

No. 686,719.

Patented Nov. 19, 1901.

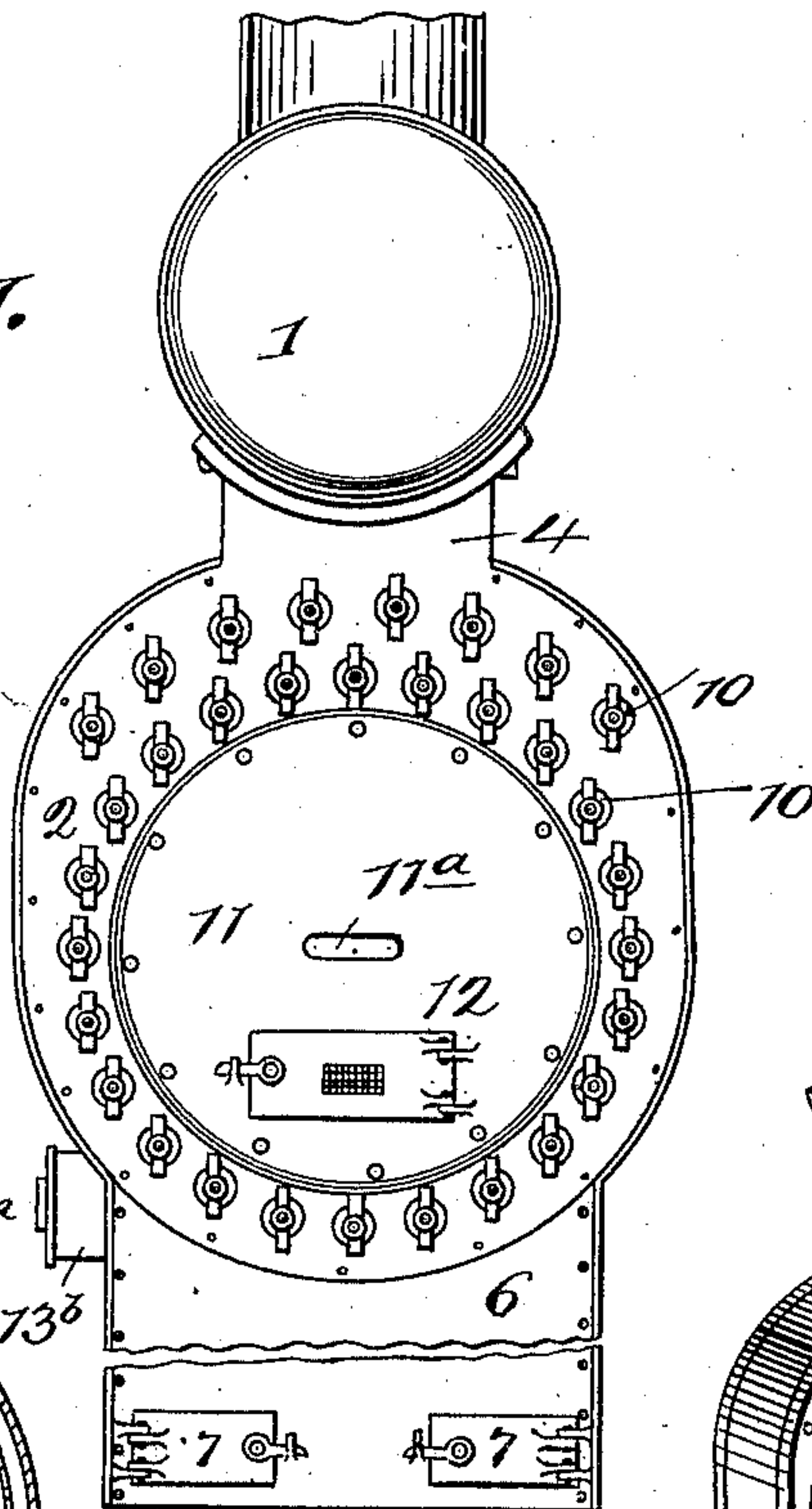
W. M. ERNST.  
STEAM BOILER.

(Application filed Sept. 21, 1900.)

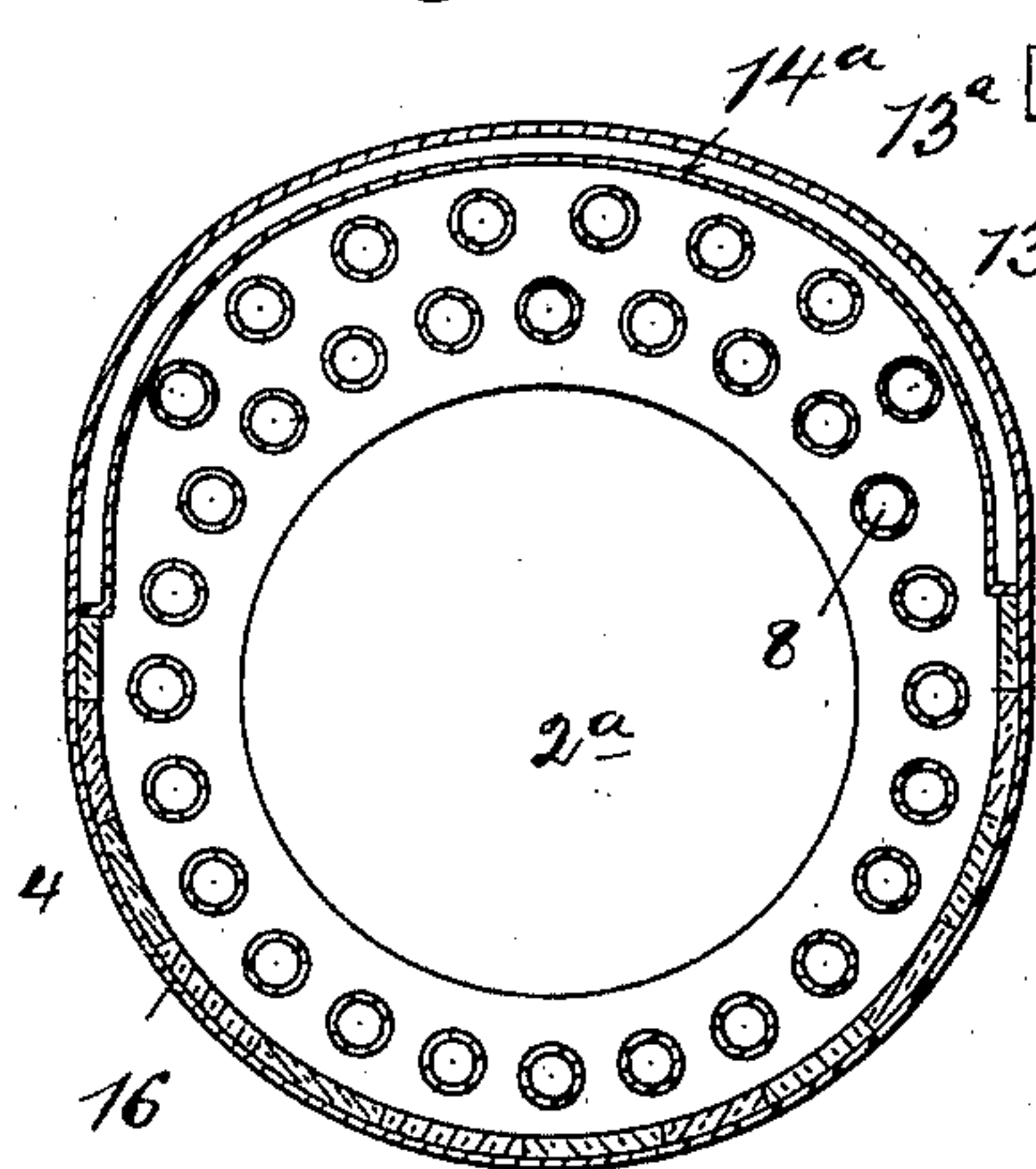
(No Model.)

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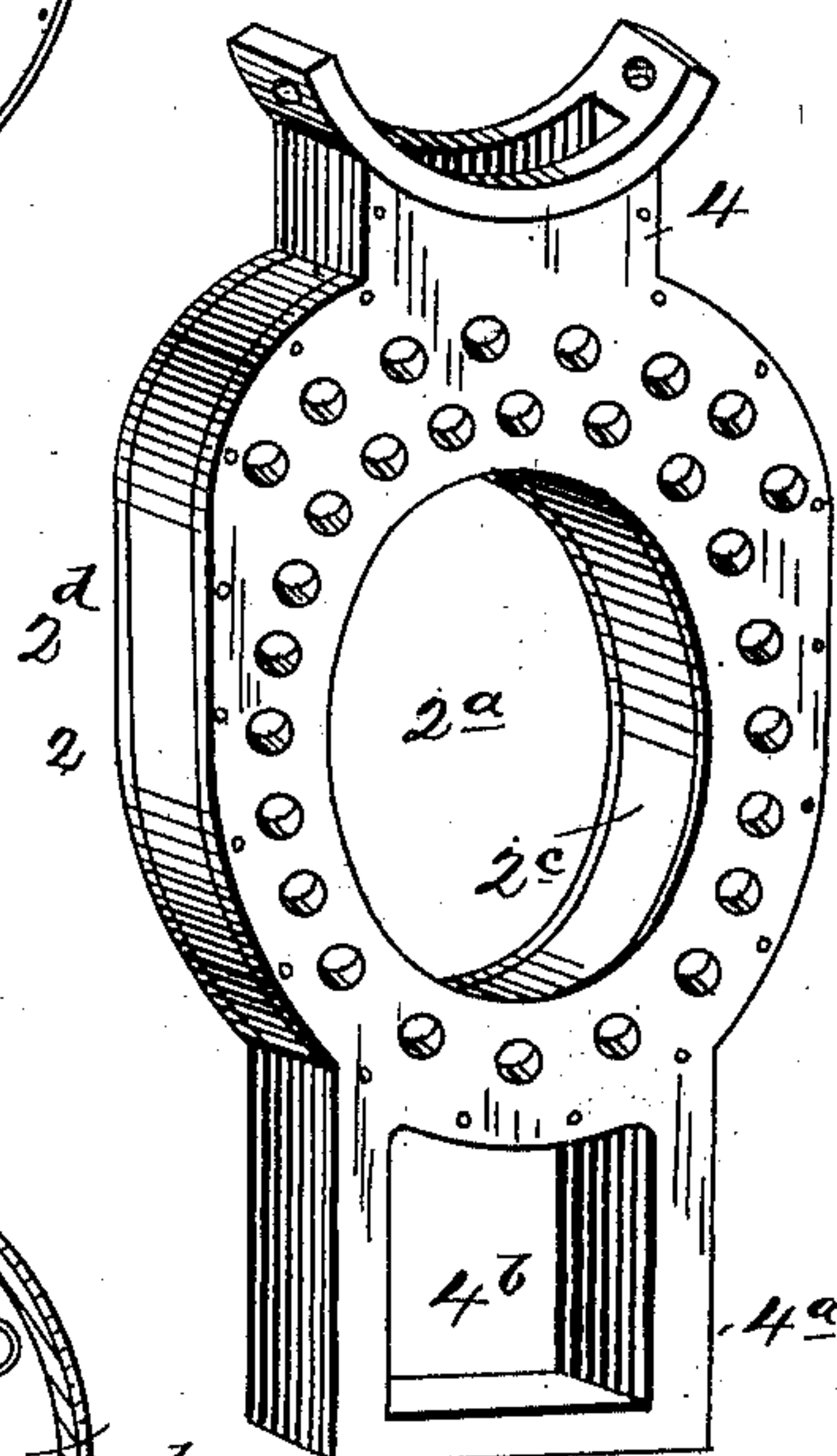
*Fig. 1.*



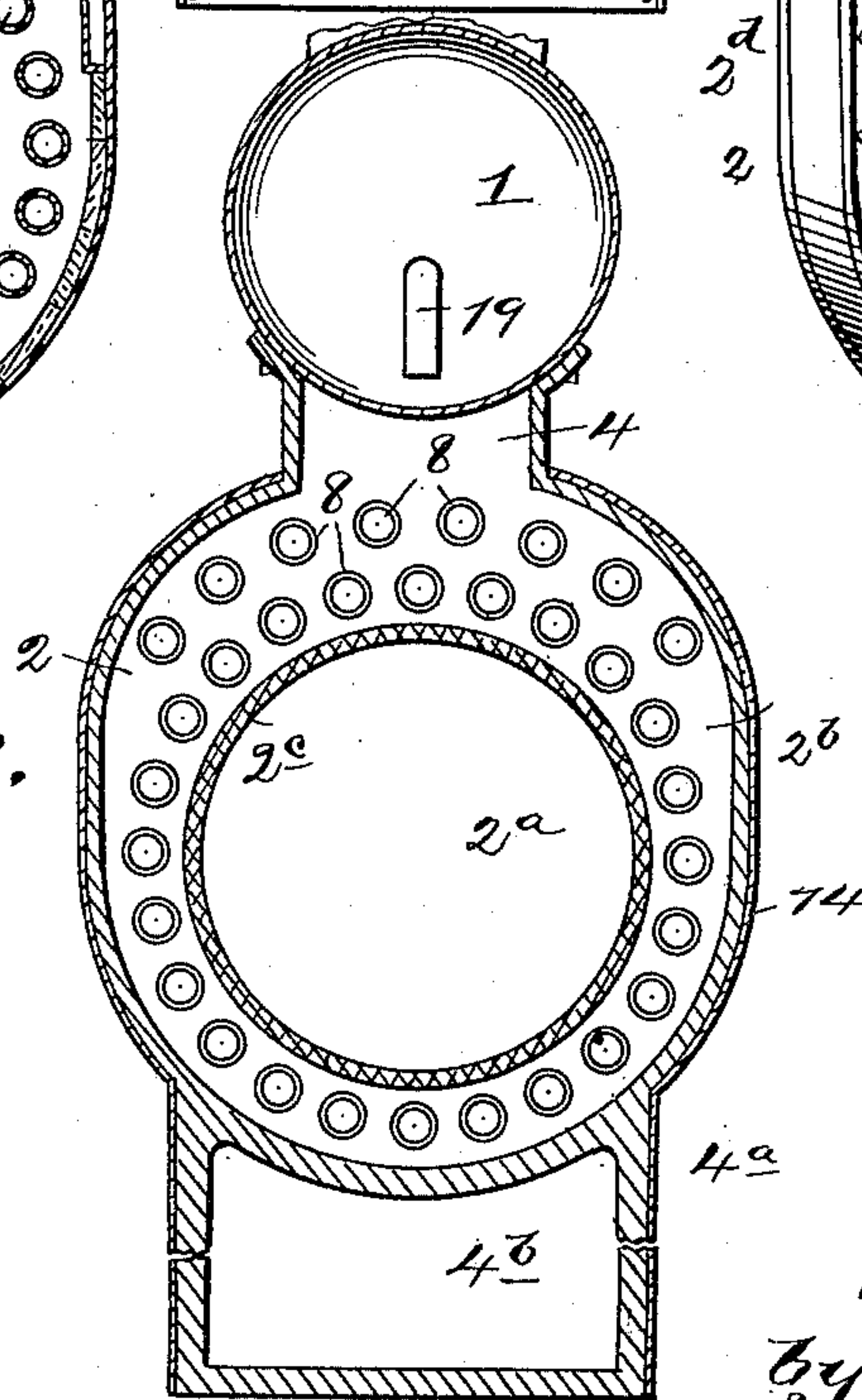
*Fig. 4.*



*Fig. 5.*



*Fig. 3.*



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No. 686,719.

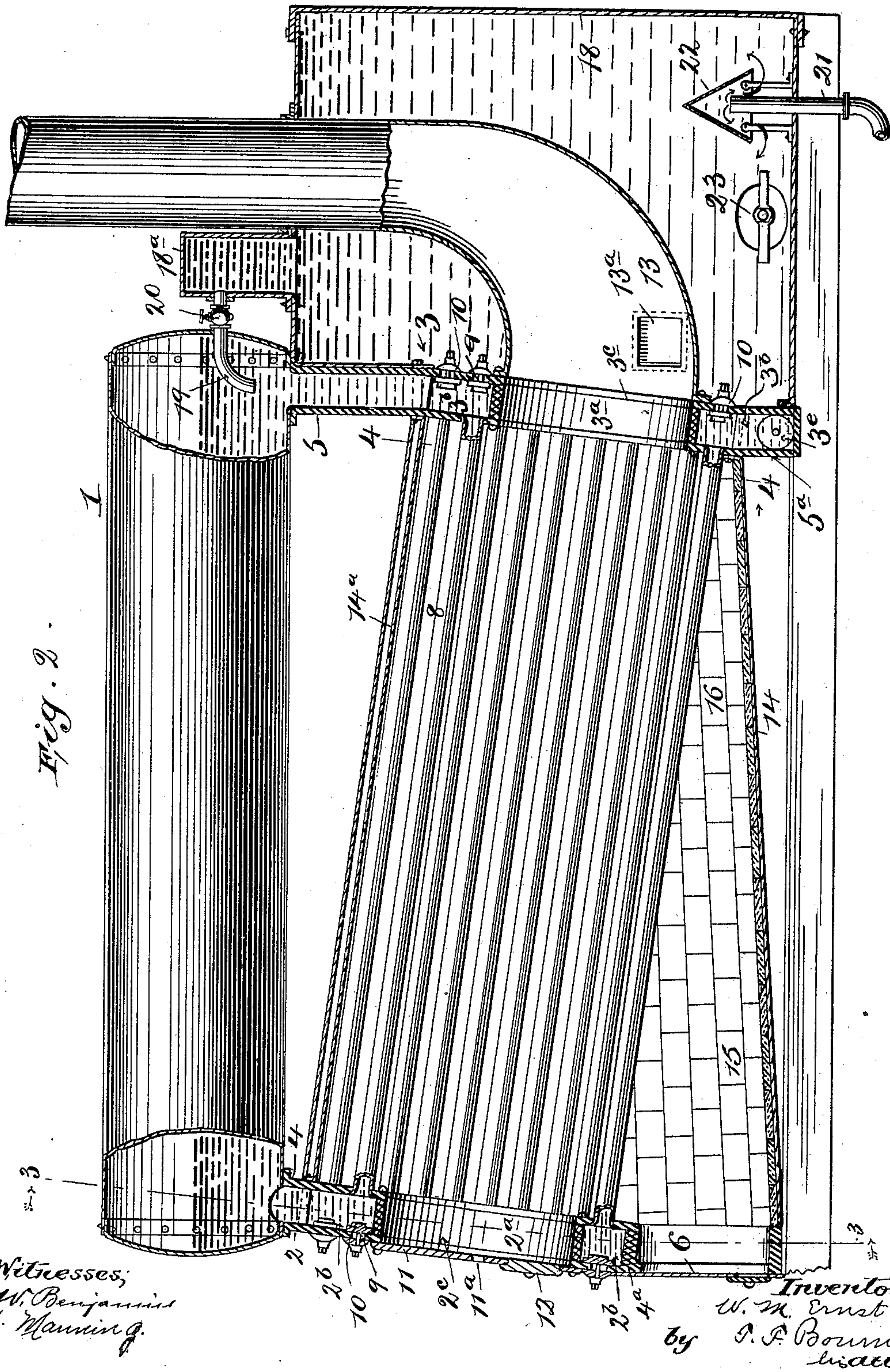
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2 Sheets—Sheet 2.





# UNITED STATES PATENT OFFICE.

WILLIAM M. ERNST, OF NEW YORK, N. Y.

## STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 686,719, dated November 19, 1901.

Application filed September 21, 1900. Serial No. 30,687. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM M. ERNST, a citizen of the United States, residing in New York city, borough of Manhattan, State of New York, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification.

My invention relates to improvements in steam-boilers more particularly adapted for use in connection with a flame issuing from a burner or nozzle—such, for instance, as that produced by pulverized fuel that is blown into the combustion-space; and my invention is especially applicable for use in conjunction with the type of boilers commonly called “water-tube” boilers, or those in which a water-drum or a steam and water drum is connected with headers between which a series of water-tubes are placed; but in this type of boiler it has been customary, so far as I am aware, to have the fire produced upon grate-bars beneath the water-tubes and to cause the heat and products of combustion to pass along the exterior of said tubes in various ways.

In carrying out my invention I provide a pair of headers in communication with a water-drum or a steam and water drum, and these headers are each provided with an opening around which any suitable number of tubes are placed with their ends in communication with the interior of the respective headers, and the smoke-stack is in communication with said opening in the rear header. The space thus formed at the central portion of or within the series or nest of tubes (which space is alined with the openings in the headers) is the main combustion space or chamber of the boiler, and the front header is adapted to have a nozzle or other outlet or burner from a pulverizer and blower of suitable type or other fuel-supply applied so that the fuel can be blown direct into said space in the midst of the tubes, where it burns in the form of a flame, the products of combustion passing into the smoke-stack. The exterior surface of the tubes will thus be subjected to the heat from the flame, and the air-currents created in the midst of said tubes will tend to keep the exterior surfaces of the tubes practically clean from deposits of ashes and the like, so that the greatest possible exposed or unobstructed surface of the tubes may be maintained.

My invention also contemplates utilizing the waste heat and products of combustion that pass through the smoke-stack as a means for heating feed-water for the boiler, and to this end the smoke stack or flue is inclosed within a water chamber or casing, so that the water may be in contact with the stack or flue, whereby as the heat and waste products pass up the stack the surrounding water will be heated. This water-chamber is connected with the drum or header, so as to supply the boiler with heated water.

My invention further contemplates various details of improvement that will be more fully hereinafter set forth and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming part hereof, wherein—

Figure 1 is a front elevation of a steam-boiler embodying my improvements. Fig. 2 is a vertical longitudinal section thereof, part of the water-drum and stack being shown in elevation. Fig. 3 is a vertical cross-section on the plane of the line 3 3 in Fig. 2. Fig. 4 is a cross-section on the line 4 4 in Fig. 2, and Fig. 5 is a perspective view of the front header looking from the right-hand side in Fig. 2.

In the accompanying drawings similar numerals of reference indicate corresponding parts in the several views.

In the drawings the numeral 1 indicates a suitable drum, which may be for water or steam and water, and 2 3 are front and rear headers, respectively connected with opposite ends of said drum in suitable or well-known manner. The headers I have illustrated are each provided with a main opening 2<sup>a</sup> 3<sup>a</sup>, extending through them and which are in alinement, whereby water-spaces 2<sup>b</sup> 3<sup>b</sup>, respectively, surround such openings, interior walls 2<sup>c</sup> 3<sup>c</sup> providing the inner surface of such spaces. The walls of the headers may be made in any suitable or well-known manner, such as by suitable plates riveted together, the front and rear walls, the outer band 2<sup>d</sup>, and the interior wall thus forming the water-space around the opening 2<sup>a</sup> or 3<sup>a</sup>. The headers are shown provided with hollow extensions 4 5, connected with the drum 1 in suitable or well-known manner, and with depending portions 4<sup>a</sup> 5<sup>a</sup> with closed bottoms, and the extension 4<sup>a</sup> has an opening 4<sup>b</sup> for



the withdrawal of ashes and which may be covered by a suitable front plate 6, provided with doors 7 or arranged in any other suitable or well-known manner. The extension 5 5<sup>a</sup> is preferably hollow to receive water, as shown in Fig. 2. The water-spaces 2<sup>b</sup> 3<sup>b</sup> of the headers are connected by tubes 8, any suitable number of which may be arranged around the openings 2<sup>a</sup> 3<sup>a</sup> and may be connected with the corresponding wall of the header by expanding or in any other well-known manner to produce water-tight joints. The headers may be provided with hand-holes 9 in line with the tubes 8 and which may be 15 closed by any suitable cover or plate 10, held thereon in any desirable manner, as the arrangement of the hand-holes and their closures forms no part of my invention. It will be seen that as the tubes 8 are arranged 20 around the openings 2<sup>a</sup> 3<sup>a</sup> of the headers a longitudinally-disposed space is formed within the midst of the tubes and in alinement with the openings in the headers. The opening 2<sup>a</sup> in the front header may be closed by a 25 plate or the like 11, that is provided with an opening 11<sup>a</sup> to receive a nozzle or other outlet or burner from a fuel pulverizer or supply, which may be connected thereto in any suitable or well-known manner, and as any 30 well-known type of fuel-pulverizer may be used for blowing pulverized fuel through the space within the water-tubes I have not illustrated the same. The front plate 11 may be provided with a suitable door 12.

35 A suitably-arranged smoke-stack 13 is in communication with the opening 3<sup>a</sup> in the rear header 3 to receive and carry off the products of combustion passing from the combustion-space within the nest of tubes. To 40 retain the heat around the tubes as much as possible, the same may be surrounded by a suitable casing 14, which may depend below the tubes in suitable manner to form an ash-pit 15. The casing 14 may be of sheet metal, 45 and to protect the same from the heat and also retain the heat within the casing as much as possible an inner layer of brick 16 may be provided, which should extend up along the sides of the tubes as high as convenient. To 50 further retain the heat around the tubes, the casing may have a wall 14<sup>a</sup> above the tubes at a distance from the wall 14 to provide a dead-air space or a space to be filled with insulating material, such as asbestos or the 55 like; but the exterior casing above described is not necessary, as the boiler may be placed in a brick setting in well-known manner.

The feed-water may be supplied to the boiler in any suitable manner; but for the 60 purpose of heating the feed-water and to conserve the waste heat I have shown a feed-water heater comprising a suitable casing 18, that surrounds the lower portion of the smoke-stack 13 and is in communication with the 65 water-drum 1, as by a pipe 19, provided with a suitable cock 20, the casing 18 being shown provided with a water-chamber 18<sup>a</sup>, to which

pipe 19 leads, the height of which is such as to substantially determine the height of water in the drum 1. By preference the water 70 is led into the heater-casing 18 by an inlet-pipe 21, passing into the bottom, over which a baffle-plate 22 is placed to cause the entering cold water to remain in the bottom of the heater and to aid in precipitating any foreign 75 matter the water may contain. By the arrangement shown the feed-water may be supplied direct from the public mains or other reservoir, if there is sufficient pressure, without the requirement of a pump for feeding 80 water to the boiler; but of course it will be understood that a pump may be used for supplying water to the boiler in well-known manner; nor is the use of my improved boiler limited to the type of feed-water heater I 85 have illustrated. 23 is a suitable manhole at the bottom of casing 18 for clearing out the same.

13<sup>a</sup> is a suitable manhole for cleaning out the lower portion of the smoke-stack 13, and 90 as the latter is surrounded by the feed-water heater I provide a tube or trunk, that passes through the wall of casing 18 and opens into stack 13 to permit access to the latter from the exterior of casing 18. 95

In the operation of my improvements the tubes, headers, and drum are supplied with the proper amount of water and the pulverizer or fuel-supply connected with the proper opening 11<sup>a</sup>, leading into the opening 2<sup>a</sup> of 100 the front header, the fuel being blown or passed through said opening into the longitudinal space in the midst of the tubes and there ignited, producing a flame, the heat from which engages the tubes to heat the water 105 therein, and the waste heat and products of combustion pass through the stack. A circulation of water is maintained in the tubes, header, and drum in manner well known in the type of water-tube boilers which I have 110 illustrated. The steam may be drawn from the drum direct in well-known manner, or said drum may be suitably connected with a steam-drum, if preferred.

One of the main advantages of my invention 115 is that pulverized fuel is not caused to pass into or through boiler-tubes, so that the disadvantages arising from the collection of ashes and the like in such tubes is obviated, and, furthermore, as a strong draft is gener- 120 ated by the blowing of the pulverized fuel within the midst of the tubes little, if any, ashes, soot, and the like will collect upon the exterior of the tubes surrounding the flames. The advantage of this will be obvious, as it 125 is well known that when ashes collect upon the surface of water-tubes the efficiency of the heating-surface is diminished. The water-tubes in my boiler can be cleaned as is customary in water-tube boilers, and the 130 refuse can be withdrawn from the rear header through a properly-covered hand-hole 3<sup>e</sup>.

Other advantages of my invention will be apparent to those skilled in the art, and it will



be understood that I do not limit my invention to the particular details of construction shown and described, as they may be varied without departing from the spirit thereof.

5 Having now described my invention, what I claim is—

1. A water-tube boiler comprising a front header provided with an opening extending through the same, tubes connected with the header and located beyond said opening, a rear header connected with the tubes, and a drum connected with the headers and in communication with the water-spaces therein, whereby a longitudinally-extending combustion-space is formed in the midst of the tubes in line with the opening in the front header, substantially as described.

2. A water-tube boiler comprising a pair of headers each provided with a water-space surrounding an opening that extends through the headers, a drum in communication with the water-spaces of said headers, and tubes connected with the water-spaces of said headers and located beyond the openings in the headers to provide a longitudinally-disposed combustion-space within the series of tubes and in communication with the openings in the headers, substantially as described.

3. A water-tube boiler comprising a pair of opposed headers, the front header being provided with an opening leading through the same, said opening having a closure adapted to permit the passage of fuel through said opening, a drum in communication with the water-spaces of said headers, and tubes connected with the water-spaces in the headers and located beyond said opening in the front header to provide a longitudinally-disposed combustion-space in the midst of the tubes, substantially as described.

4. A header for a water-tube boiler, comprising opposed walls having openings, an interior wall connected therewith to form an opening through the header, and an exterior wall surrounding said interior wall, all arranged to provide a water-space outside of the opening in the header, and a closure for said opening provided with an opening adapted to receive a nozzle or burner, substantially as described.

5. In a water-tube boiler a pair of headers each provided with an opening leading through the same, a drum communicating with the water-spaces in said headers, tubes connecting the headers and located beyond the openings in the headers to provide a longitudinally-disposed combustion-space, a

stack or flue communicating with the opening in the rear header, and a casing surrounding the stack or flue and adapted to contain water to be heated by the heat passing through the stack or flue, substantially as described.

6. In a water-tube boiler, a pair of headers each provided with an opening leading through the same, a drum communicating with the water-spaces in said headers, tubes connecting the headers and located beyond the openings in the headers to provide a longitudinally-disposed combustion-space, a stack or flue communicating with the opening in the rear header, a casing surrounding the stack or flue and adapted to contain water to be heated by the heat passing through the stack or flue, means for admitting water into the lower part of said casing, and means for conducting the heated water from said casing into the boiler, substantially as described.

7. In a water-tube boiler, a pair of headers each provided with an opening leading through the same, a drum communicating with the water-spaces in said headers, tubes connecting the headers and located beyond the openings in the headers to provide a longitudinally-disposed combustion-space, a stack or flue communicating with the opening in the rear header, a casing surrounding the stack or flue and adapted to contain water to be heated by the heat passing through the stack or flue, and a tube or trunk leading from said stack through said casing and provided with a closure to permit cleaning out of the stack, substantially as described.

8. In a water-tube boiler, a pair of headers each provided with an opening leading through the same, a drum communicating with the water-spaces in said headers, tubes connecting the headers and located beyond the openings in the headers to provide a longitudinally-disposed combustion-space, a stack or flue communicating with the opening in the rear header, a casing surrounding the stack or flue and adapted to contain water to be heated by the heat passing through the stack or flue, said casing having a chamber at its upper part, a pipe connecting said chamber with the water-space of the boiler, and a cock to control the flow of water through said pipe, substantially as described.

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