

(No Model.)

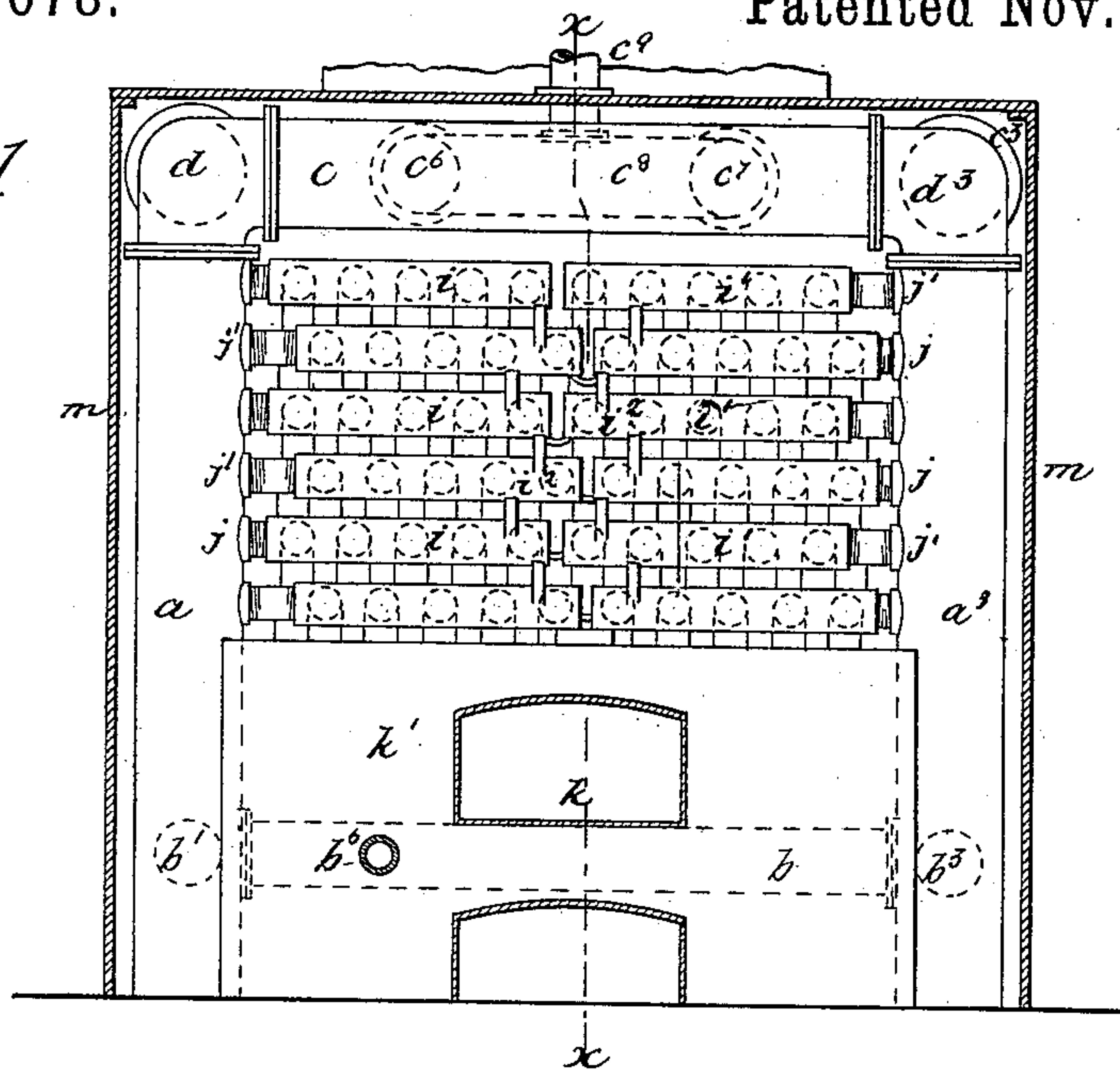
3 Sheets—Sheet 1.

P. REILLY.  
TUBULAR STEAM GENERATOR.

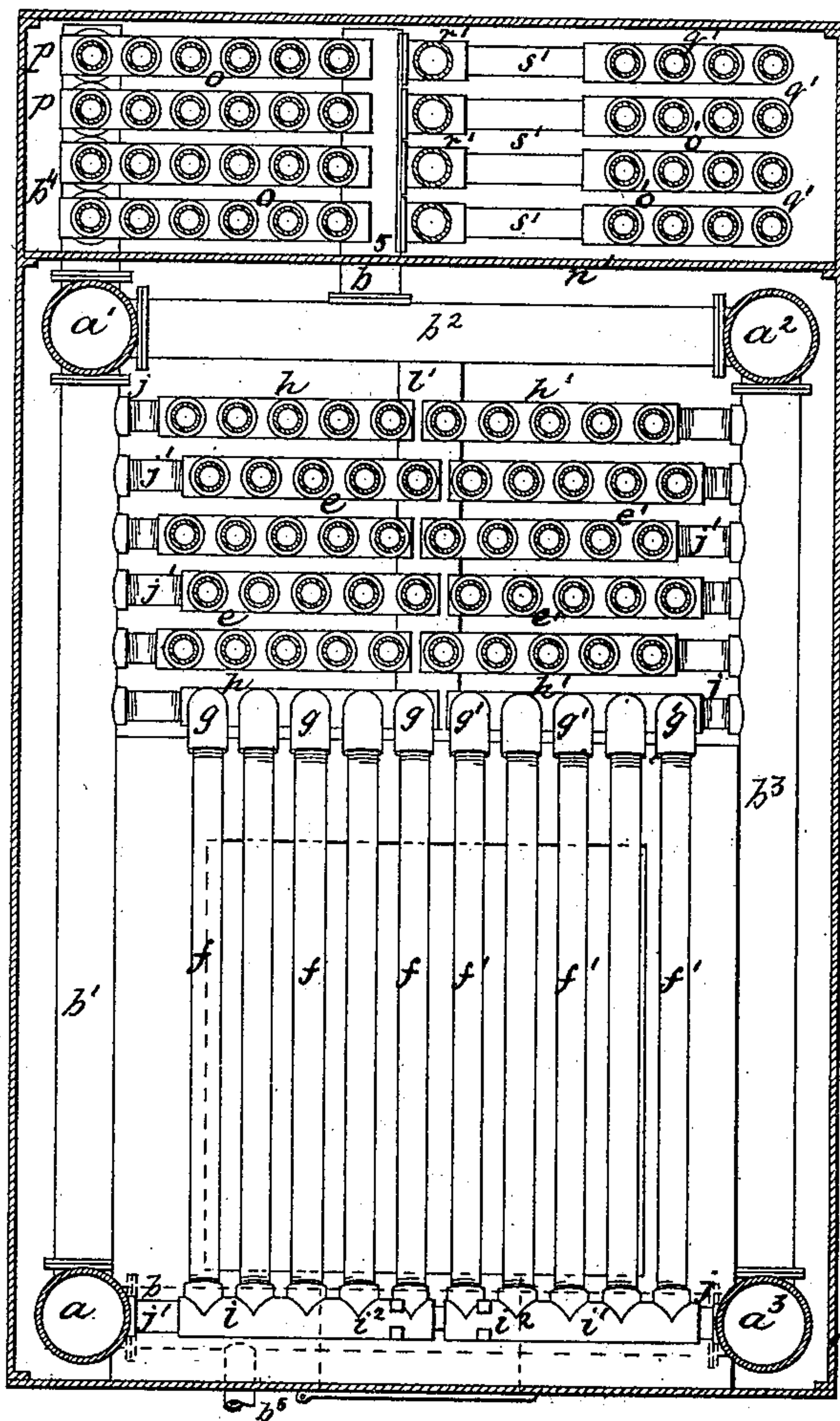
No. 329,678.

Patented Nov. 3, 1885.

*Fig. 1*



*Fig. 3*



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*H. D. Williams*  
*L. W. Trues*

*Patrick Reilly*  
*Inventor:*  
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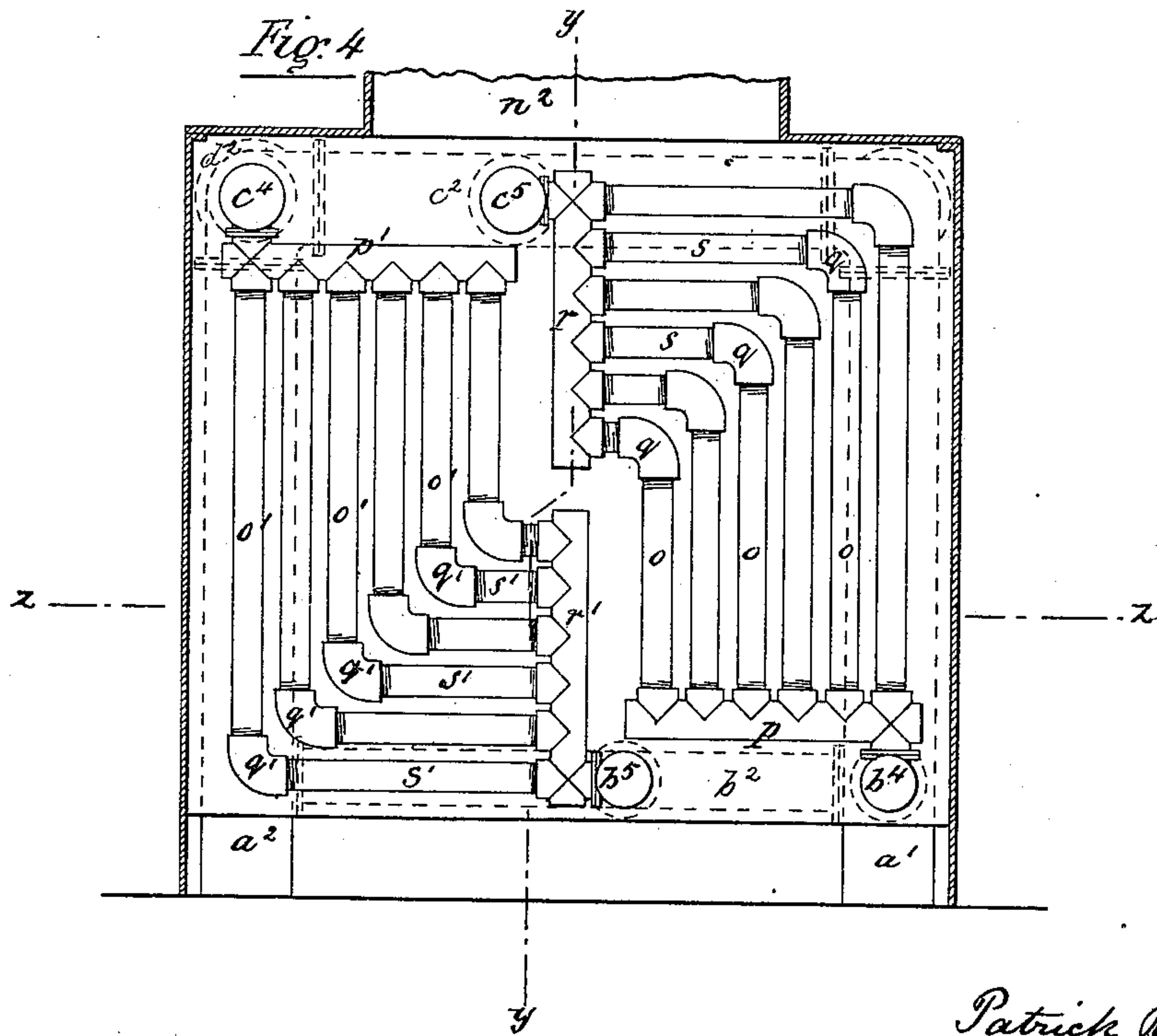
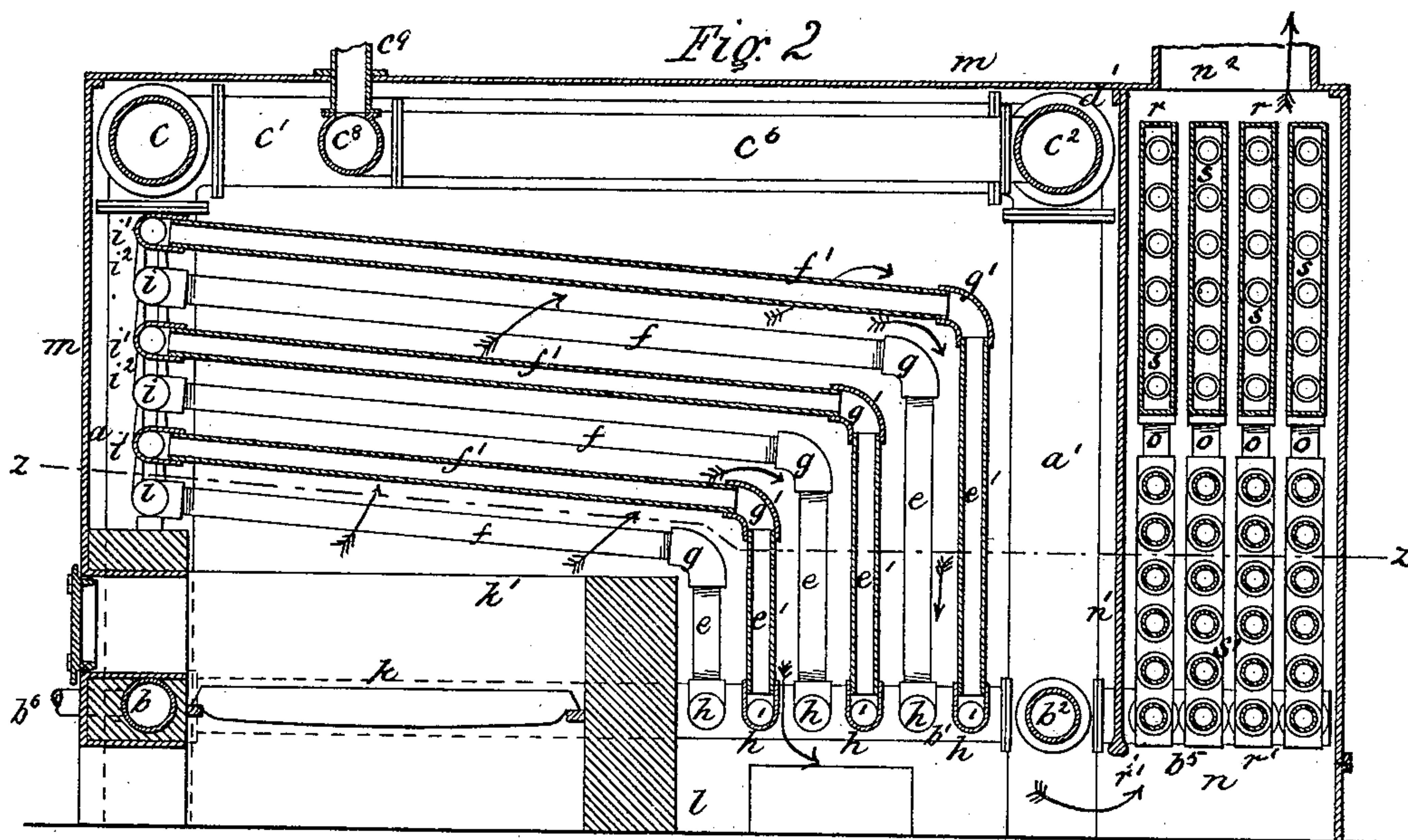
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3 Sheets—Sheet 2.

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TUBULAR STEAM GENERATOR.

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Witnesses  
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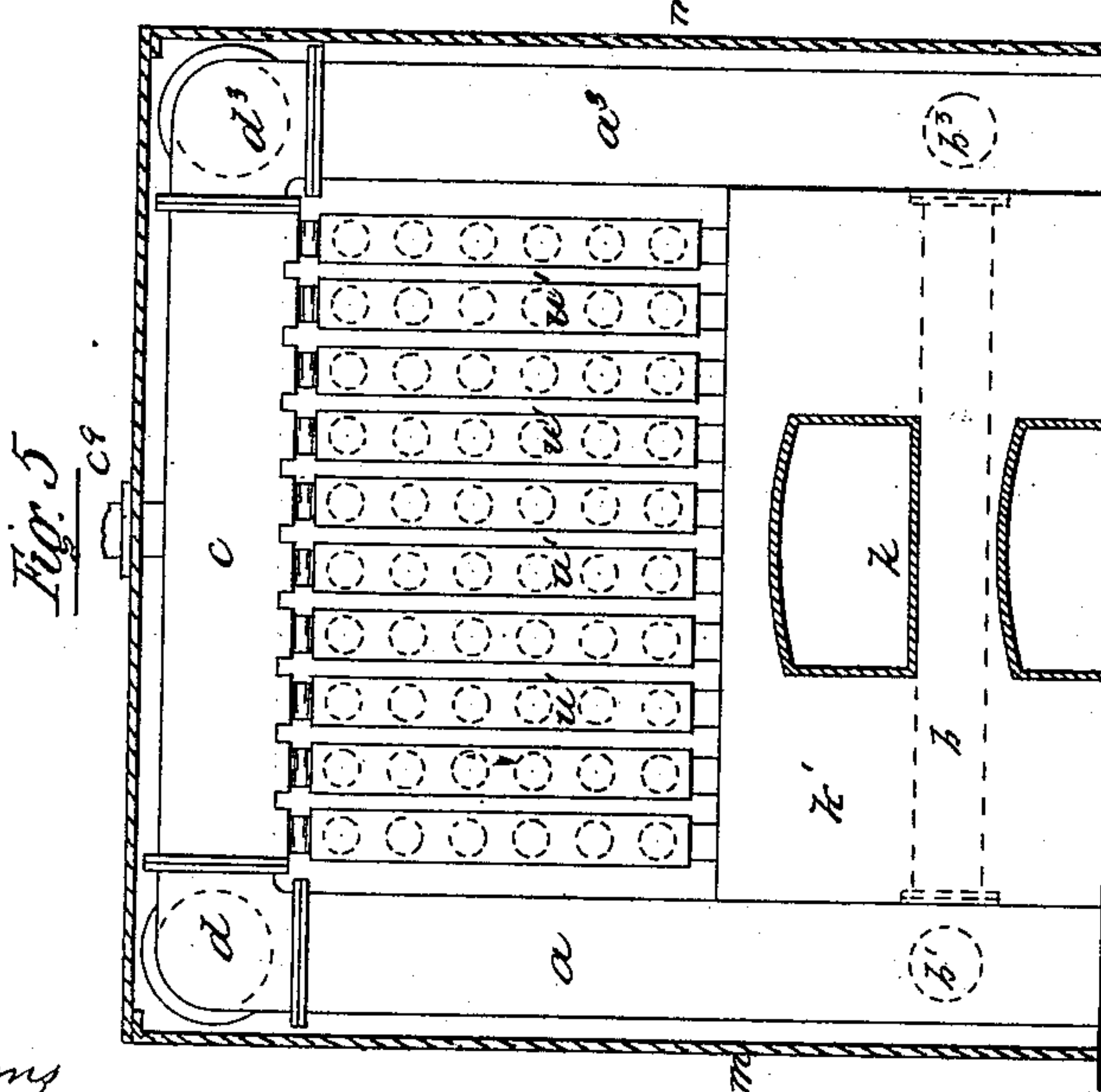
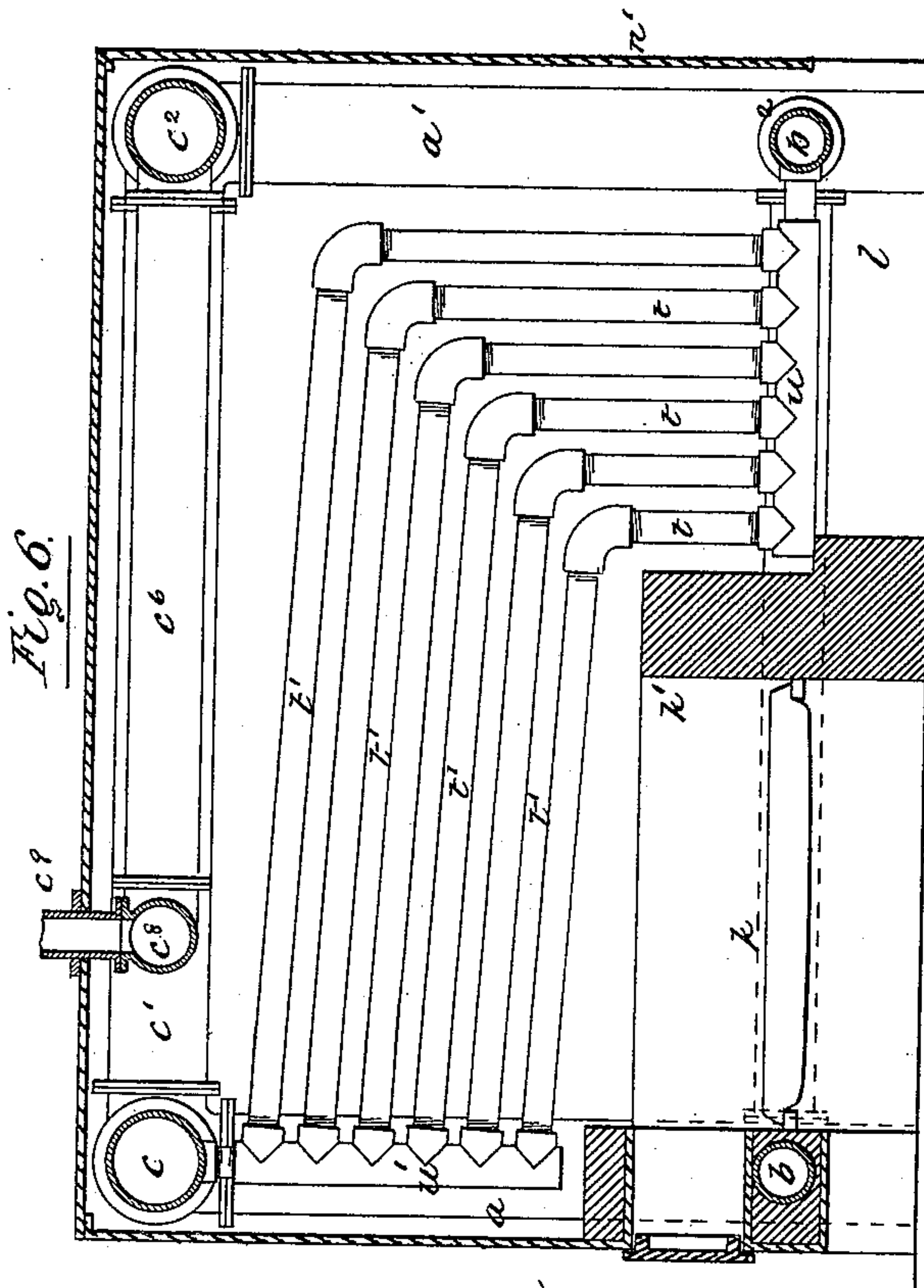
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3 Sheets—Sheet 3.

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Witnesses.

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# UNITED STATES PATENT OFFICE.

PATRICK REILLY, OF BROOKLYN, NEW YORK.

## TUBULAR STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 329,678, dated November 3, 1885.

Application filed August 12, 1885. Serial No. 174,195. (No model.)

*To all whom it may concern:*

Be it known that I, PATRICK REILLY, a citizen of the United States, residing at Brooklyn, county of Kings, State of New York, have invented certain new and useful Improvements in Tubular Steam-Generators, of which the following is a specification.

The steam-generator forming the subject of this invention is of the same class as that described in my application for Letters Patent filed July 20, 1885, under Serial No. 172,104, and comprises a system of large pipes forming the main supporting-frame of the generator, and a system of small pipes or tubes connected to the upper and lower pipes of the main supporting-frame.

In this invention all the steam-generating tubes follow one general design—viz, each has a single bend of about a right angle; they are connected together in sets by being secured at their ends in headers, and these headers are connected to the large pipes of the supporting-frame. By this arrangement great simplicity of construction is had, ample water and steam space and steam-generating capacity are provided, and the labor of cleaning the various parts greatly reduced, besides retaining all the advantages belonging to this class of steam-generators.

To describe my invention more particularly the accompanying drawings will now be referred to, in which—

Figure 1, Sheet 1, is a front elevation of the generator with the front plate of the casing removed; Fig. 2, Sheet 2, is a longitudinal section on the line  $x x$ , Fig. 1, and the line  $y y$ , Fig. 4. Fig. 3, Sheet 1, is a plan view cut on the line  $z z$ , Fig. 2. Fig. 4, Sheet 2, is a rear elevation with the back plate of the casing removed; and Figs. 5 and 6, Sheet 3, are views, respectively, similar to Figs. 1 and 2, of a modification.

The stand-pipes  $a a' a^2 a^3$ , the lower horizontal water-pipes,  $b b' b^2 b^3$ , the upper horizontal steam-pipes,  $c c' c^2 c^3$ , and connecting-bends  $d d' d^2 d^3$  are similar to the pipes correspondingly indicated by reference-letters in my before-mentioned application, so it is unnecessary here to particularly describe their construction and functions.

The steam-generating part of the boiler consists of the straight pipes or tubes  $e e'$ , arranged

vertically, and straight pipes or tubes  $f f'$ , arranged about horizontally—that is, with a slight downward inclination from the front to the rear of the generator. Each one of the vertical tubes  $e e'$  is, by means of an elbow or bend,  $g g'$ , secured to an inclined tube,  $f f'$ , thus forming independent steam-generating tubes having only one bend of about a right angle; and they are connected together in sets by the free ends of the parts  $e e'$  being screwed into headers  $h h'$ , and the free ends of the parts  $f f'$  into headers  $i i'$ , thus constituting sections of the generator. These headers are open at one end only. The parts  $e e'$  have right and left threads on their ends to permit of these sections or sets of tubes being readily put together. Said parts  $e e'$  are screwed into the bends  $g g'$  and headers  $h h'$  after the parts  $f f'$ , with the bends  $g g'$  secured on their ends, have been screwed into the headers  $i i'$ . There may be any desired number of sections and of bent tubes in each section, according to the size of the generator. The headers  $h$  and  $i$  of one set of sections are secured in the main supporting-pipes, as shown—that is, the open ends of the headers  $h h$  are connected to sockets formed in the sides of the horizontal pipe  $b'$ , and the headers  $i i$  are connected to sockets formed in the front stand-pipe,  $a$ , and the headers  $h'$  and  $i'$  of the other set of sections are similarly connected to the pipe  $b'$  and stand-pipe  $a^3$ . All of these said connections are made by means of short connecting-pieces  $j$  and  $j'$ , having right and left threads, which facilitates placing the different sections of tubes in proper position in the main frame; and to cause the bent tubes of each section to occupy a position opposite the spaces between the bent tubes of adjoining sections the alternate connecting-pieces  $j'$  are made somewhat longer than the connecting-pieces  $j$ . The furnace-bars  $k$  are of ordinary construction, and the wall  $k'$  is built up so as to nearly reach the inclined tubes  $f f'$  of the two lower sections, the vertical tubes  $e e'$  of these sections being immediately behind the rear or bridge wall. The inclined and vertical tubes of each succeeding section have increased lengths, so that all the vertical tubes and all the inclined tubes of the various sections are about parallel, thus making it an easy matter to clean them, the soot, &c., being readily removed from the



soot-chamber  $l$  through a door formed in the side wall of the casing  $m$ . A light wall may be built in this chamber  $l$  to support the inner ends of the headers  $h h'$ , as shown at  $l'$ , Fig. 3. The inner ends of the front headers,  $i i'$ , are supported by resting on the projections  $i^2 i^2$ , cast on or attached to the upper side of each of the preceding or lower headers.

To provide for more heating-surface and increase the steam-generating capacity of the boiler, a series of tubes is located in a rear chamber,  $n$ , formed in the casing by the partition  $n'$ , which extends down to within a short distance of the bottom, the flue-opening  $n^3$  being at the upper end of the chamber  $n$ . These tubes in the chamber  $n$  embody the same principles of construction as the other steam-generating tubes—that is, they have right-angle bends and are connected together in sections, the vertical tubes  $o$  and  $o'$  being secured in headers  $p$  and  $p'$ , and having bends  $q$  and  $q'$  on their other ends, into which bends and the headers  $r r'$  are screwed horizontal tubes  $s s'$ . These sections of right-angled tubes are arranged transversely in the chamber  $n$ , and each of two sections in the same transverse plane are reversed in position, so as to fill, as nearly as possible, the whole of the chamber  $n$ , as shown at Fig. 4. The horizontal headers  $p$  and vertical headers  $r'$  are respectively connected to the short pipes  $b^4$  and  $b^5$ , which are closed at their outer ends, and are connected at their inner ends to the main supporting-pipes, the pipe  $b^4$  to the stand-pipe  $a'$  and the pipe  $b^5$  to the horizontal water-pipe  $b^2$ , and the horizontal header  $p'$  and vertical header  $r$  are connected to short pipes  $c^4$  and  $c^5$ , which project from the upper part of the main supporting-pipes, the pipe  $c^4$  from the bend  $d^2$  and the pipe  $c^5$  from the central part of the pipe  $c^2$  of the steam-space of the generator.

From the form of the steam-generating tubes and the manner in which they are connected with the headers and the headers with the main supporting-pipes, it will be seen that all parts may independently expand and contract without imparting severe strains to any of the connections, as the right-angle bends of the generating-tubes provide for their individual expansion without interference, and the free ends of the headers provide for variable expansion of the tubes, &c., of each section without interference from other sections; also, that the water has free circulation in all the independent single-bend generating-tubes entering any of the water-pipes, as the pipe  $b$  at  $b^6$ , and passing from the water-pipes  $b' b^3$  through the lower headers, bent tubes, and upper headers to the stand-pipes  $a a^3$ , and the steam, as it forms in the tubes, ascending to the steam-space pipes  $c c' c^2 c^3$ , and from the rear pipe,  $c^2$ , passes into the superheating-pipes  $c^6 c^7$  and their connecting-pipe  $c^8$ , from which it is taken by pipe  $c^9$ . At one end the pipes  $c^6 c^7$  are connected to the inner side of the pipe  $c^2$ , and at their other ends simply connected together, so that they are free

to expand without applying strains to other parts of the generator.

The arrows indicate the direction of the products of combustion. 70

In the modification shown at Figs. 5 and 6 the sections have their bent tubes  $t t'$  arranged in vertical planes, their headers  $u$  being secured to the inner side of the rear horizontal water-pipe,  $b^2$ , with their free closed ends resting on a projection at the rear of the bridge-wall of the furnace, and their other headers,  $u'$ , which are vertical, being secured to the under side of the front steam-pipe,  $c$ . 75

The steam-generating tubes, instead of being made up of two straight pieces of tube and a simple bend, may be made of a single piece of tube bent at or about a right angle. 80

Steam-generators constructed as here set forth may be provided with water-jackets composed of coils of pipes, as described and claimed in my before-mentioned application. 85

Having now described my invention, what I claim, and desire to secure by Letters Patent, is— 90

1. In a tubular steam-generator, the combination, with the main supporting-frame consisting of stand-pipes and horizontal connecting-pipes, of steam-generating tubes having a single bend, one part extending about horizontally from the front upper part of the main frame toward the rear, and the other part of the tubes extending vertically and downward to the rear lower part of the main frame, substantially as and for the purpose set forth. 95 100

2. The combination, with the main supporting-frame of a tubular steam-generator comprising four corner stand-pipes and upper steam and lower water horizontal connecting-pipes, of sections of tubes composed of single-bend tubes and connecting-headers at their ends secured by their headers arranged horizontally in two sets to the sides of the rear part of the lower water-tubes of the frame, with spaces left between the opposed free ends of the headers of the two sets of steam-generating tubes, and to the upper front part of the frame, substantially as and for the purpose set forth. 105 110 115

3. In a tubular steam-generator, in combination, a main supporting-frame comprising stand-pipes and horizontal connecting-pipes, steam-generating tubes having single bends and arranged in sections longitudinally in and connected at their ends to the main frame, a rear chamber formed by a partition extending nearly to the bottom of the generator, and sections of right-angle tubes transversely arranged in said rear chamber and also connected to the rear end of the main frame, substantially as and for the purpose set forth. 120 125

4. In a tubular steam-generator, in combination, the main supporting-frame comprising stand-pipes  $a a' a^2 a^3$ , horizontal water-pipes  $b b' b^2 b^3$ , and steam-pipes  $c c' c^2 c^3$ , and the steam-superheating pipes  $c^6 c^7$ , arranged between the pipes  $c c' c^2 c^3$ , and connected at one of their ends to the rear pipe,  $c^2$ , and at their other 130



ends to the short pipe  $c^3$ , substantially as set forth.

5 5. In a tubular steam-generator, in combination, the main supporting-frame comprising the stand-pipes  $a a' a^2 a^3$  and horizontal connecting-pipes  $b b' b^2 b^3$  and  $c c' c^2 c^3$ , the single-bend steam-generating tubes  $e f g$  and  $e' f' g'$ , the headers  $h$  and  $i$  and  $h' i'$ , the right and left threaded connecting-pieces  $j j'$ , and furnace  $k$   
10  $k'$ , substantially as set forth.

6. In a tubular steam-generator, in combination, the main supporting-frame comprising the stand-pipes  $a a' a^2 a^3$  and horizontal connecting-pipes  $b b' b^2 b^3$ , and  $c c' c^2 c^3$ , the single-bend steam-generating tubes  $e f g$  and  $e' f' g'$ , the headers  $h$  and  $i$  and  $h' i'$ , the right and left threaded connecting-pieces  $j j'$ , the rear chamber,  $n$ , pipes  $b^4$  and  $b^5$ , projecting from the lower part of the main frame, pipes  $a^4 a^5$ , projecting from the upper part of the main frame,  
20 and sections of right-angled tubes composed of

headers  $p r$  and  $p' r'$ , tubes  $o s$  and  $o' s'$ , and bends  $q$  and  $q'$ , and furnace  $k k'$ , substantially as set forth.

7. In a tubular steam-generator, in combination, the main supporting-frame comprising the stand-pipes  $a a' a^2 a^3$  and horizontal connecting-pipes  $b b' b^2 b^3$  and  $c c' c^2 c^3$ , the rear chamber,  $n$ , pipes  $b^4$  and  $b^5$ , projecting from the lower part of the main frame, pipes  $a^4$  and  $a^5$ , projecting from the upper parts of the main frame, and sections of right-angled tubes composed of headers  $p r$  and  $p' r'$ , tubes  $o s$  and  $o' s'$ , and bends  $q$  and  $q'$ , and the furnace  $k k'$ ,  
30 substantially as set forth.

In testimony whereof I have hereunto set my hand, at New York, county and State of New York, this 7th day of August, 1885.

PATRICK REILLY.

Witnesses:

H. D. WILLIAMS,  
ALFRED SHEDLOCK.