circulation-tubes, preferring wrought iron, lap-welded, each six to eight feet in length, and having a diameter of about two inches.

The tubes are arranged in three planes, of three in each plane, as represented in figs. 2, 3, 4, 7, and 8. Such a section or stave will, in itself, constitute a steam-generator of from three to four-horse power. When the sections are made segments of annuli, as represented in fig. 5, I prefer the outer face of such segments to be not more than twelve inches across, and eight inches on the sides, *w*, measured externally, and its inner face less than twelve inches across, according to the curvature of the annulus of which the section forms a part.

When the sections are made cylindrical, as represented in fig. 6, I prefer to give them a diameter of not more than eight inches.

The power of the individual sections or staves may be increased by increasing the number of the circulation-tubes, and the power of the aggregate boiler may be indefinitely increased by multiplying the number of the sections or staves. The dimensions given produce good results, and are convenient in many situations, but I do not wish to limit myself to such dimensions, as other dimensions are often desirable. The holes in the sections or staves, for the attachment of the circulation-tubes, when the sections are of cast iron, may either be cast in them, or may be drilled in them after the sections are cast, and these tubes may be fastened into the sections, either by the usual mode of expanding, overlapping, and "caulking," or by means of nipples and elbows, or by screw-nuts, or in any secure manner.

Instead of constructing the pediment *h* of masonry, it may be made of cast iron, in convenient portable parts, or, instead of this, the sections or staves *a* may be prolonged at their lower ends, so as to stand directly upon a ground foundation, with the exception of such of them as may be on the side where the fire-front would be placed, those sections being shorter in length, to admit of the formation of the fire-door and ash-pit openings.

I do not confine myself to the specific mode of connecting the several sections, as more union-tubes, and tubes of greater or less diameter than those represented, and tubes screwed in by elbows and nipples, or bolted on, may be used if desired.

Sometimes it is desirable to arrange the sections so that they form a square, as in figs. 1, 2, and 8, but it is generally preferable to arrange them so as to form an oblong in the aggregate, as in fig. 7. Sometimes only a portion of the sections or staves constituting the aggregate boiler may be provided with circulation-tubes, as in figs. 7 and 8, or sometimes the sections having circulation-tubes may be alternated with sections without such tubes, if desired.

Instead of the blank sections or staves, as represented in figs. 1, 2, 3, 7, and 8, mason-work may at times be employed with advantage.

Most of the boilers in common use may, if desired, be enclosed in the fire-chamber formed by the sections or staves, arranged as above described, and in such case the sections constitute a divisible water-jacket to the same.

I am aware that steam-generators have been constructed, having some one or more of the features of my invention. Thus, they were made by Perkins, in England, in 1824, of cast iron, in separate sections. Other steam-generators have been made of "cast-metal sections," and patented by S. F. Gold, of the United States, in 1859. Steam-generators have also been made of small "units of construction," having a "globular, elliptical, conical," or "polyhedral" form, as patented by Joseph Harrison, jr., in 1859. Steam-generators have also been made with tubes for holding and circulating the water, as in the Gurney, the Field, the Dimpfel, the Howard, and the Rogers and Black boilers, and others already patented; but in none of these, nor in any other forms that I know of, have the several features of my invention been hitherto combined.

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

1. The boiler, composed of separate elongated sections or staves, connected at bottom, for the interpassage of water, and at top, for the interpassage of steam, one or more of such sections being provided with circulation-tubes on the side next the fire, each being set on end, and all the sections being arranged around a common fire, so as to form the fire-chamber or furnace-flue, substantially as shown and described.

2. The combination of the blank sections or staves with those having circulation-tubes, substantially as described.

ROBERT E. ROGERS.

Witnesses:

W. A. A. McKINLEY,

WM. JAS. BURNS.