

B. T. BABBITT.

STEAM GENERATOR.

No. 271,397.

Patented Jan. 30, 1883.

Fig 1.

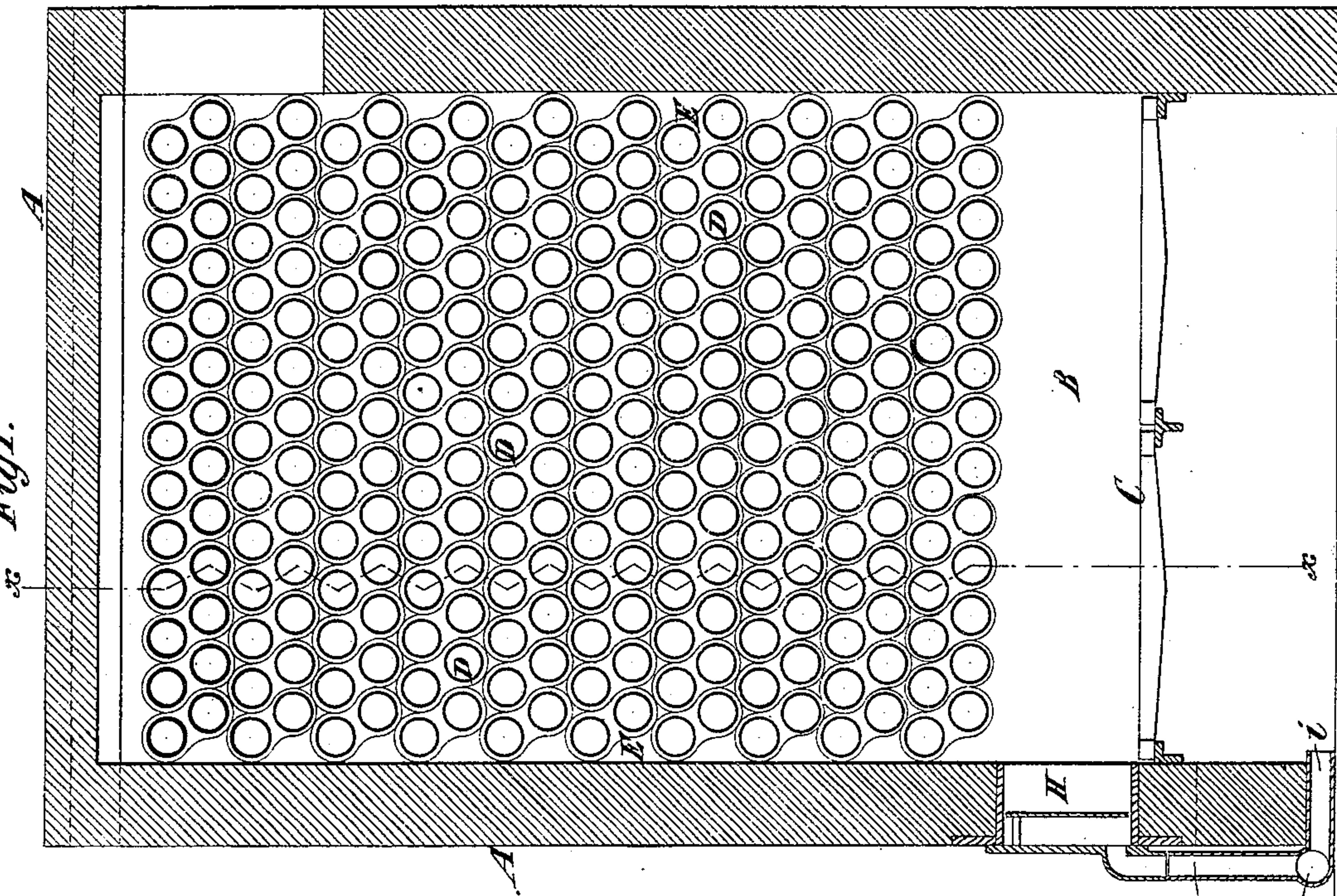
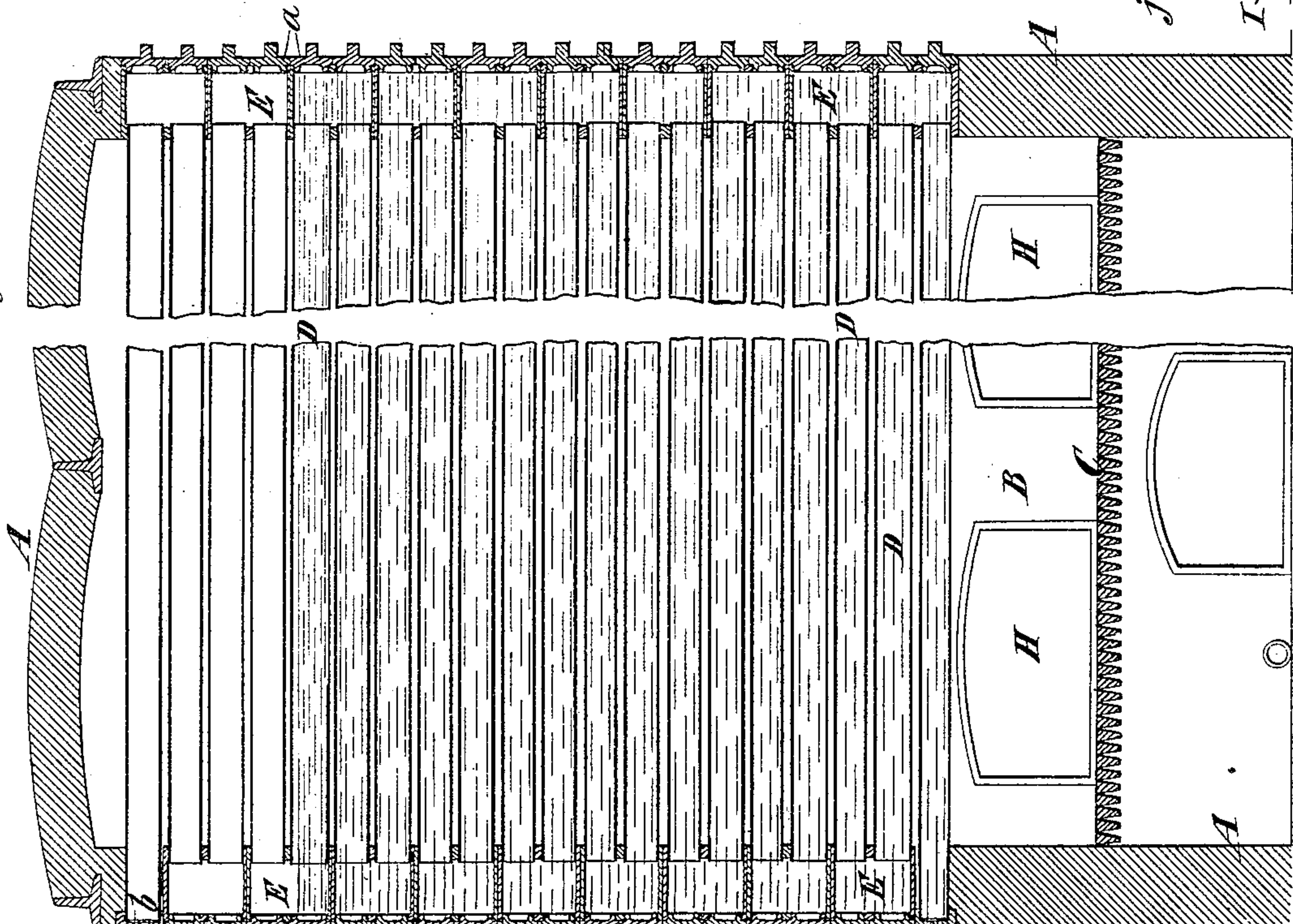


Fig 2.



Witnesses: {  
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Ed L Moran

Inventor:  
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by his Atty  
Brown & Wrenn



(No Model.)

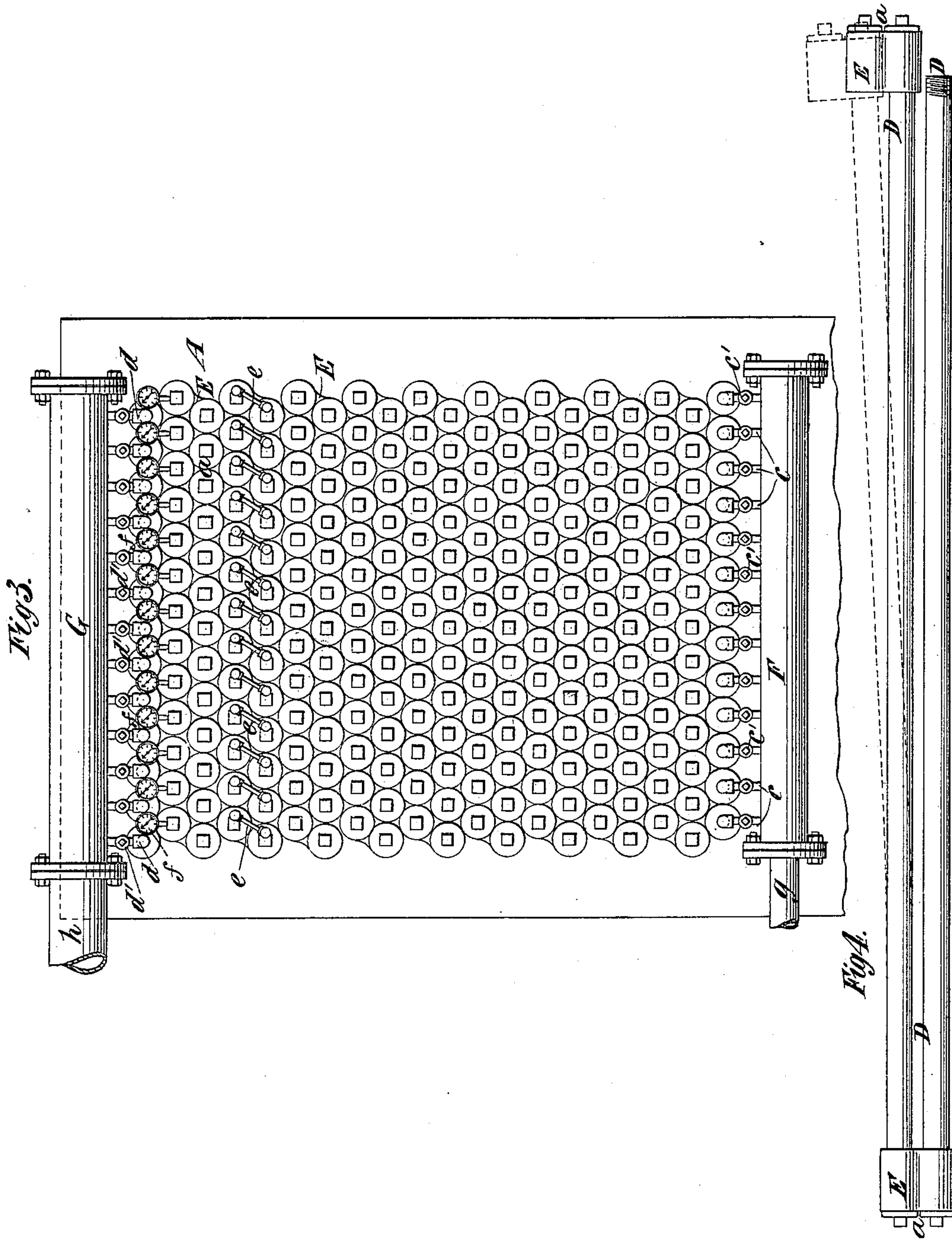
3 Sheets—Sheet 2

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(No Model.)

3 Sheets—Sheet 3.

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Fig 7.

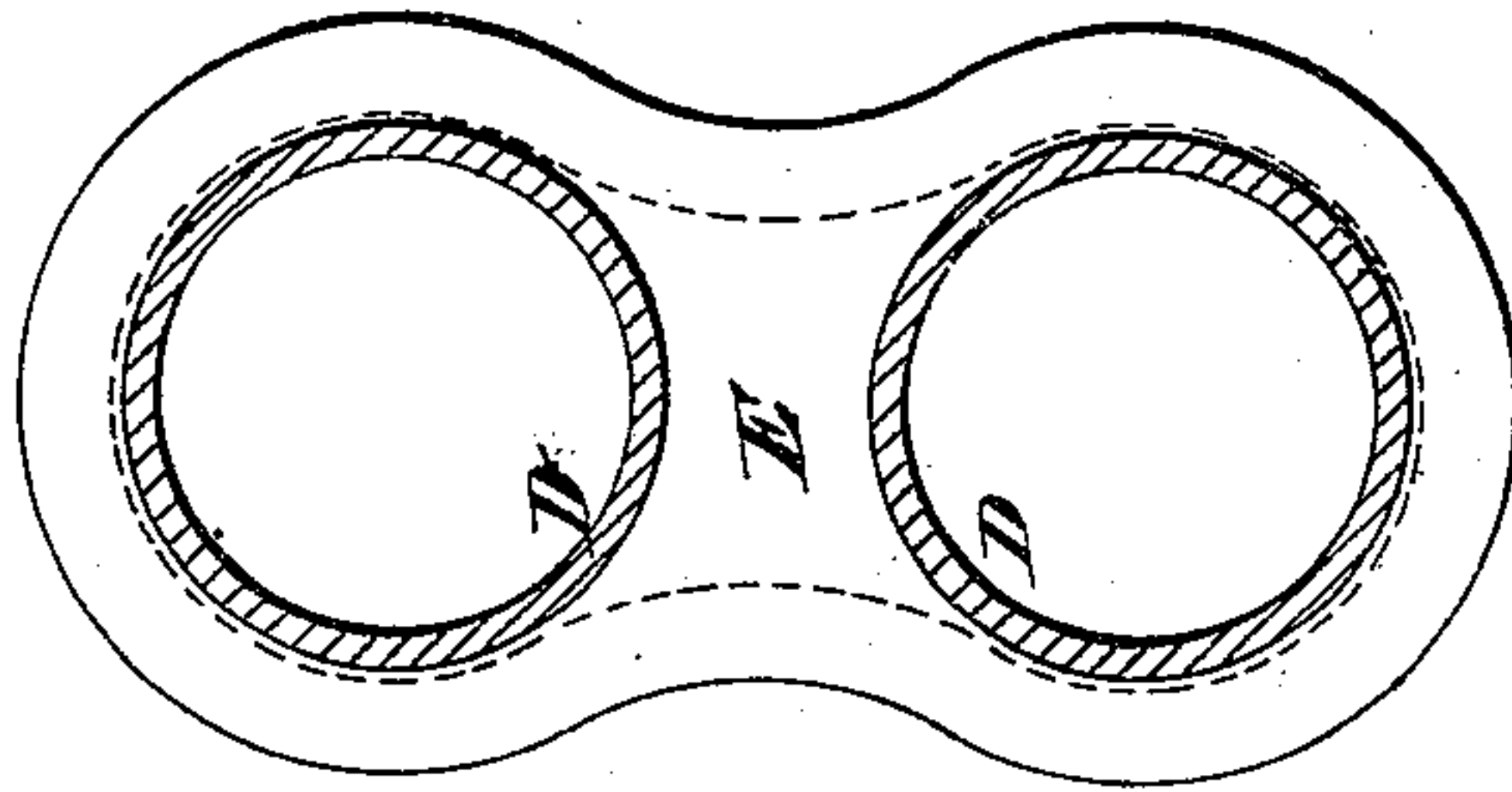


Fig 6.

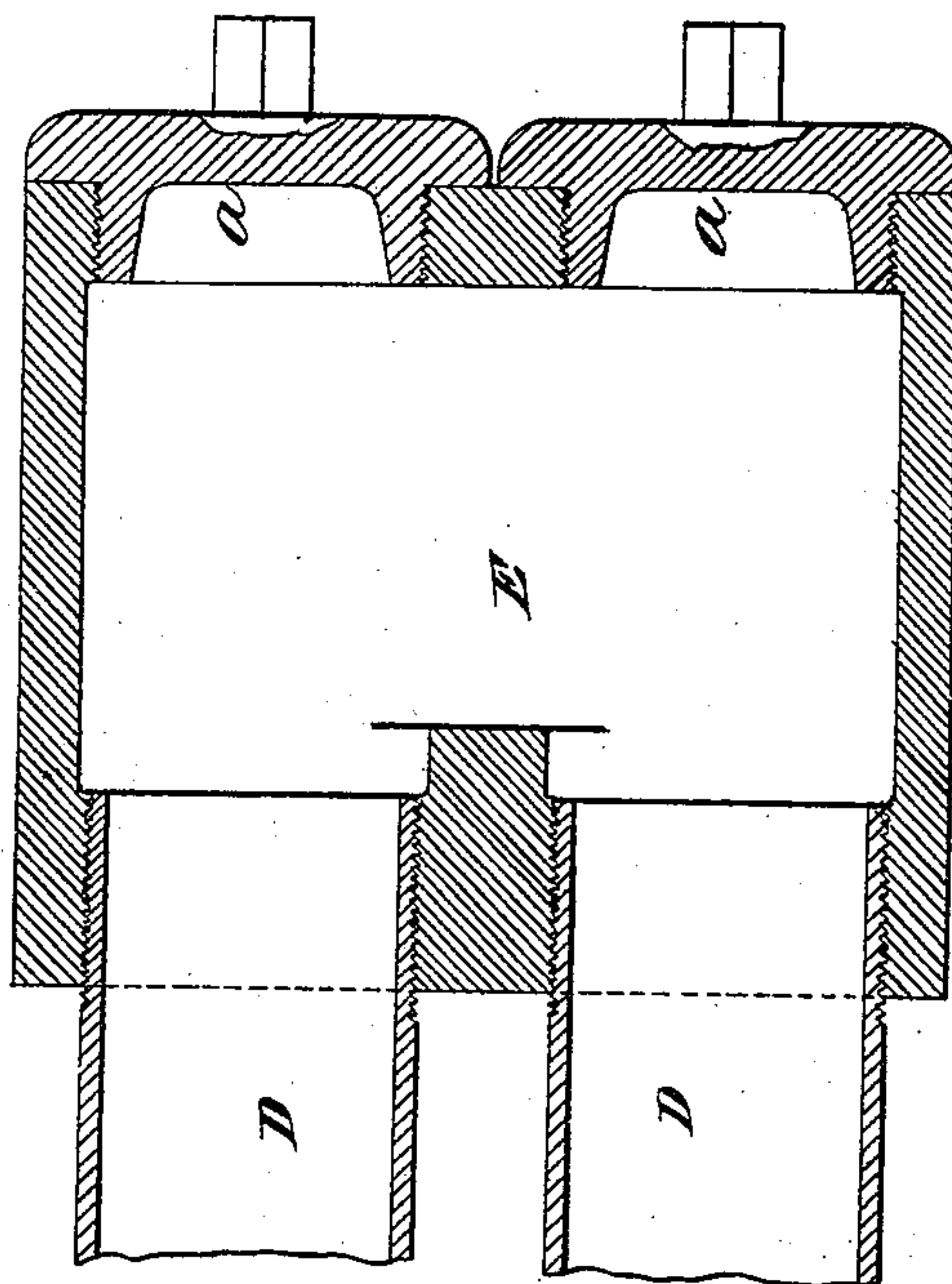
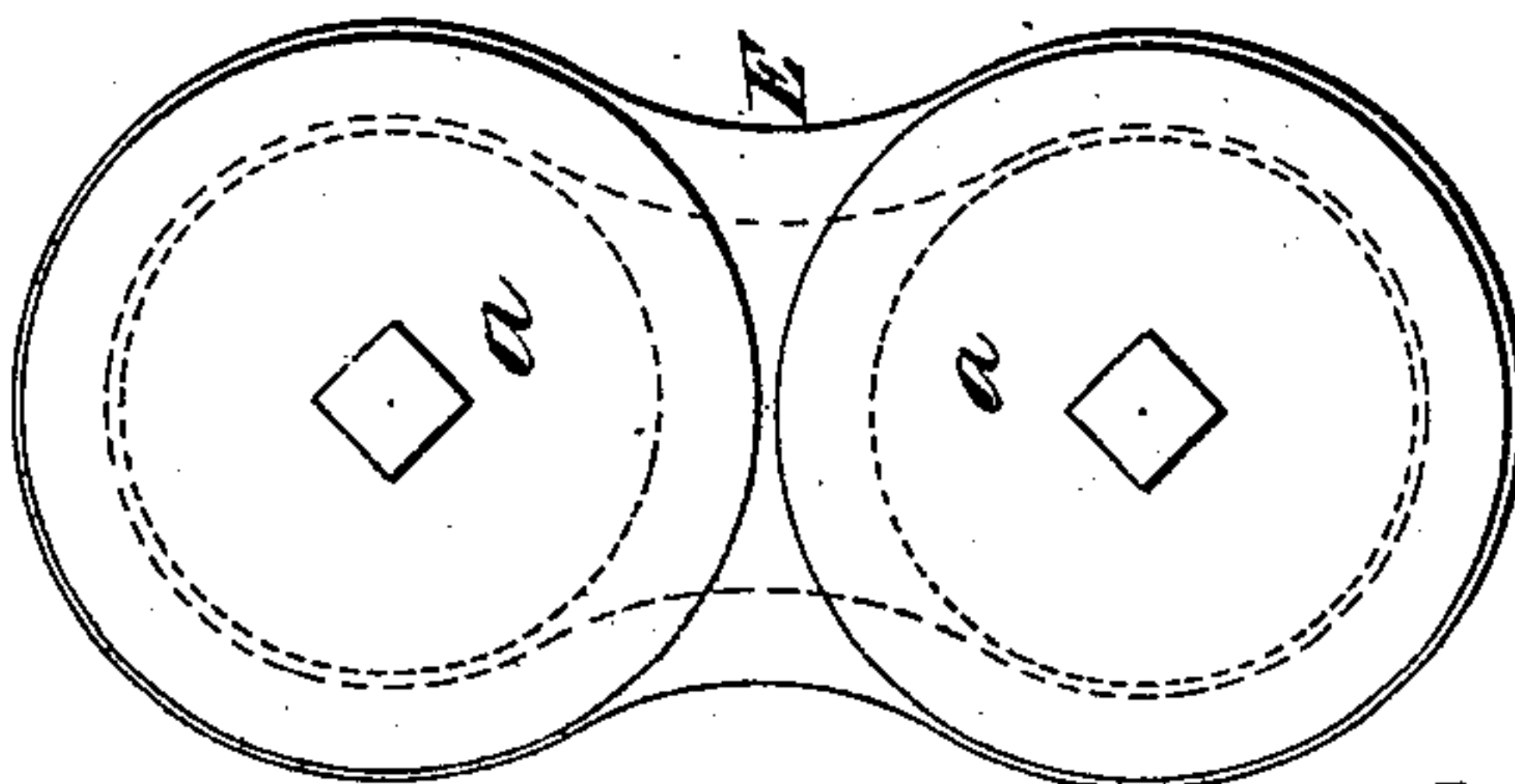


Fig 5.



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# UNITED STATES PATENT OFFICE.

BENJAMIN T. BABBITT, OF NEW YORK, N. Y.

## STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 271,397, dated January 30, 1883.

Application filed September 7, 1882. (No model.)

*To all whom it may concern:*

Be it known that I, BENJAMIN T. BABBITT, of the city of New York, in the county and State of New York, have invented a new and useful Improvement in Steam-Generators, of which the following is a specification.

My invention relates to that class of generators in which the water and steam spaces and the heating-surfaces are composed of tubes connected by returns or bends at the ends, so that the hot water passes through the tubes from side to side or end to end of the generator as it ascends.

My invention consists in the combination, in a steam-generator, of tubes arranged in zigzag lines in upright rows, and returns connecting them at both ends, each return connecting two tubes, and being separate from and independent of the returns connecting other tubes, and each return having concave sides and rounded ends so formed that the ends of the returns in one upright row will fit into the concave sides of the returns in adjacent rows in such manner that the returns, with small filling-pieces inserted between them, form opposite walls for the sides or ends of the generator.

In the accompanying drawings, Figure 1 represents a vertical section of my improved generator. Fig. 2 represents a vertical section upon the dotted line *xx*, Fig. 1. Fig. 3 represents a front view of all the generators above the furnace. Fig. 4 represents a diagram illustrating the manner of connecting the tubes. Fig. 5 represents an end view of one of the returns on a large scale. Fig. 6 represents a sectional view of a portion of two tubes and the return connecting them, and Fig. 7 represents a transverse section of two tubes and an inside view of one of the returns.

Similar letters of reference designate corresponding parts in all the figures.

A designates the brick setting of the generator.

B designates the furnace, and C the fire-grate, which, as represented, covers the whole space within the walls of the generator.

D designates a number of tubes arranged horizontally and in upright rows, and E designates returns or bends whereby the tubes of each upright row are connected with each other at opposite ends. The tubes D are of considerable length relatively to their diameter.

For example in a generator having tubes five inches in diameter the length of the tubes might be from twenty to twenty-five feet.

The form of the returns E is best shown in Figs. 5, 6, and 7, and they may be of cast or malleable iron. Although the tubes D are arranged in opposite rows, the tubes in each row are not all in the same vertical plane, but are set zigzag, as indicated by the dotted line *xx* in Fig. 1—that is, alternate tubes in each upright row are set in one vertical plane, while the intermediate tubes are set in another vertical plane. The tubes of the several upright rows are arranged as nearly together as possible, and the generator will therefore have the tubes arranged in horizontal tiers, as clearly shown in Fig. 1. The returns or bends are of peculiar outline, as shown in Figs. 5 and 7, and each presents the appearance of two cylinders joined by a portion slightly less in width than the diameter of the cylinders. The sides of the returns are concave, or curved inward between their ends, so that when the returns are arranged in the inclined position which they will occupy the rounded end of each return will fit into the concave side of the returns in adjacent upright rows. When thus constructed the returns at opposite ends of the tubes fit very closely together and form the two opposite walls of the generator, as clearly shown in Fig. 3. Small holes or openings of approximately triangular form will be left between the returns in adjacent horizontal tiers, and these may be stopped up in any suitable manner—as, for instance, with specially-shaped fire-bricks—thus forming an imperforate wall.

In the returns E, opposite each tube D, is a cap or screw-plug, *a*, which may be removed for the purpose of cleaning out the interior of the tubes. As here represented, the tubes have screw-threads formed on their ends and are screwed into the returns; but they might be expanded in a well-known manner, if desired. If the tubes were expanded into the returns, the holes in which the caps or plugs *a* are inserted should be slightly larger than the tubes, so that if any tube leaks it may be drawn out and a new one inserted through the return and expanded into place. The upper and lower tube of each upright row is closed by a cap, *b*, as best shown in Fig. 2.



In constructing my generator, the tubes and returns having been threaded, I first screw two tubes into one return, as shown in Fig. 4. I then spring one of the tubes outward or  
 5 away from the other, as also shown in dotted lines in Fig 4, and screw a second return upon said tube. This I continue until as many tubes are thus connected as are required for one upright row, after which the top and bottom tubes  
 10 are closed by the caps *b*.

*F* designates a header or supply-pipe, which extends transversely to the tubes *D* across the lower part of the generator, and *G* designates a steam-collector or pipe extending  
 15 transversely to the tubes *D* at the upper part of the generator. The lower tube of each row is connected by a branch pipe, *c*, with the header *F*, and in said pipe is a cock or valve, *c'*, whereby the passage of water through it  
 20 may be regulated. The upper pipe of each row is connected by a branch pipe, *d*, with the steam-collector *G*, and in each pipe is a cock or valve, *d'*, whereby the passage of steam through it may be regulated.

I attach to each row of tubes a water-gage, *e*, and a steam-gage, *f*, as shown best in Fig. 3, and the feed-water is introduced into the header *F* through a feed-pipe, *g*, while the steam is taken through a pipe, *h*, from the  
 30 steam-collector *G*, as shown in Fig. 3. The steam-gages *f*, attached to the several rows of tubes, can be watched, and if any of the rows of tubes are making steam faster than the other the cocks *c'* *d'* can be regulated so as  
 35 to produce a uniform production of steam in all parts of the generator.

The water in the generator may be carried as high as is desired; but in the present instance I have shown the four upper tubes in  
 40 each upright row as above the water-level, and hence these tubes constitute a superheater which enables the generator to produce dry steam. This is a very important advantage of my generator.

45 *H* designates the fire-doors, of which there may be any number, and *I* designates a hot-

air pipe extending along the generator, and provided with branches *i*, leading into the ash-pit, and with other branches, *j*, leading upward through the door. The branch pipes *j* are  
 50 composed of two pieces, one of which is attached to the door, so as to swing with it as the door is opened, and the other of which is fixed on the air-pipe *I*. The ends of these two sections of pipe are finished so as to make a tight  
 55 joint when they are brought into line. By this means I provide, in a convenient manner, for introducing hot air both above and below the grate.

In my improved generator I secure a very  
 60 large grate-surface, and all the heating-surface is directly over the grate, and is therefore very effective.

The generator is very simple in construction. It can be cheaply made and very easily kept  
 65 clean.

The parts of the generator which are of larger diameter—namely, the header *F* and collector *G*, are only tubes of ordinary size—  
 70 say, for instance, of about ten inches in diameter—and the generator is therefore essentially a safety-generator.

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

The combination of the tubes *D*, arranged  
 75 in zigzag lines in upright rows, and the returns *E*, connecting them at both ends, each return connecting two tubes and being separate from and independent of the returns connecting  
 80 other tubes, and each return having concave sides and rounded ends so formed that the ends of the returns of one upright row fit into the concave sides of the returns in adjacent rows  
 85 in such manner that the returns, with small filling-pieces inserted between them, form opposite walls for the sides or ends of the generator, substantially as herein described.

B. T. BABBITT.

Witnesses:

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