

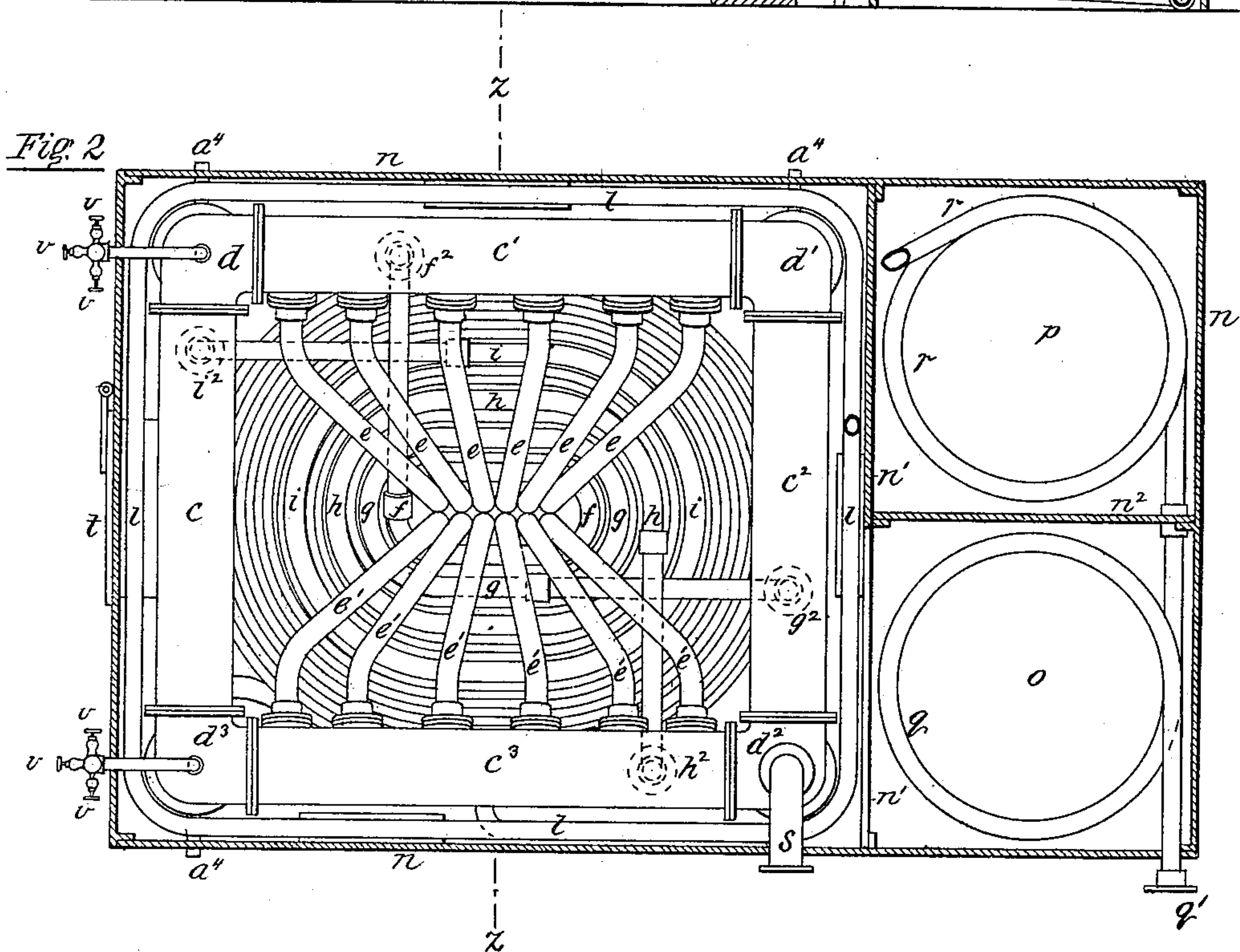
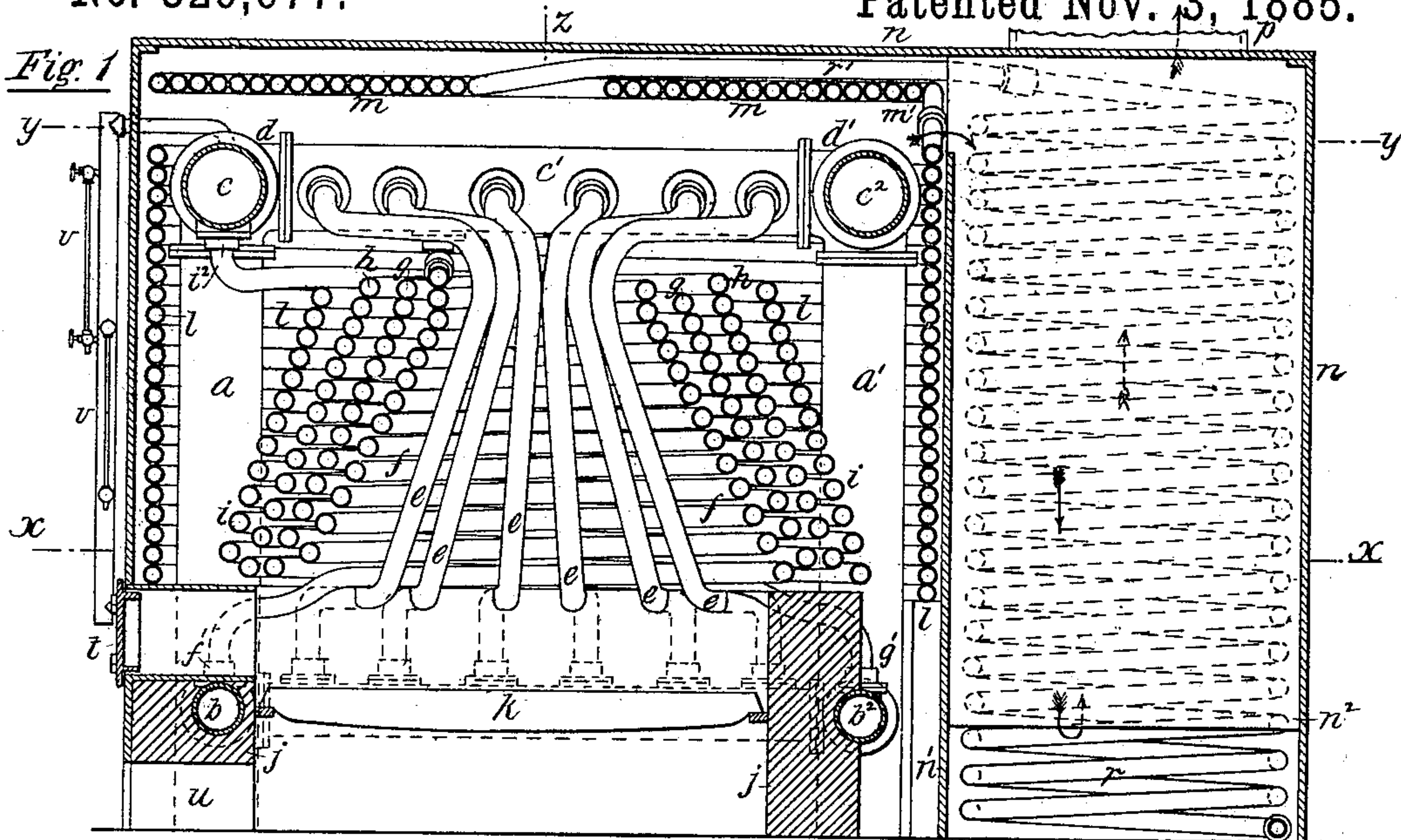
(No Model.)

2 Sheets—Sheet 1.

P. REILLY.  
TUBULAR STEAM GENERATOR.

No. 329,677.

Patented Nov. 3, 1885.



Witnesses

H. D. Williams  
James M. Farnsworth

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Inventor

per Alfred Hedlock,  
att'y.



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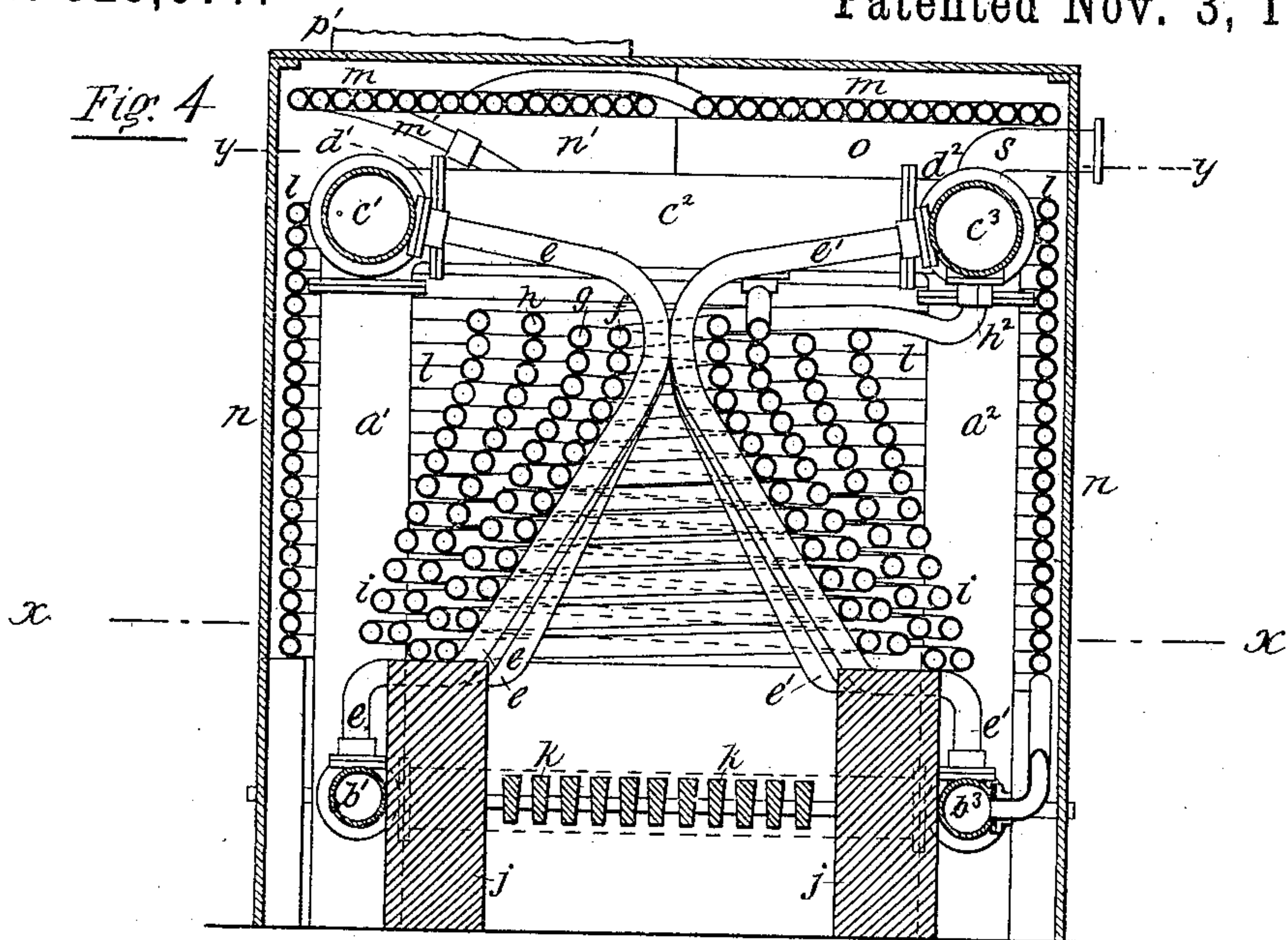
2 Sheets—Sheet 2.

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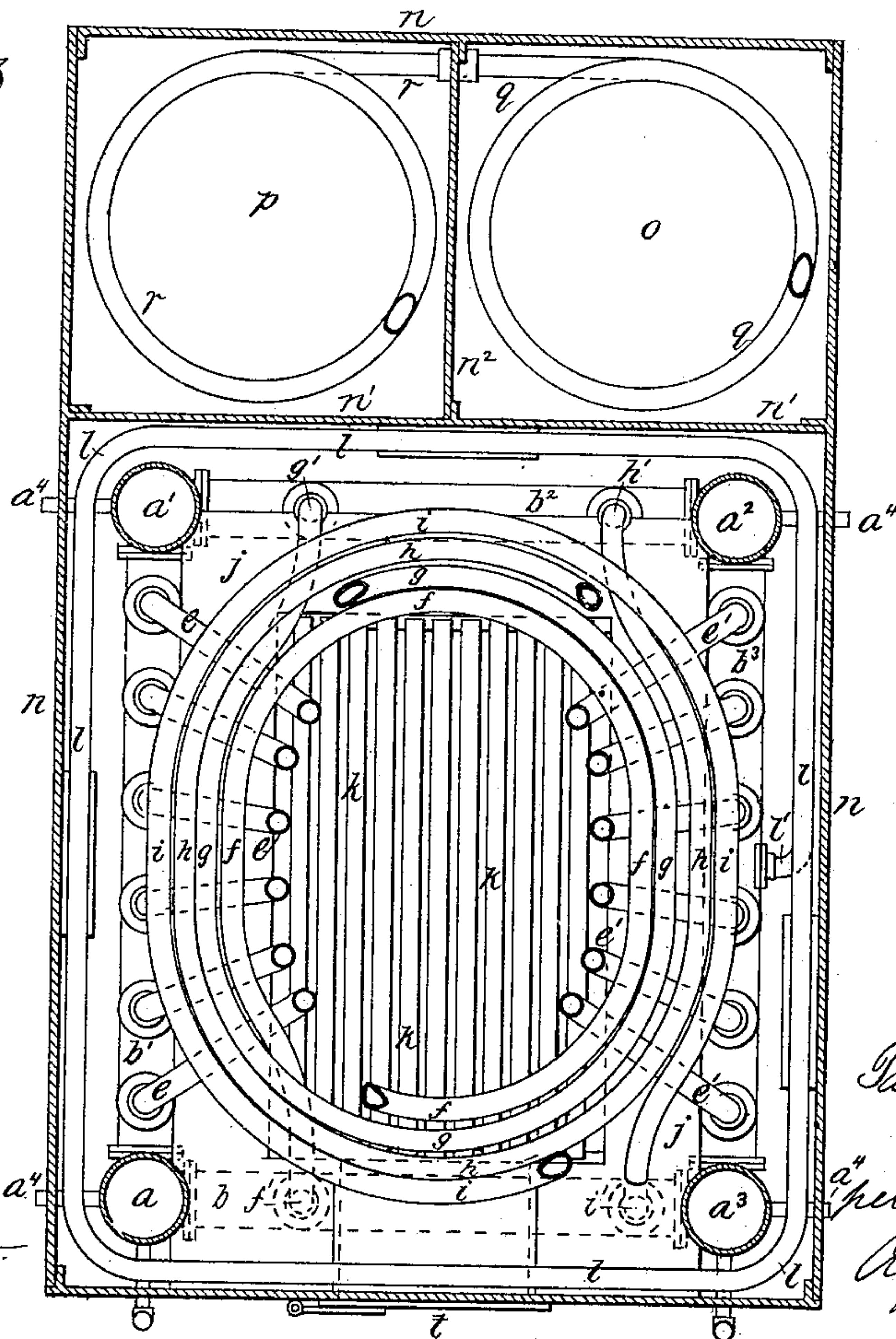
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*Fig. 4*



*Fig. 3*



*Witnesses*

*H. D. Williams*

*James M. Parnsworth*

*Patrick Reilly*

*Inventor*

*Alfred Shetlock*  
*Atty.*



# UNITED STATES PATENT OFFICE.

PATRICK REILLY, OF BROOKLYN, NEW YORK.

## TUBULAR STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 329,677, dated November 3, 1885.

Application filed July 20, 1885. Serial No. 172,104. (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.

This invention has for its object the construction of a steam-generator adapted to generate steam quickly, be perfectly safe, and embody such principles of construction that it may be made of any desired size and capacity. With this object in view I employ only tubes and pipes in the construction of my improved steam-generator, making the main supporting part of comparatively-large pipes to provide ample water and steam capacity, so connected and arranged as to allow for expansion and contraction without injury to them, and connecting several series of central tubes and tubular coils to the upper and lower parts of the large pipes in such a manner that each of the central tubes and tubular coils is independent of the others, thus providing for a free and rapid circulation of the water, and all are so arranged in relation to the furnace as to quickly and fully utilize the heat due to the combustion of the fuel in converting the water into steam. The whole of the generator is surrounded by a tubular-coil water-jacket, through which the water flows before it enters the steam-generating tubes.

But to describe my invention more particularly, I will now refer to the accompanying drawings, in which—

Figure 1, Sheet 1, is a longitudinal vertical central section of my improved steam-generator. Fig. 2, Sheet 1, is a horizontal section cut on the line  $y y$ . Fig. 3, Sheet 2, is a horizontal section cut on the line  $x x$ ; and Fig. 4, Sheet 2, is a transverse vertical section cut on the line  $z z$ .

The main supporting-frame comprises four vertical or corner stand-pipes,  $a a' a^2 a^3$ , four horizontal pipes,  $b b' b^2 b^3$ , connected by suitable flanges to and between the stand-pipes at a short distance from their lower ends, or about in line with the fire-grate, and four pipes,  $c c' c^2 c^3$ , connected to the top of the stand-pipes by means of the triple bends  $d d' d^2 d^3$ . These stand-pipes  $a a' a^2 a^3$  form water-legs of the generator, the water-level being a short

distance below their upper ends, so that the lower horizontal pipes,  $b b' b^2 b^3$ , are always full of water, and the lower ends of the stand-pipes below these horizontal pipes form reservoirs for the collection of sediment, of which the generator may be readily freed by blowing off the same through the pipes  $a^4$ , connected to the lower ends of the stand-pipes. The upper horizontal pipes,  $c c' c^2 c^3$ , constitute the steam-receivers.

The steam-generating part of the boiler comprises, first, two sets of tubes formed so as to extend from the side horizontal pipes,  $b'$  and  $b^3$ , over the furnace in inclined positions, with their upper parts close together and to the side steam-receivers,  $c'$  and  $c^3$ , the one set,  $e e e$ , connecting the pipes  $b'$  and  $c'$ , and the other set,  $e' e' e'$ , connecting the pipes  $b^3$  and  $c^3$ ; second, independent tubular coils surrounding the tubes  $e e'$  and supported thereby, connecting the front and rear horizontal pipes,  $b$  and  $b^2$ , to the steam-receivers  $c c' c^2 c^3$ . In the drawings four tubular coils are shown; but their number and size may be varied as desired and according to the size and capacity of the generator. The lower end of the inner coil,  $f$ , is connected at  $f'$  to the front pipe,  $b$ , and its upper end,  $f^2$ , to the pipe  $c'$  of the steam-receiver. The second coil,  $g$ , is connected at its lower end,  $g'$ , to the rear pipe,  $b^2$ , and at its upper end,  $g^2$ , to the rear pipe,  $c^2$ , of the steam-receiver. The third coil,  $h$ , connects the rear pipe,  $b^2$ , with the side pipe,  $c^3$ , of the steam-receiver by its ends  $h'$  and  $h^2$ , respectively, and the fourth or outer coil,  $i$ , connects at its lower end,  $i'$ , with the front pipe,  $b$ , and at its upper end,  $i^2$ , with the front pipe,  $c$ , of the steam-receiver. These tubular coils  $f g h i$  are formed alternately right and left, so that their adjacent folds or coils cross one another, thus causing the products of combustion from the furnace to pass around all parts of the coils by breaking the direct passages which would be formed if the coils were wound in one direction only, besides which this reverse alternate coiling of the tubes  $f, g, h$ , and  $i$  admits of uniformly direct connections being made between the pipes  $b b' b^2 b^3$  and the steam-pipes  $c c' c^2 c^3$ .

The furnace is formed by the four walls  $j j$ , built under the lower parts of the tubes  $e e'$ , and the grate-bars  $k k$  are supported on ledges



projecting from the front and rear walls in the ordinary manner. Surrounding the whole of the upper part of the generator above the furnace is a water-jacket composed of a coil  
5 of tubes,  $l$ , whose lower end,  $l'$ , is connected to the side water-pipe,  $b^3$ , and a flat coil,  $m$ , located on the top and forming a hood for the generator, is connected at its outer end,  $m'$ , to the upper end of the coil  $l$ . This water-jacket  
10 prevents any loss of heat by radiation, thus causing the full utilization of all the heat from the combustion of the fuel in the furnace.

The casing  $n$ , which may be made of sheet or cast iron plates suitably bolted together,  
15 covers the entire generator, and in its rear part are formed the two chambers  $o$  and  $p$ , separated from the main portion of the generator by the wall or partition  $n'$ . The upper part of this partition  $n'$  is cut away opposite  
20 the chamber  $o$ , and the lower part of the wall or partition  $n^2$ , which divides the chambers  $o$  and  $p$ , is also cut away, thus providing a passage for the gaseous products of combustion from the furnace down the chamber  $o$ , and up  
25 the chamber  $p$ , to the flue or stack attached to the outlet  $p'$ , as indicated by the arrows; and in these chambers  $o$  and  $p$  are placed the tubular coils  $q$  and  $r$ , respectively connected together at their lower ends. The upper end  
30 of the coil  $r$  is connected to the center of the flat coil  $m$  by the tube  $r'$ , and the upper end,  $q'$ , of the coil  $q$  passes out through the casing  $n$ , and is connected to the source of water-supply.

35 The coils  $q$  and  $r$  and water-jacket coils  $m$  and  $l$  are always full of water, the flow of which is as follows: The water enters the end  $q'$  of the coil  $q$ , passes down this coil and up the coil  $r$  to the center of the flat coil  $m$ , and after  
40 circulating through this flat coil to its outer end passes down the outside jacket-coil,  $l$ , to the center of the horizontal side pipe,  $b^3$ . From this point it is distributed throughout the whole of the lower part of the generator, entirely filling the four pipes  $b' b^2 b^3$  and partly  
45 filling the stand-pipes  $a' a^2 a^3$ ; and from the four pipes  $b' b^2 b^3$  the water flows into the central supporting-tubes,  $e e' e'$ , and the coils  $f g h i$  in independent streams, in which  
50 tubes and coils it is directly acted upon by the heat of the fire, and the resultant steam passes to various parts of the steam-receiver  $c' c^2 c^3$ ,  $d' d^2 d^3$ , from one or more parts of which it may be taken, but preferably from the rear  
55 part,  $c^2 d' d^2$ —as, for instance, at  $s$ , as the steam in this part of the receiver will be dryest. Any water that passes up the tubes  $e e'$  and coils  $f g h i$  with the steam will separate therefrom in the pipes  $c' c^2 c^3$  and flow down  
60 the stand-pipes  $a' a^2 a^3$ .

$t$  represents the fire-door in the front part of the casing  $n$ ;  $u$ , the ash-pit opening, and  $v v$  water-gages and pet-cocks.

65 From this construction and arrangement of pipes and water-supply and steam-generating tubes it is evident that but little of the heat due to the combustion of fuel in the furnace will

be wasted; that the large pipes of the main supporting part are so arranged as to be free to expand and contract without excessive strains  
70 on their connecting-joints; that steam will be quickly generated in the independent central tubes,  $e e'$ , and coils  $f g h i$ , and a constant and large supply maintained, as each tube and coil may be considered as an independent genera-  
75 tor, as the water contained therein is quickly converted into steam, which passes up from all of them into a steam-receiver of large capacity, also under the influence of the gaseous products of combustion; and that the central  
80 tubes,  $e e'$ , and their connections and those of the coils  $f g h i$  are so made as to avoid all straining of parts due to unequal expansion and contraction of this part of the generator.

It is evident that, according to the size of  
85 the generator it is desired to construct, the number of the central pipes,  $e e'$ , and coils  $f g h i$  may be varied, or the coils may be omitted, the number of central pipes being increased in this case, if desired, to afford suffi-  
90 cient steam-generating capacity.

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

1. In a tubular steam-generator, in combi-  
95 nation, four stand-pipes, horizontal pipes connected to and between them at their upper ends and lower parts, and steam-generating tubes, each connected to an upper and a lower horizontal pipe, and inclined, so as to come  
100 together at the upper central part of the generator, and furnace-grate bars located directly under the steam-generating tubes, substantially as described.

2. In a tubular steam-generator, in combi-  
105 nation, a main supporting-frame comprising stand-pipes and horizontal connecting-pipes, furnace-grate bars located within the same, central steam-generating tubes connected to the upper and lower parts of the main sup-  
110 porting-frame pipes and formed so as to extend over the grate-bars, and tubular coils arranged around and supported by the central tubes and independently connected to the upper and lower parts of the main sup-  
115 porting-frame pipes, substantially as and for the purpose set forth.

3. In a tubular steam-generator, in combination, the stand-pipes  $a' a^2 a^3$ , the horizontal connecting-pipes  $b' b^2 b^3$ ,  $c' c^2 c^3$ , and triple-  
120 bend connections  $d' d^2 d^3$ , substantially as and for the purpose set forth.

4. In a tubular steam-generator, in combination, the stand-pipes  $a' a^2 a^3$ , the horizontal connecting-pipes  $b' b^2 b^3$ ,  $c' c^2 c^3$ , and the  
125 steam-generating pipes  $e e' e'$ , substantially as and for the purpose set forth.

5. In a tubular steam-generator, in combination, the stand-pipes  $a' a^2 a^3$ , the horizontal connecting-pipes  $b' b^2 b^3$ ,  $c' c^2 c^3$ , the  
130 steam-generating pipes  $e e' e'$ , and the tubular coils  $f g h i$ , substantially as and for the purpose set forth.

6. In a tubular steam-generator, in combi-



nation, the stand-pipes  $a a' a^2 a^3$ , the lower horizontal connecting-pipes,  $b b' b^2 b^3$ , the upper horizontal pipes  $c c' c^2 c^3$ , and bend-connections  $d d' d^2 d^3$ , constituting the steam-receiver, 5 steam-generating tubes connected to the pipes  $b b' b^2 b^3$ , and the pipes  $c c' c^2 c^3$ , and the furnace composed of the walls  $j j$  and grate-bars  $k k$ , substantially as and for the purpose set forth.

10 7. A tubular steam-generator consisting of a main frame of pipes,  $a a' a^2 a^3$ ,  $b b' b^2 b^3$ ,  $c c' c^2 c^3$ , steam-generating pipes  $e e' e' e'$ ,  $f g h i$ , fur-

nace  $j j k k$ , water-heater composed of the coils  $l$  and  $m$ , surrounding the generator, and coils  $q$  and  $r$ , located in the chambers  $o$  and  $p$  at 15 the back of the generator, substantially as and for the purpose set forth.

In testimony whereof I have hereunto set my hand, at New York, county and State of New York, this 15th day of July, 1885.

PATRICK REILLY.

Witnesses:

H. D. WILLIAMS,

ALFRED SHEDLOCK.