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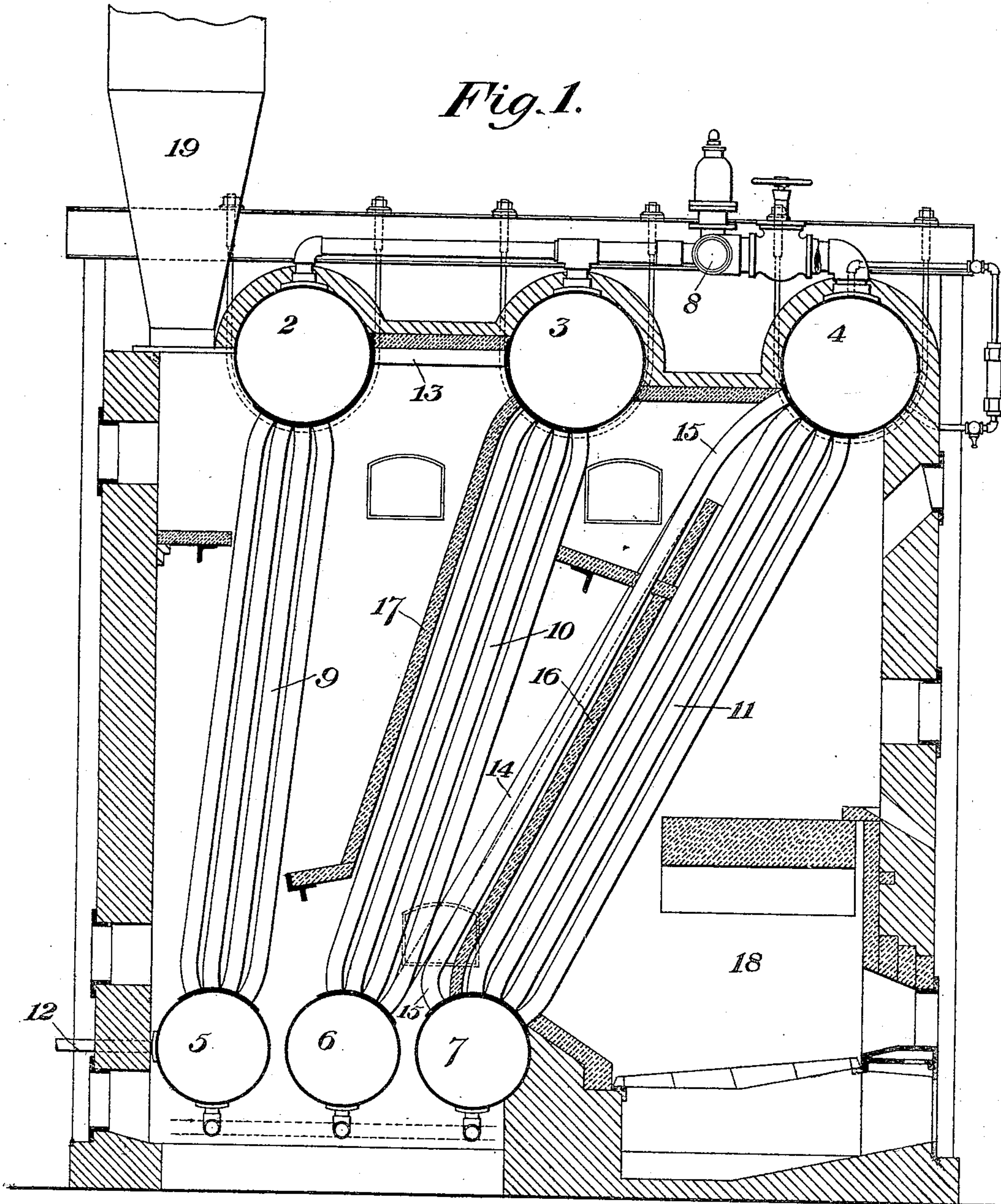
J. PIERPOINT.  
BOILER.

4 Sheets—Sheet 1.

No. 529,306.

Patented Nov. 13, 1894.

*Fig. 1.*



WITNESSES

*H. M. Corwin*  
*N. L. Gill*

INVENTOR

*James Pierpoint*  
*by W. B. Russell & Sons*  
*his Attorneys*

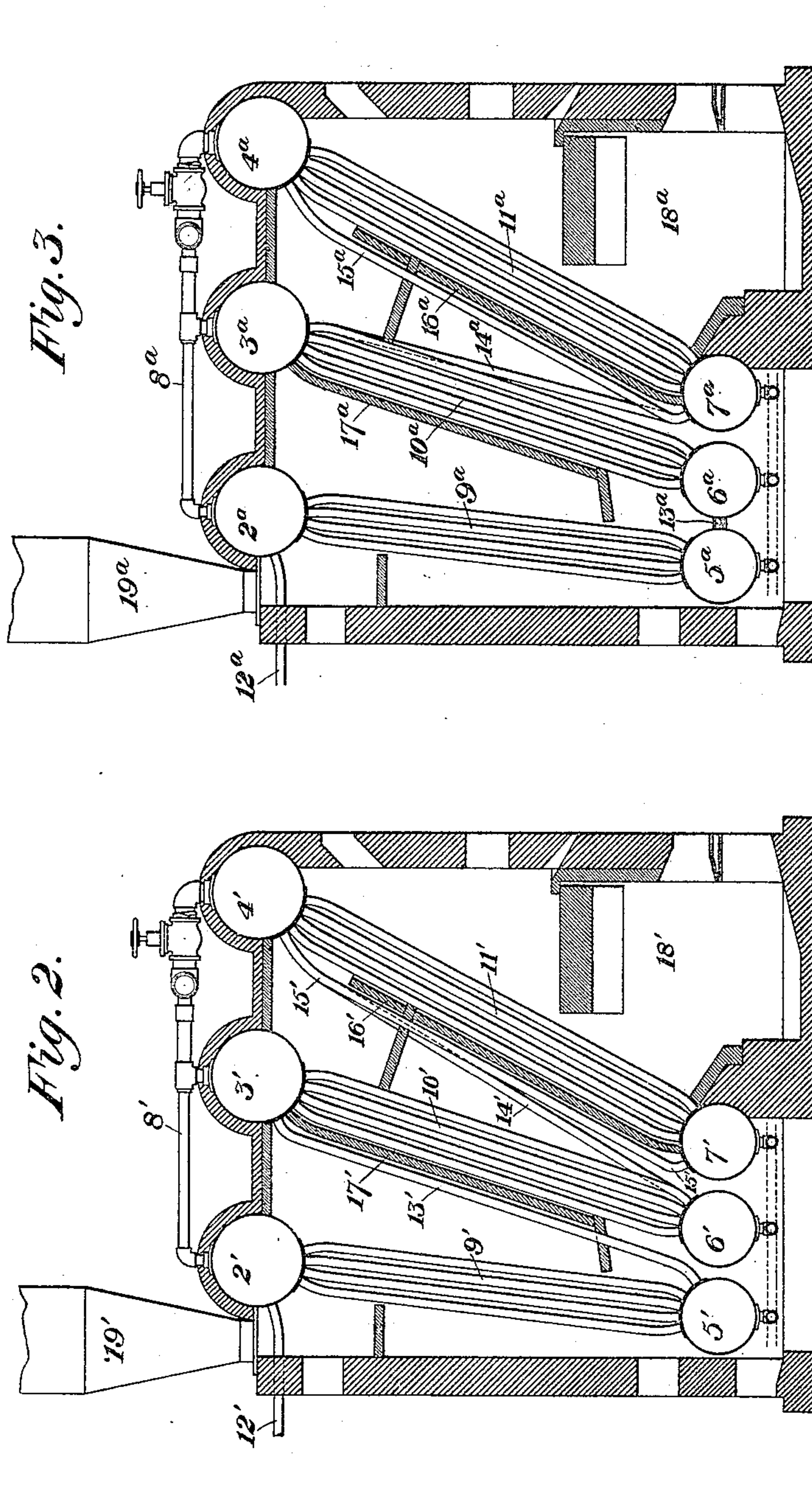
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WITNESSES

*H. M. Corwin*  
*H. L. Gill*

INVENTOR

*James Pierpoint*  
*by T. B. Baskin & Sons*  
*his attorneys*



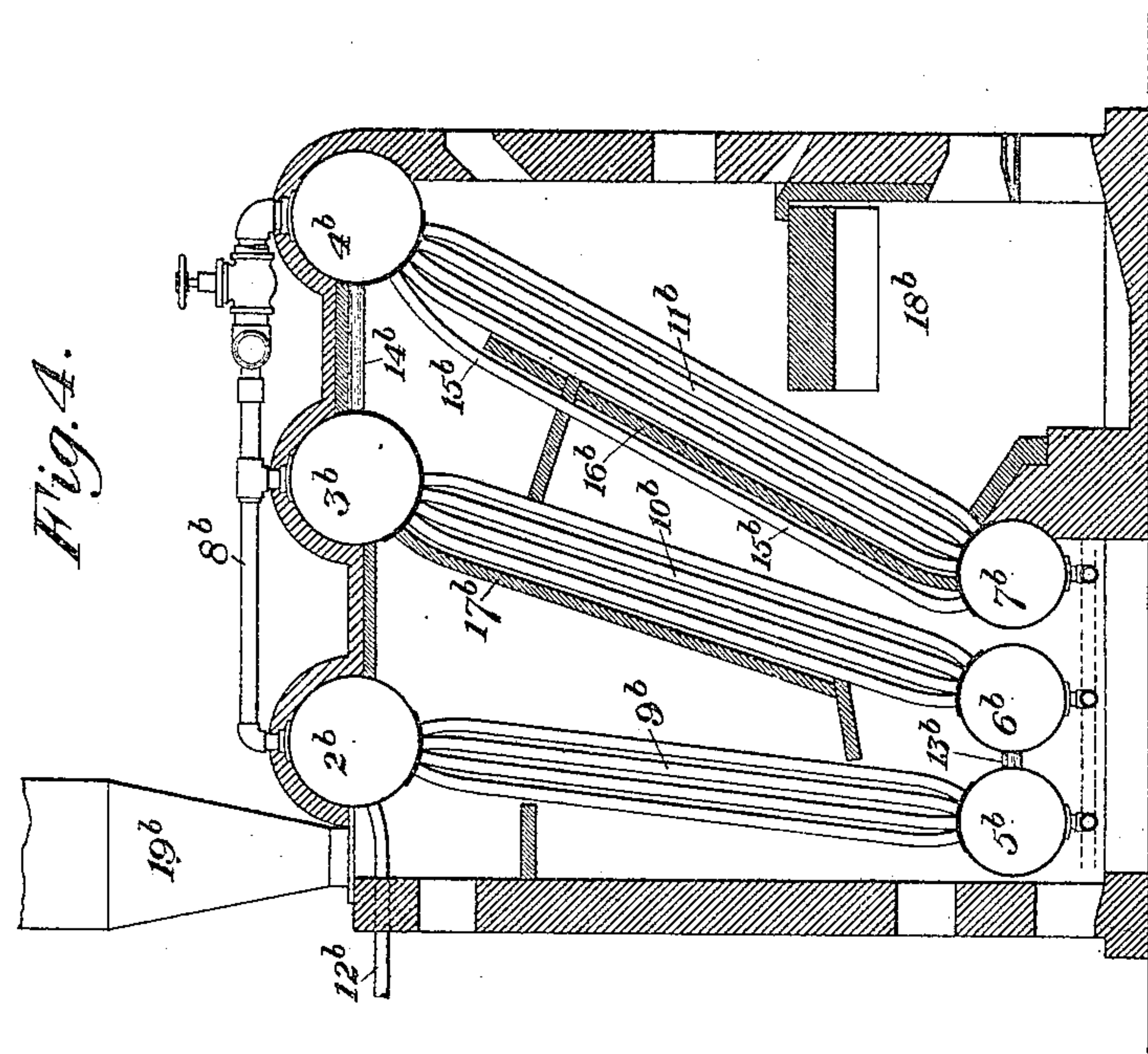
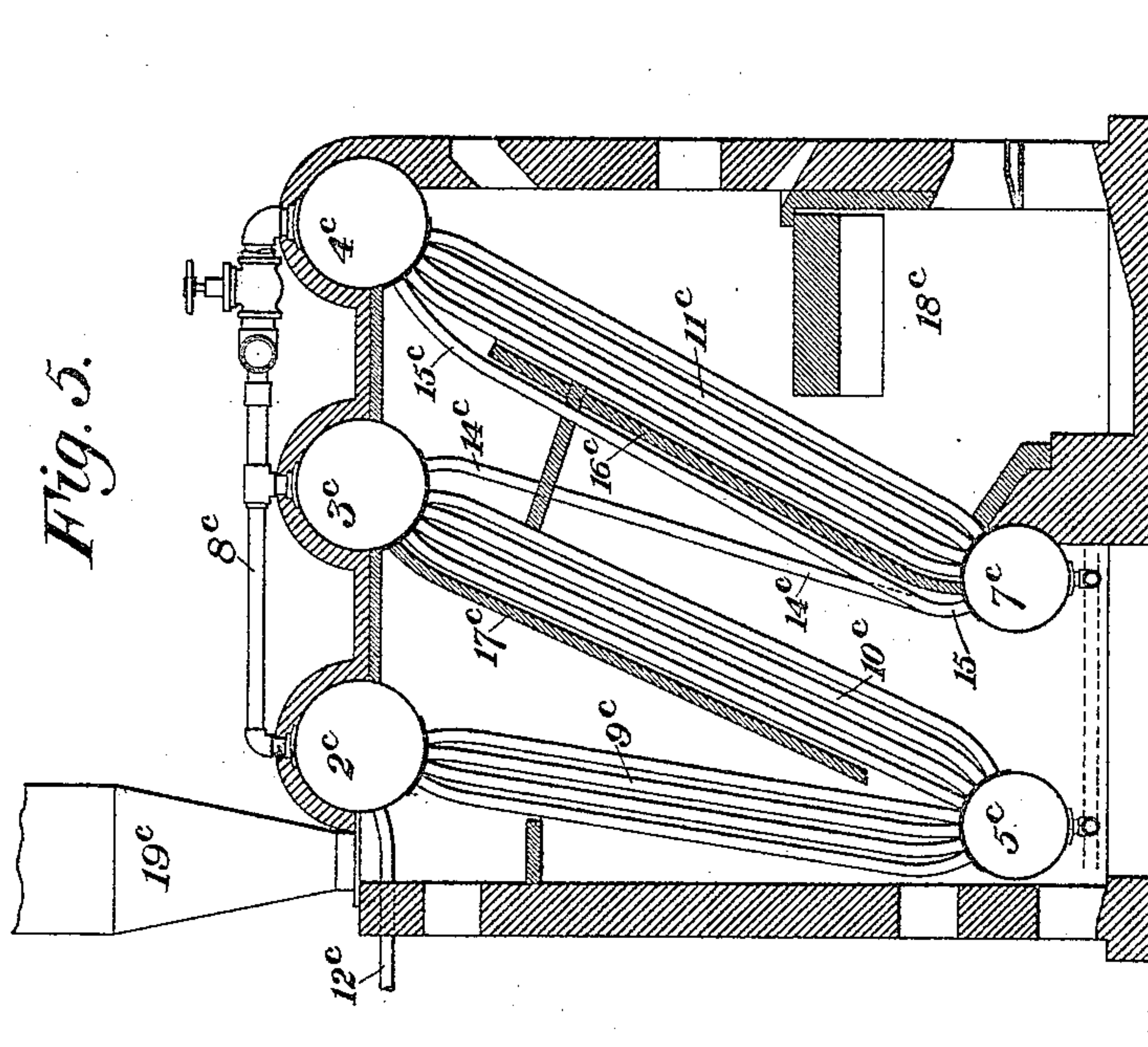
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WITNESSES

*H. M. Conner*  
*A. L. Gill*

INVENTOR

*James Pierpoint*  
*by W. Wakefield & Sons*  
*his attorneys*

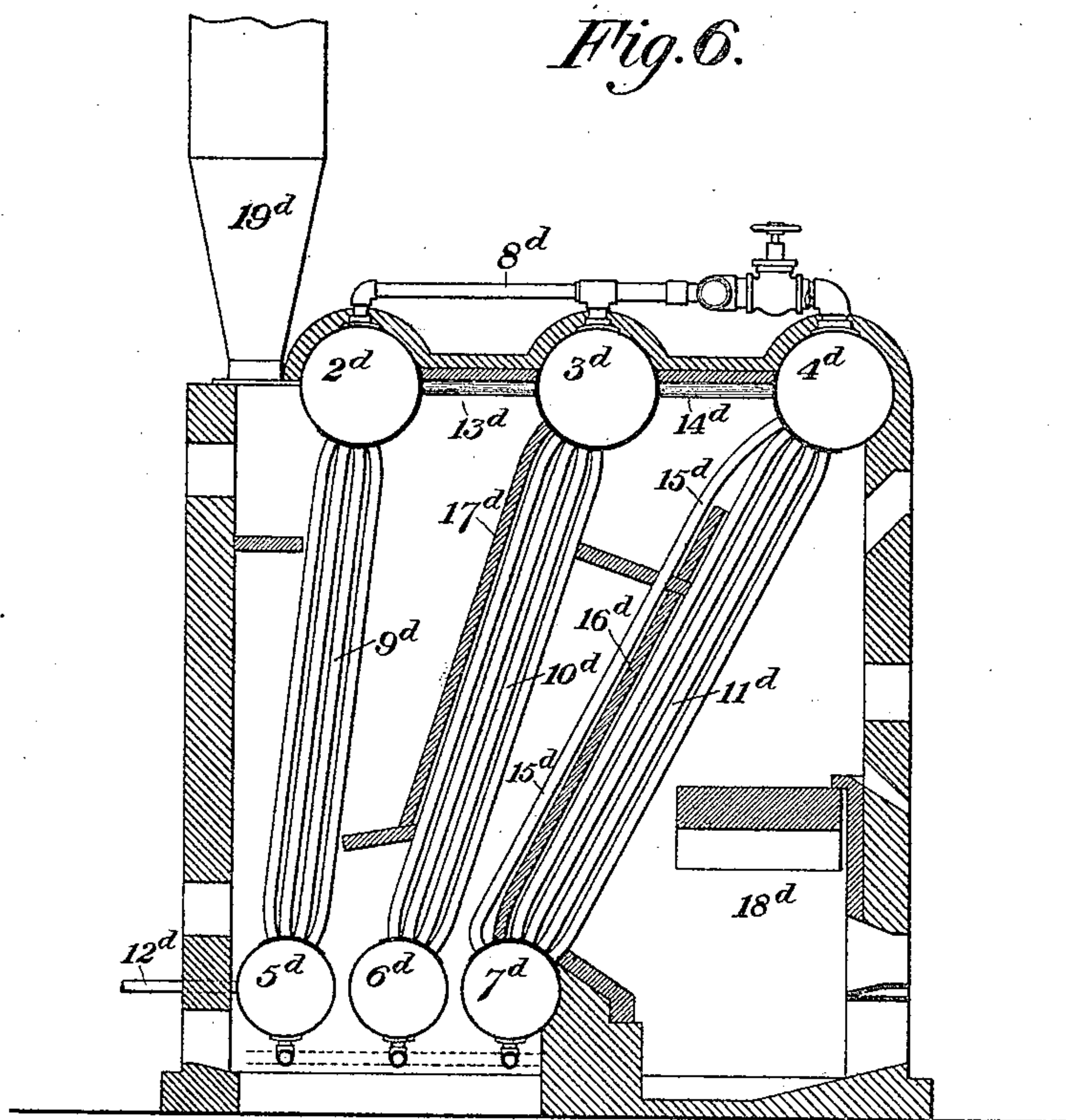
(No Model.)

J. PIERPOINT.  
BOILER.

4 Sheets—Sheet 4.

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Patented Nov. 13, 1894.



WITNESSES

*H. M. Corwin*  
*A. L. Gill*

INVENTOR

*James Pierpoint*  
*by W. B. Baskinwell & Son*  
*his attorneys*



# UNITED STATES PATENT OFFICE.

JAMES PIERPOINT, OF PITTSBURG, PENNSYLVANIA.

## BOILER.

SPECIFICATION forming part of Letters Patent No. 529,306, dated November 13, 1894.

Application filed July 12, 1894. Serial No. 517,342. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES PIERPOINT, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Boilers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a vertical sectional view of my improved boiler; and Figs. 2 to 6 inclusive are similar views of modified forms of the same.

My invention relates to the class of vertical water-tube boilers, and it consists broadly in a boiler having a front upper and lower drum connected by direct tubes and also by circulating tubes, and a series of drums within the setting through which the water passes successively or in serial order before reaching the front upper and lower drums.

It also consists in the construction and arrangement of parts as hereinafter more fully described and set forth in the claims.

In Fig. 1 of the drawings, 2, 3 and 4 represent elevated steam and water drums, and 5, 6, 7, are lower water drums designed for the collection of sediment precipitated from the water in the tubes of the boiler. Each of the upper drums has communication with a main steam delivery pipe 8, and each of the lower drums should be provided with a suitable valve-controlled blow-off pipe or cock. The rear drums 2 and 5 are connected by a bank of tubes 9, the middle drums 3 and 6 are connected by a bank of tubes 10, and the front drums 4 and 7 are connected by a bank of tubes 11. The feed-water inlet pipe 12 enters the rear lower drum 5, and the upper drums 2 and 3 are connected by an overflow water pipe 13 which permits the water to flow from drum 5 through the tubes 9 and drum 2 into the drum 3. The lower drum 6 is connected with the upper drum 4 by a diagonal feed pipe or pipes 14, and the front drums 4, 7, are connected by a bank of circulating tubes 15.

16 is a fire-brick partition interposed between the banks of tubes 11 and 15; and 17 is a partition interposed between the banks 9 and 10.

18 is the combustion-chamber of the furnace, and 19 is the stack-flue.

The hot gases and products of combustion

from the combustion-chamber ascend first along the tubes 11, then descend along the tubes 10 and 15, and finally ascend along the bank of tubes 9. The tubes 11 therefore are exposed to the greatest heat, the tubes 10 and 15 to less heat, and the tubes 9 to still less than the tubes 10, which in turn are subjected to greater heat than the tubes 15.

The operation is as follows:—The boiler having been filled up to the water level of the upper drums by water admitted through the feed-pipe 12, and the fire having been started in the combustion-chamber so as to raise the temperature of the water to the boiling point, the difference in temperature to which the banks of tubes 11 and 15 are subjected causes a continuous circulation between the drums 4 and 7 up the tubes 11 and down the tubes 15. As the water in the boiler is evaporated, the feed water, entering the drum 5, ascends to the drum 2 through the tubes 9, passes into the drum 3 through the tubes 13, thence descends through the tubes 10 to the drum 6, and thence rises through the pipe or pipes 14 to the drum 4, whence it passes in circuit back and forth between the drums 4 and 7 as above explained. The pipe (or pipes) 14 is preferably of such small area relatively to the combined area of the tubes of any of the banks, that it shall be sufficient only to conduct the feed-water to the drum 4, but not sufficient to permit local circulation of water between the drums 4 and 6. As the drums 5, 6, 7, are not connected by nipples, the water passes in continuous serial course from the rear feed drum of the boiler until it reaches the part of the boiler comprising the two front drums and their double connecting banks of tubes, and when it reaches this front part of the boiler it travels in circuit from one drum to the other.

The construction is very favorable to the precipitation of sediment before the water reaches the hottest tubes, and is well adapted to produce dry steam and to maintain a constantly uniform water level for the water of the upper drums.

Variations in the construction of the boiler, embodying the principles above stated, may be made by the skilled mechanic. Thus in Fig. 2 I show a modification, in which the parts corresponding to the parts of Fig. 1



are designated by the same numerals distinguished therefrom by the prime (') mark. Here the feed-water pipe 12' is connected with the upper drum 2', the drums 5' and 3' are connected by a diagonal bank of tubes 13', and the remainder of the boiler is the same in construction as in Fig. 1. In this case, the direct course of the feed-water is in succession through the drum 2', tubes 9', drum 5', tubes 13', drum 3', tubes 10', drum 6', tubes 14', to the drum 4', whence it travels in circuit through the tubes 11 and 15.

In Fig. 3, in which the parts are designated by the reference figures of Fig. 1, distinguished by the exponent letter *a*, the feed-water pipe 12<sup>a</sup> enters the upper drum 2<sup>a</sup>, the lower drums 5<sup>a</sup> and 6<sup>a</sup> are connected by pipes or nipples 13<sup>a</sup>, and the middle upper drum 3<sup>a</sup> is connected with the lower front drum 7<sup>a</sup> by a diagonal feed-pipe or pipes 14<sup>a</sup>. Here the course of the feed-water is from the drum 2<sup>a</sup> through tubes 9<sup>a</sup>, drum 5<sup>a</sup>, pipes 13<sup>a</sup>, drum 6<sup>a</sup>, tubes 10<sup>a</sup>, drum 3<sup>a</sup>, pipe or pipes 14<sup>a</sup> to the drum 7<sup>a</sup>, whence it travels in circuit through the tubes 11<sup>a</sup> and 15<sup>a</sup>.

In Fig. 4, in which the parts are distinguished by the exponent letter *b*, the feed-water enters the drum 2<sup>b</sup>, the drums 5<sup>b</sup> and 6<sup>b</sup> are connected by pipes or nipples 13<sup>b</sup>, and the drums 3<sup>b</sup> and 4<sup>b</sup> are connected by pipes or nipples 14<sup>b</sup>. The course of the feed-water is from the drum 2<sup>b</sup> through the tubes 9<sup>b</sup>, drum 5<sup>b</sup>, pipes 13<sup>b</sup>, drum 6<sup>b</sup>, tubes 10<sup>b</sup>, drum 3<sup>b</sup>, pipes 14<sup>b</sup>, to drum 4<sup>b</sup>, whence it passes in circuit through the tubes 11<sup>b</sup> and 15<sup>b</sup>.

In Fig. 5, in which the parts are distinguished by the exponent letter *c*, there are but two lower drums 5<sup>c</sup> and 7<sup>c</sup>. The feed-water inlet 12<sup>c</sup> enters the rear upper drum 2<sup>c</sup>, the drum 5<sup>c</sup> is connected with the drums 2<sup>c</sup> and 3<sup>c</sup> by tubes 9<sup>c</sup>, 10<sup>c</sup>, and the drum 3<sup>c</sup> is connected with the drum 7<sup>c</sup> by a feed-pipe or pipes 14<sup>c</sup>. The course of the feed-water to the drum 7<sup>c</sup> is from the drum 2<sup>c</sup> through the tubes 9<sup>c</sup>, drum 5<sup>c</sup>, tubes 10<sup>c</sup>, drum 3<sup>c</sup>, and pipe 14<sup>c</sup>, whence it travels in circuit through the tubes 11<sup>c</sup> and 15<sup>c</sup>.

In Fig. 6, in which the parts are distinguished by the exponent letter *d*, the feed-water pipe 12<sup>d</sup> enters the rear lower drum 5<sup>d</sup>, the drums 2<sup>d</sup> and 3<sup>d</sup> are connected by pipes or nipples 13<sup>d</sup>, and the drums 3<sup>d</sup> and 4<sup>d</sup> are connected by pipes or nipples 14<sup>d</sup>. Here the feed-water passes from the drum 5<sup>d</sup> through the tubes 9<sup>d</sup>, drum 2<sup>d</sup>, pipes 13<sup>d</sup>, drum 3<sup>d</sup>, pipes 14<sup>d</sup>, to the drum 4<sup>d</sup>, whence it circulates through the pipes 11<sup>d</sup> and 15<sup>d</sup>.

Other modifications of my invention embodying the same principle will suggest themselves to those skilled in the art.

With a view of claiming broadly the principle of construction above described, and also of claiming the diagonal feed tube and final circulating pipes shown in Figs. 1, 2, 3, 4, and 5, I claim as my invention—

1. A steam boiler having upper steam and water drums and lower water drums, direct

tubes connecting the front upper and lower drums, circulating tubes arranged in a cooler part of the furnace, also connecting said front upper and lower drums, a feed water inlet entering one of the rear drums, and tubes or pipes connecting serially the feed water inlet and intermediate drums, with the circuit constituted by the front drums and their tubes; substantially as described.

2. A steam boiler comprising lower water drums, and three upper steam and water drums, direct tubes connecting the front upper and lower drums, circulating tubes also connecting said front upper and lower drums, said circulating tubes being arranged in a cooler part of the furnace, and tubes or pipes connecting serially the other drums with each other and with the circuit constituted by said front drums and their tubes; substantially as described.

3. A steam boiler comprising lower water drums, and upper steam and water drums, direct tubes connecting the front upper and lower drums, circulating tubes also connecting said front upper and lower drums, and set in a cooler part of the furnace, tubes or pipes serially connecting the remaining drums with each other, and a pipe or pipes extending from one of the front drums to one of the hinder drums, whereby is formed a connection between the circuit constituted by the front drums and their tubes, and the remaining drums; substantially as described.

4. A steam boiler comprising water drums, and upper steam and water drums, direct tubes connecting the front upper and lower drums, circulating tubes also connecting said front upper and lower drums, and set in a cooler part of the furnace, tubes or pipes serially connecting the remaining drums with each other; and a pipe or pipes extending diagonally from one of the front drums to one of the hinder drums, whereby is formed a connection between the circuit constituted by the front drums and their tubes, and the remaining drums; substantially as described.

5. A steam boiler comprising water drums, and upper steam and water drums, direct tubes connecting the front upper and lower drums, circulating tubes also connecting said front upper and lower drums, and set in a cooler part of the furnace, tubes or pipes serially connecting the remaining drums with each other, and a pipe or pipes extending diagonally from one of the front drums to one of the hinder drums, whereby is formed a connection between the circuit constituted by the front drums and their tubes, and the remaining drums, said diagonal pipe or pipes being of small area relative to the conjoined area of the tubes of any of the banks; substantially as described.

6. A boiler comprising upper steam and water drums, 2, 3, 4, lower water drums, 5, 6, 7, tubes 9 connecting the drums 2, 5, pipes 13 connecting the drums 2, 3, tubes 10 connecting the drums 3, 6, tubes 11 connecting the



drums 4, 7, circulating tubes 15 also connecting the drums 4, 7, and a feed-pipe or pipes 14 connecting the drums 6 and 4; substantially as described.

5 7. In a steam boiler and in combination with the upper and lower drums, a bank of direct tubes connecting the front upper and lower drums, a fire wall or partition as 16, and a  
10 said partition, but connecting the front upper

and lower drums, with means for connecting the remaining drums with each other, and with the circuit constituted by the front drums and their tubes; substantially as described.

In testimony whereof I have hereunto set 15 my hand.

JAMES PIERPOINT.

Witnesses:

THOMAS W. BAKEWELL,  
F. E. GAITHER.