

No. 704,571.

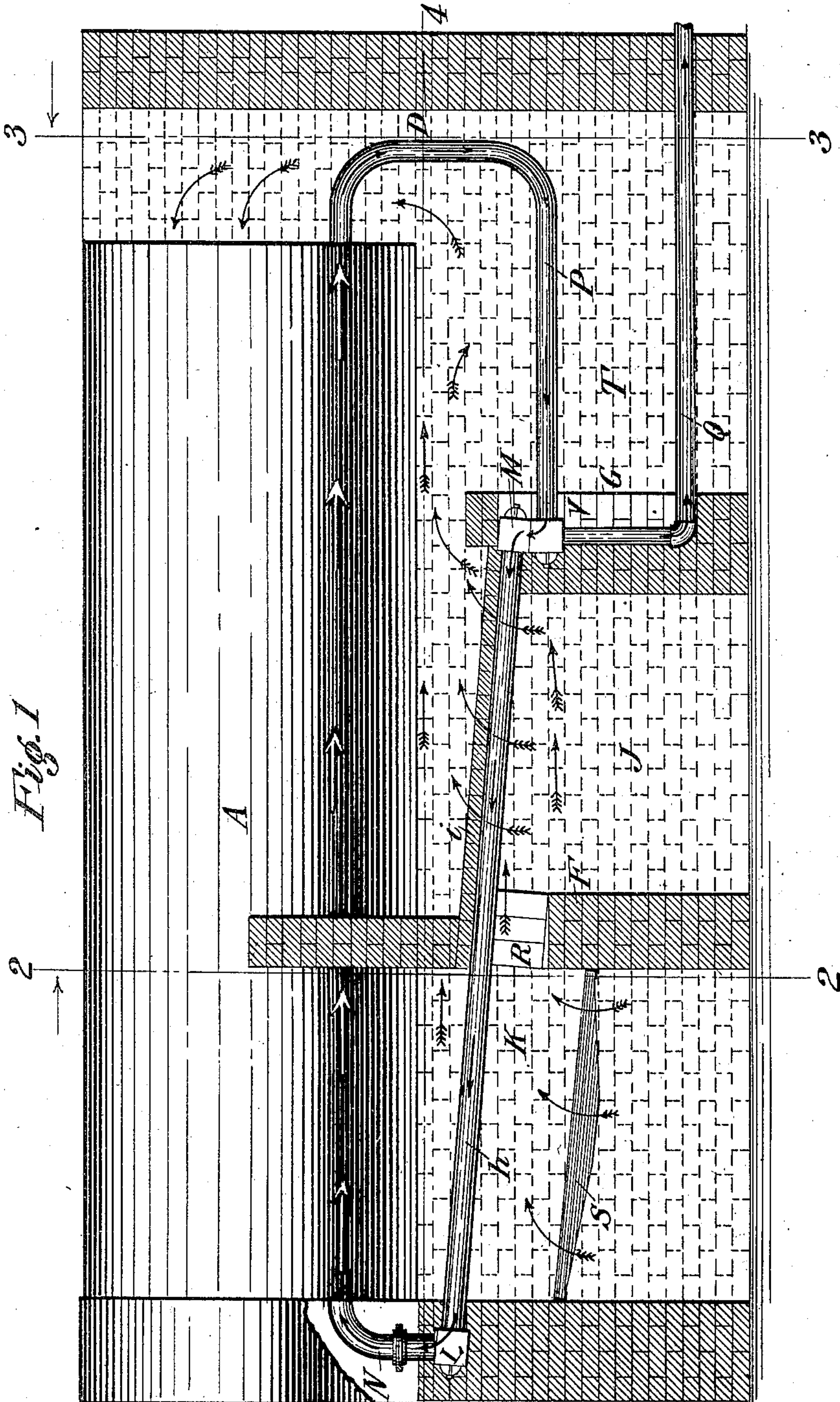
Patented July 15, 1902.

O. D. ORVIS.  
STEAM GENERATOR.

(Application filed Feb. 26, 1902.)

(No Model.)

3 Sheets—Sheet 1.



Witnesses  
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3 Sheets—Sheet 2.

Fig. 3

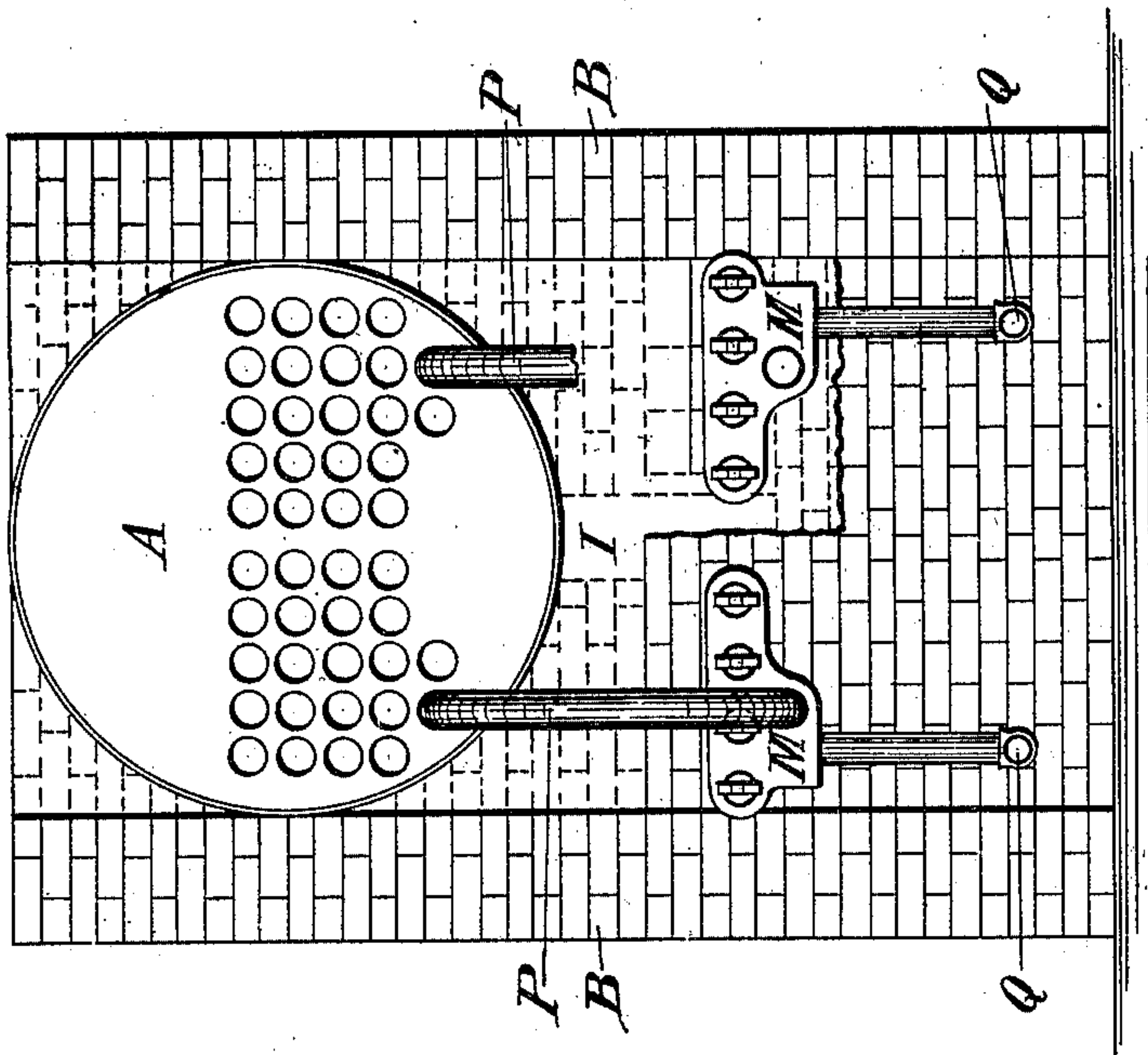
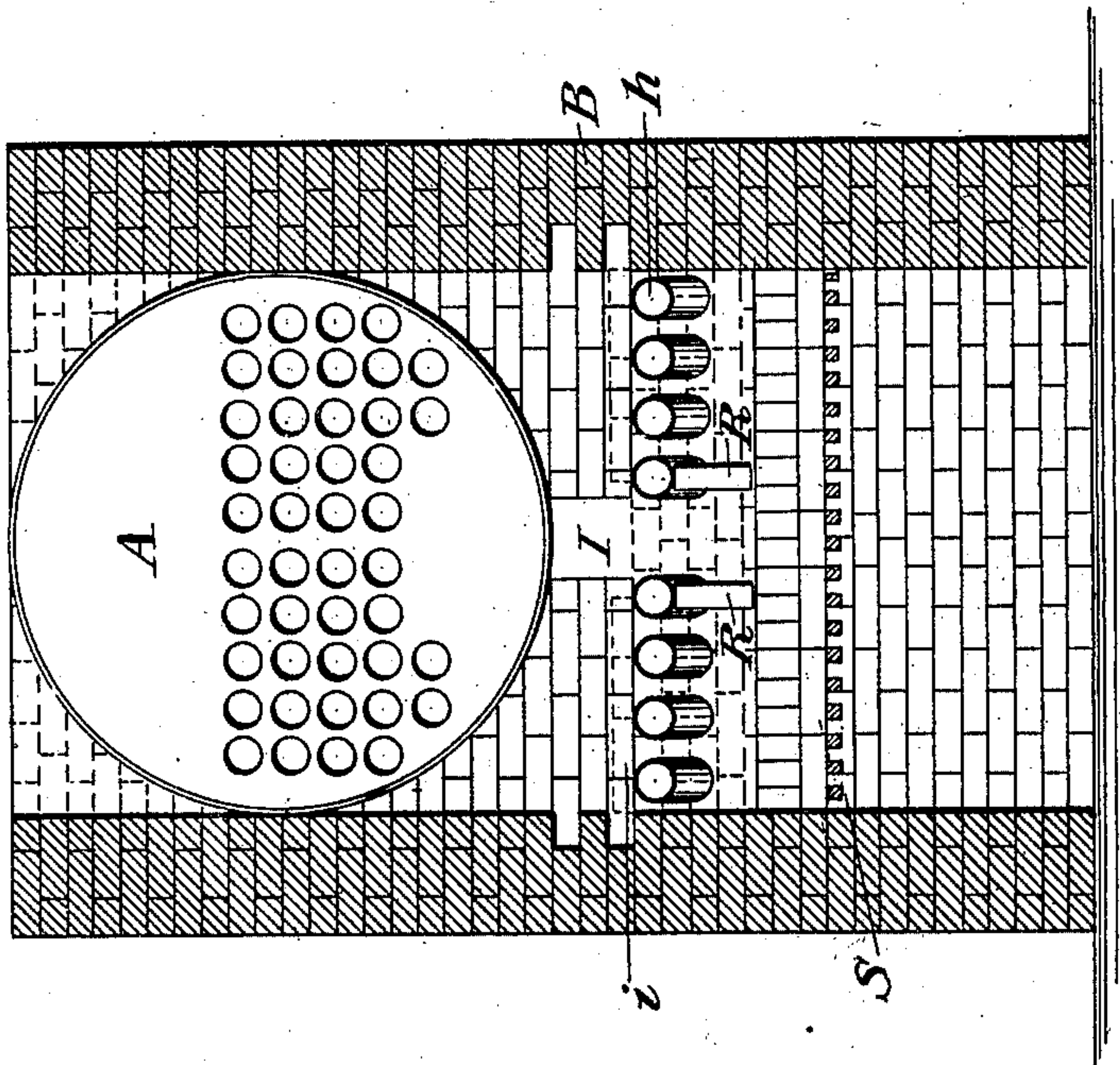


Fig. 2



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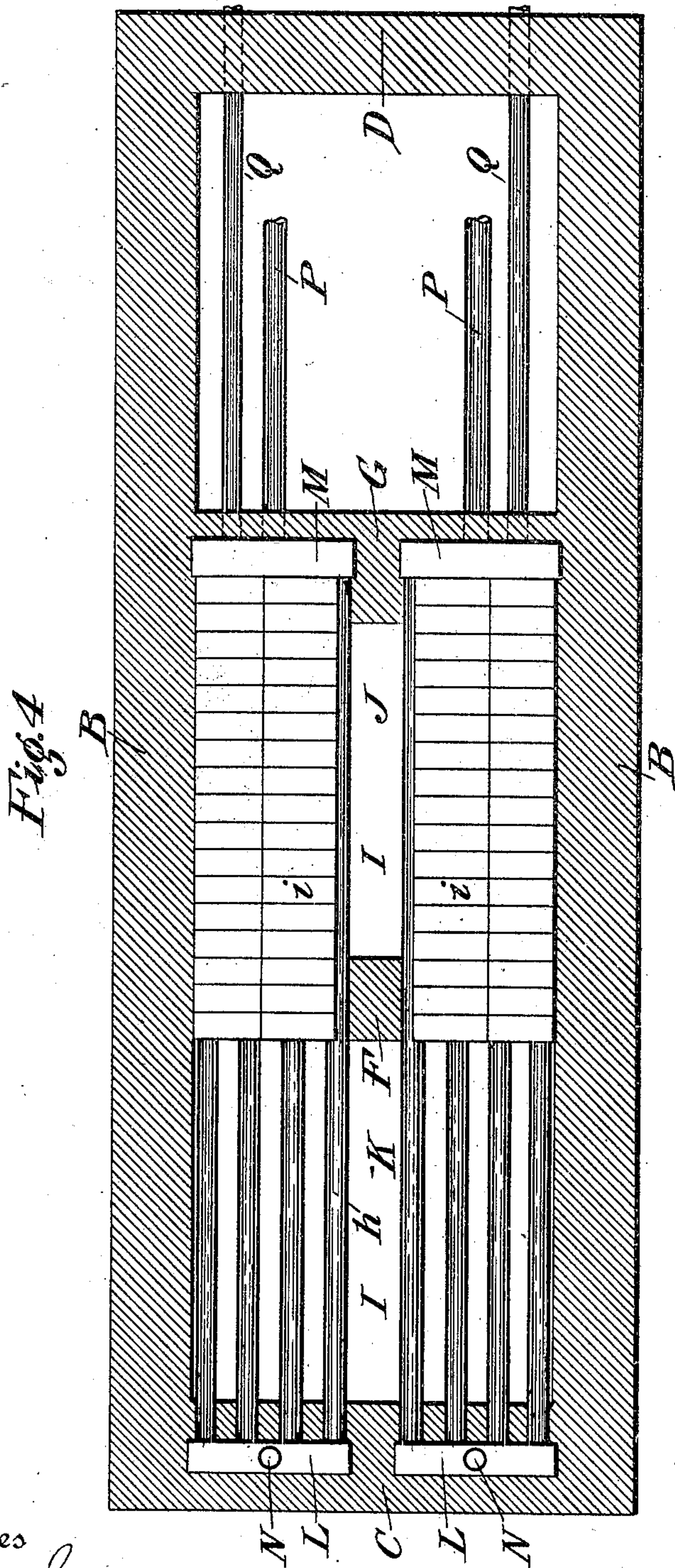
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# UNITED STATES PATENT OFFICE.

OREL D. ORVIS, OF NEW YORK, N. Y.

## STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 704,571, dated July 15, 1902.

Application filed February 26, 1902. Serial No. 95,679. (No model.)

*To all whom it may concern:*

Be it known that I, OREL D. ORVIS, a citizen of the United States, residing in the borough of Manhattan, city of New York, county of New York, and State of New York, have invented certain new and useful Improvements in Steam-Generators, of which the following is a specification.

This invention relates to steam-generators, its objects being to increase and perfect the combustion of the furnace-gases and to establish a rapid and constant circulation of water throughout the boiler system. An important feature is the special shaping and arrangement of the generating-tubes whereby leaking at the joints and connections due to expansion is practically obviated.

In the application of the invention two bridge-walls are employed beneath the boiler. The first bridge-wall supports the back of a continuous grate extending across the width of the furnace. The second bridge-wall is located between the first bridge-wall and the back of the furnace and forms the back of a chamber into which the combustion products of the grate-chamber are allowed to pass. The water-tubes extend longitudinally from the front wall to the rear of the furnace and between the furnace-grate and the bottom of the boiler and are supported by both bridge-walls.

Referring now to the accompanying drawings, Figure 1 designates a vertical longitudinal section of a steam-generator, showing an application of the invention. Fig. 2 is a vertical transverse section on the line 2 2 of Fig. 1. Fig. 3 is a vertical transverse section on the line 3 3 of Fig. 1. Fig. 4 is a horizontal longitudinal section on the line 4 4 of Fig. 1. A is a fire-tube boiler supported by the side walls B B, the front wall C, and the first bridge-wall F.

D is the rear wall of the furnace, and G is the second bridge-wall.

*h h* are water-tubes arranged a suitable distance apart in two horizontal series and partly covered with a suitable refractory material *i i*, such as fire-brick, and forming over the chamber J water-tube mantles. These water-tube mantles extend inwardly from the side walls B B and are separated by the space I. The water-tubes *h h* are mantled only

over the chamber J, that part of the water-tubes passing through the grate-chamber K being uncovered. The front ends of the water-tubes *h h* terminate in the headers L L and the rear ends in the headers M M. The headers L L are located at or in the front wall C and are connected with the water-space in the boiler by the tubes N N. The headers M M rest upon or in recesses V V in the rear of the bridge-wall G and are connected with the water-space in the boiler by the bent tubing P P.

Q Q are the blow-off pipes.

S shows the grate-bars, beneath which air is admitted to the furnace. The brick-supports R R (see Fig. 2) upon the first bridge-wall F give support to the water-tubes and their mantles and provide a passage for the flame and furnace-gases to pass over the top of the first bridge-wall and under the water-tube mantles, the greatest concentrated volume passing directly up between the water-tube mantles and striking the lower central portion of the shell of the boiler. These gases mingle in the second chamber, passing out between the water-tube mantles and over the second bridge-wall to the return-tubes of the boiler and finally into the smoke-stack.

As shown in Fig. 1, the water-tubes *h h* are preferably in a position substantially horizontal and parallel with the fire-grate and at a sufficient distance above the grate to permit of convenient firing and manipulation. These tubes terminating at their rear ends in the headers M M are free to expand backward from the second bridge-wall G into the rear chamber T. The joints of the tubing are protected from the action of the fire by masonry, and the strained effect caused by the expansion of the tubes is taken up in the bow or bend in each of the tubes P P. The tubes P P should be formed of seamless steel tubing, bent into the required shape to allow for expansion and contraction. This arrangement obviates the necessity of exposing joints and connections to the action of the fire.

To illustrate the invention, the simplest kind of a bend is given to the tubes P P, and tubes bent in this manner will allow for considerable expansion without the slightest injury to the joints and connections; but it should be observed that many other forms of



tubing embodying this principle could be used and such forms may be preferable for generators constructed differently from the one shown in the drawings. The drawings also show only two sets of parallel water-tubes *h h*, forming a central longitudinal flame-passage; but it may be found convenient to increase the number of sets of tubes or to arrange the individual tubes or their respective sets in a manner not strictly parallel.

Owing to the inclined position of the water-tubes *h h* from the rear to the front of the furnace, a constant circulation of water is produced, the water leaving the boiler by the tubes *P P*, traversing the tubes *h h*, and thence into the boiler by the tubes *N N*. With this arrangement the coldest water, which stays at the bottom of the boiler, is brought into contact with the greatest heat of the furnace through the tubing *h h* and upon reëntering the boiler ascends to the surface, thus augmenting circulation.

The blowing-off tubes *Q Q* are connected to the rear water-tube headers *M M*, an arrangement by which the entire water-circuit may be cleared from sediment.

Though I have shown and prescribed definite arrangements for carrying out the general principles of this invention, it will be seen that many modifications may be made without departing from the spirit of the invention.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a steam-generator, a furnace containing two bridge-walls, a continuous grate extending across the width of the front of the furnace, sets of water-tubes extending longitudinally from the front of the furnace to or beyond the second bridge-wall and inwardly from the opposite sides of the furnace forming an intermediate longitudinal space for the passage and direction of the greatest volume of flame and furnace-gases against the boiler; said sets of tubes being mantled over the chamber formed between the first bridge-wall and the second bridge-wall, and connections of said sets of water-tubes with the front and rear of the boiler for the purpose specified.

2. In a steam-generator, a furnace containing two bridge-walls, a continuous grate extending across the width of the front of the furnace, sets of water-tubes extending longitudinally from the front of the furnace to or beyond the second bridge-wall and inwardly from the opposite sides of the furnace forming an intermediate longitudinal space for the passage and direction of the greatest volume of the flame and furnace-gases against the boiler; said sets of water-tubes mantled over the chamber formed between the first bridge-wall and the second bridge-wall, headers located at the front wall of the furnace connecting the front ends of said sets of water-tubes and connections between said head-

ers and the water-space in the boiler, and headers located in a recess in or behind the second bridge-wall connecting the rear ends of said sets of water-tubes and bent or bowed tubular connections between said headers and the water-space in the boiler substantially as and for the purpose set forth.

3. In a steam-generator, the combination of a furnace containing two bridge-walls, a continuous grate extending across the width of the front of the furnace, sets of water-tubes extending longitudinally from the front of the furnace to or beyond the second bridge-wall, means of support for said sets of water-tubes upon the first bridge-wall and connections of said sets of water-tubes with the front and rear of the boiler for establishing water circulation.

4. A steam-generator comprising a furnace containing two bridge-walls, a continuous grate extending across the width of the front of the furnace, sets of water-tubes extending longitudinally from the front of the furnace to or beyond the second bridge-wall, means of support for said sets of water-tubes upon the first bridge-wall, mantles or coverings upon said sets of water-tubes located over the chamber formed between the first bridge-wall and the second bridge-wall and connections of said sets of water-tubes with the front and rear of the boiler substantially as and for the purpose described and illustrated.

5. A steam-generator comprising a furnace containing two bridge-walls, a continuous grate extending across the width of the front of the furnace, sets of water-tubes extending longitudinally from the front of the furnace to or beyond the second bridge-wall, mantles or coverings upon said sets of water-tubes located over the chamber formed between the first bridge-wall and the second bridge-wall, means of support for said sets of water-tubes and their mantles upon the first bridge-wall, headers located at the front wall of the furnace connecting the front ends of said sets of water-tubes and headers located at the second bridge-wall connecting the rear ends of said sets of water-tubes and connection of said headers with the front and rear of the boiler substantially as described.

6. In a steam-generator, a furnace containing two bridge-walls, a continuous grate extending across the width of the front of the furnace, sets of water-tubes extending longitudinally from the front of the furnace to or beyond the second bridge-wall and inwardly from the opposite sides of the furnace forming an intermediate longitudinal flame-space, said sets of water-tubes mantled over the chamber formed between the first bridge-wall and the second bridge-wall, means of support for said sets of water-tubes upon the first bridge-wall, headers located at the front wall of the furnace connecting the front ends of said sets of water-tubes and connections between said headers and the water-space in the



boiler and headers located at the second  
bridge-wall connecting the rear ends of said  
sets of water-tubes and bent or bowed tubu-  
lar connections between said headers and the  
5 water-space in the boiler substantially as set  
forth.

In testimony whereof I have hereunto set

my hand in the presence of two subscribing  
witnesses.

OREL D. ORVIS.

Witnesses:

JAMES A. CONNOLLY,  
O. G. SCHAEFER.