

No. 668,755.

Patented Feb. 26, 1901.

O. D. ORVIS.  
STEAM GENERATOR.

(No Model.)

(Application filed July 17, 1900.)

2 Sheets—Sheet 1.

Fig. 2.

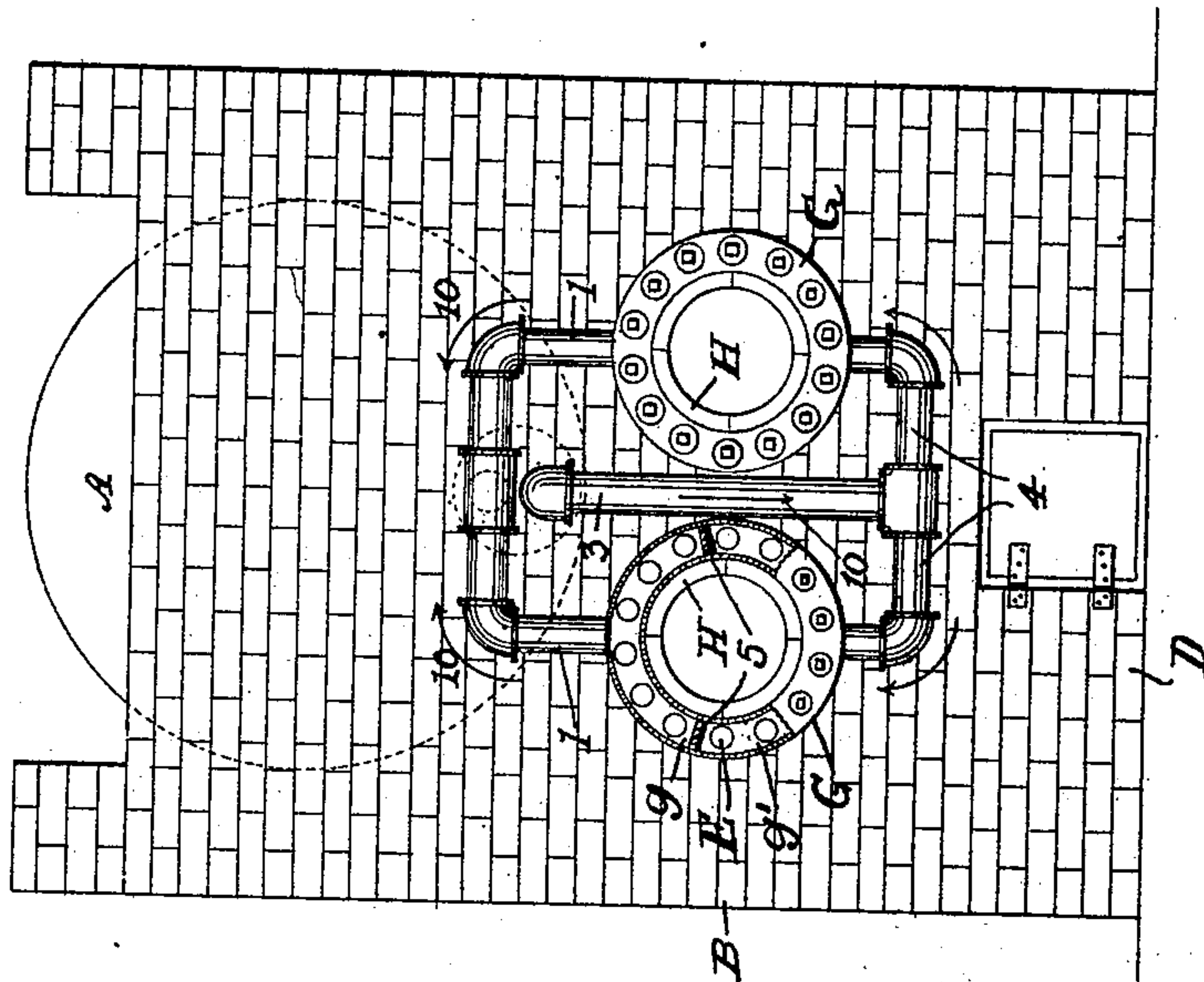
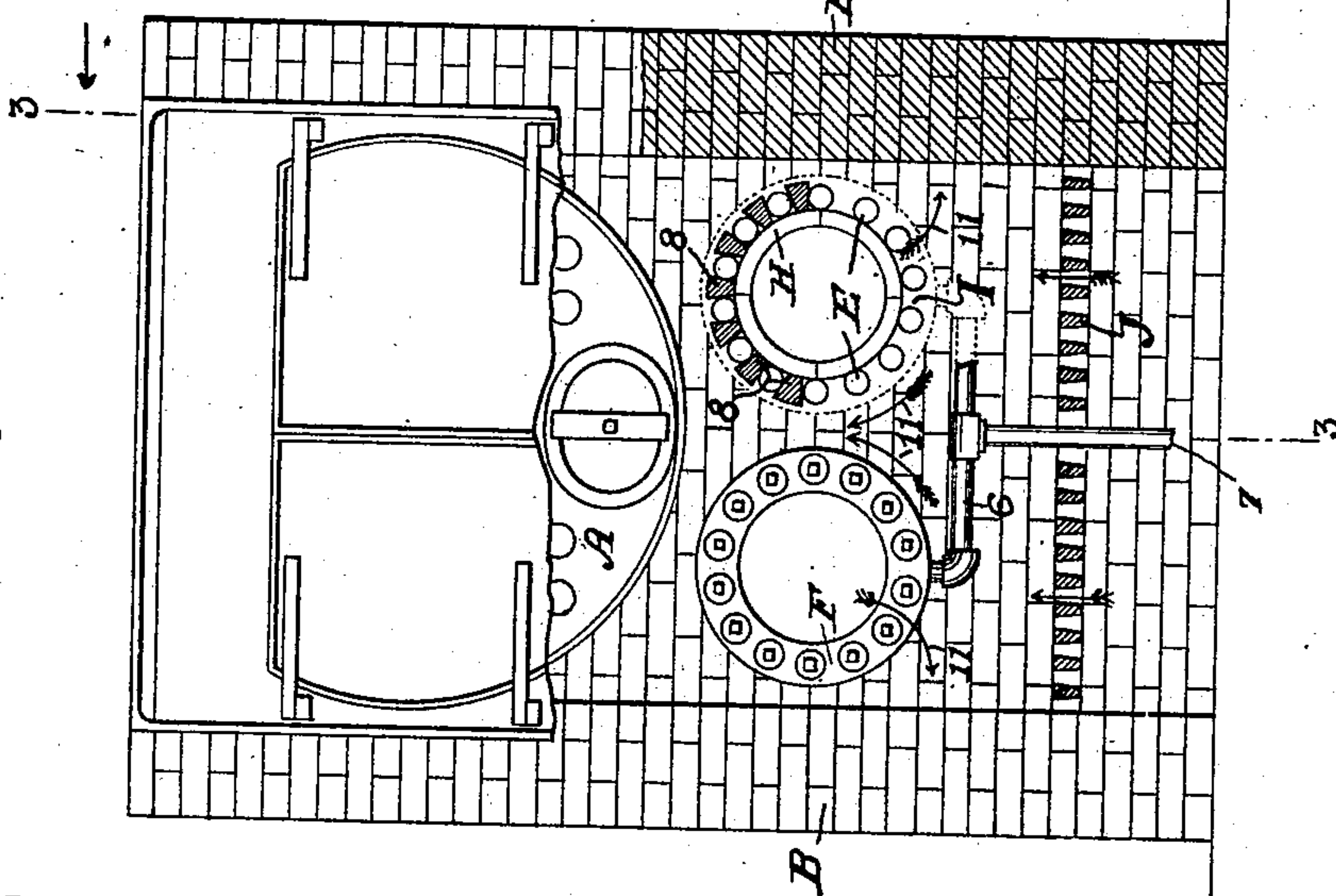


Fig. 1.



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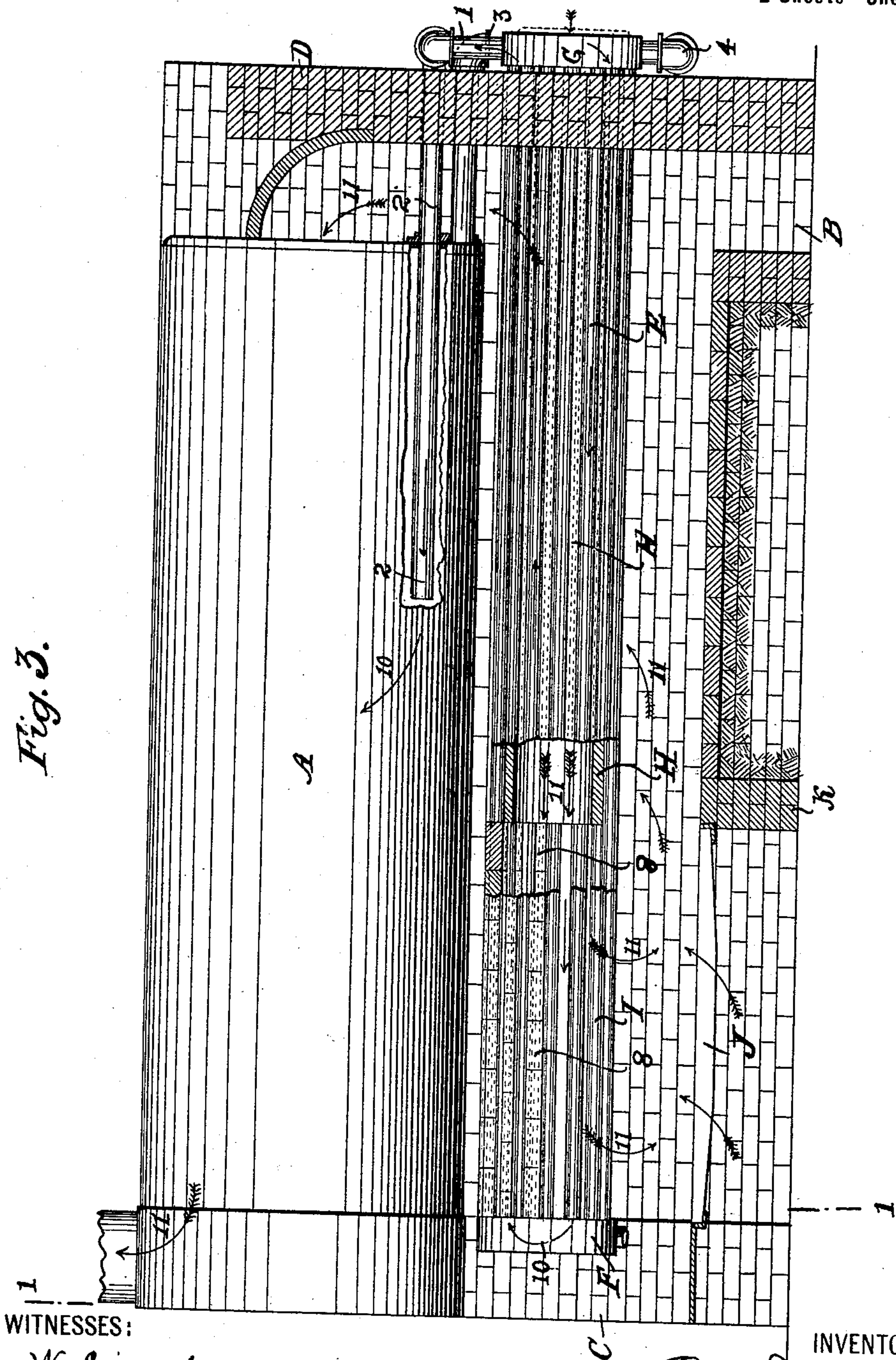
STEAM GENERATOR.

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Fig. 3.



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# UNITED STATES PATENT OFFICE.

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TRUSTEE, OF SAME PLACE.

## STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 668,755, dated February 26, 1901.

Application filed July 17, 1900. Serial No. 23,893. (No model.)

*To all whom it may concern:*

Be it known that I, OREL D. ORVIS, a citizen of the United States of America, residing at borough of Manhattan, New York, in the  
5 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.

My invention has reference to improve-  
10 ments in steam-generators of that class in which the downdraft or combined downdraft and updraft principle of combustion is employed, and has for its object to increase the efficiency of such generators by effecting a  
15 high and uniform heating of the air before its arrival at the grate and also to increase the heating-surface and to obtain an effective circulation of the water.

With this object in view my invention consists, essentially, in a steam-generator comprising a boiler, a series of water-tubes located beneath the boiler and placed in communication with the water-space of the boiler,  
20 a grate at one end of the water-tubes, and an air-heating flue located within the series of water-tubes and extending through the same to the grate for supplying heated air to the grate.

The nature of my invention will best be understood when described in connection with the accompanying drawings, in which—

Figure 1 represents a transverse vertical section on the line 1 1, Fig. 3. Fig. 2 is a rear view, partly in section. Fig. 3 is a longitudinal vertical section on the line 3 3, Fig. 1.  
35

Similar letters and numerals of reference designate corresponding parts throughout the several views of the drawings.

Referring to the drawings, the letter A designates a boiler provided with fire-tubes supported in the usual manner and having a usual setting consisting of the side walls B B, the front wall C, and the rear wall D.  
40

E designates water-tubes of suitable diameter which extend throughout the length of the furnace and are preferably arranged in two circular series located adjacent to the side walls B B of the furnace and a short distance below the boiler. Of course it is understood  
50 that the tubes may be arranged in elliptical,

square, or rectangular configuration; but the circular form is generally adopted. The front ends of the water-tubes are connected to and communicate with headers F, and at their rear ends, which extend through the rear wall D  
55 of the furnace, they are connected to and communicate with headers G. The tops of the rear headers G are connected by water-legs 1 and fittings with a water-pipe 2, which enters the boiler at some distance from its  
60 bottom and extends into the boiler to about one-half of the length of the latter. The bottom of the rear headers G are connected by a branched water-leg 3 with a pipe 4, connected with the boiler below the water-pipe  
65 2 and extending into the boiler only a short distance or not at all. The rear headers G, which are made annular in form, are divided by two radial partitions 5, thus forming two  
70 isolated chambers  $g$   $g'$ , of which the upper chamber  $g$  communicates with the water-leg 1 and the lower chamber  $g'$  with the water-leg 3. The upper chamber communicates with the upper set of the series of water-tubes E and the lower chamber with the lower  
75 set of the series of water-tubes. The front headers F are connected with a pipe 6, to which a blow-off pipe 7 may be connected.

The front of the furnace being the hotter, the circulation of water through the boiler and  
80 the water-tubes takes place as indicated by arrows 10 in Fig. 3—that is, from the boiler to the pipe 4, water-leg 3, lower chamber  $g'$ , lower set of tubes E, header F, upper set of tubes E, upper chamber  $g$ , water-legs 1, and  
85 pipe 2, back to the boiler, the water having passed twice through the length of the furnace before its return to the boiler.

To conduct heated air to the water-grates I, formed by the front portions of the water-  
90 tubes E, I construct within the two series of water-tubes air-flues H, which extend from the rear header G forward to the grates I. The upper portions of the fronts of the series of water-tubes are closed through distances  
95 corresponding to the length of the grate required either by suitable arches or by crownings formed by the insertion of wedge-shaped blocks 8, made of suitable refractory material, between the upper sets of tubes, as  
100



shown in Fig. 1, so that the air passing from the air-heating flues H must pass downwardly through the fuel on the grate I. Below the grate I is located a grate J, which is adapted  
 5 to receive the droppings from the upper grate, and air is conducted from below to this grate through the ash-pit door in the usual manner. The grate J is supported by the front wall of the boiler and by a suitable bridge-wall K.  
 10 The upper grate I is fired through a suitable door in the usual manner. The products of combustion issuing from the burning fuel on the grate I pass outwardly between the tubes E of the grate and through the combustion-  
 15 chamber L and heat the flues H. They then pass upwardly to the fire-tubes of the boiler A to the uptake and to the chimney, as indicated by arrows 11. The products of combustion of the fuel on the grate J mix with  
 20 the products of combustion of the fuel on the grate I, all tending to highly heat the air-flues H. Consequently the incoming or counter current of air passing through the said flues is highly and uniformly heated and a  
 25 more perfect combustion of the fuel takes place. The quantity of incoming air can be regulated by a suitable register or door, as indicated in Fig. 3.

It is of course to be understood that in place  
 30 of the fire-tube boiler shown in the present example there could be substituted a flue-boiler or a plain cylindrical boiler, as used in the well-known types of water-tube boilers.

What I claim as new is—

35 1. A steam-generator comprising a boiler, a series of water-tubes located in the furnace beneath the boiler and placed in communication with the water-space of the boiler, a grate at one end of the water-tubes, and an  
 40 air-heating flue located within and extending through the series of water-tubes to the grate

for supplying heated air to the latter, substantially as described.

2. A steam-generator comprising a boiler, a series of water-tubes located beneath the  
 45 boiler and extending throughout the length of the furnace, a grate formed at one end of the series of water-tubes by the lower tubes of the series and by an arch, and an air-heating flue located within and extending through  
 50 the series of water-tubes from the rear of the furnace to the grate for supplying heated air to the latter, substantially as described.

3. A steam-generator comprising a boiler, a series of water-tubes located in the furnace  
 55 beneath the boiler, headers at opposite ends of said series of tubes with which said tubes communicate, partitions formed in one header dividing the same into two chambers separately communicating with the water-space of  
 60 the boiler, and a flue located within and extending through the series of water-tubes to the grate for supplying heated air to the latter, substantially as described.

4. A downdraft steam-generator comprising  
 65 a boiler, water-tubes arranged in a plurality of series and located beneath the boiler adjacent to the side walls of the furnace and extending throughout the length of the furnace, grates formed at the front ends of said  
 70 series of water-tubes, and air-flues located within and extending through said series of water-tubes from the rear of the furnace to the grates for supplying heated air to the latter, substantially as described.

In testimony whereof I have hereunto set  
 75 my hand in the presence of two subscribing witnesses.

OREL D. ORVIS.

Witnesses:

EUGENIE P. HENDRICKSON,  
 A. FABER DU FAUR, Jr.