

No. 864,211.

PATENTED AUG. 27, 1907.

T. SUZUKI.
VERTICAL BOILER.
APPLICATION FILED APR. 1, 1907.

3 SHEETS—SHEET 1.

Fig. 1.

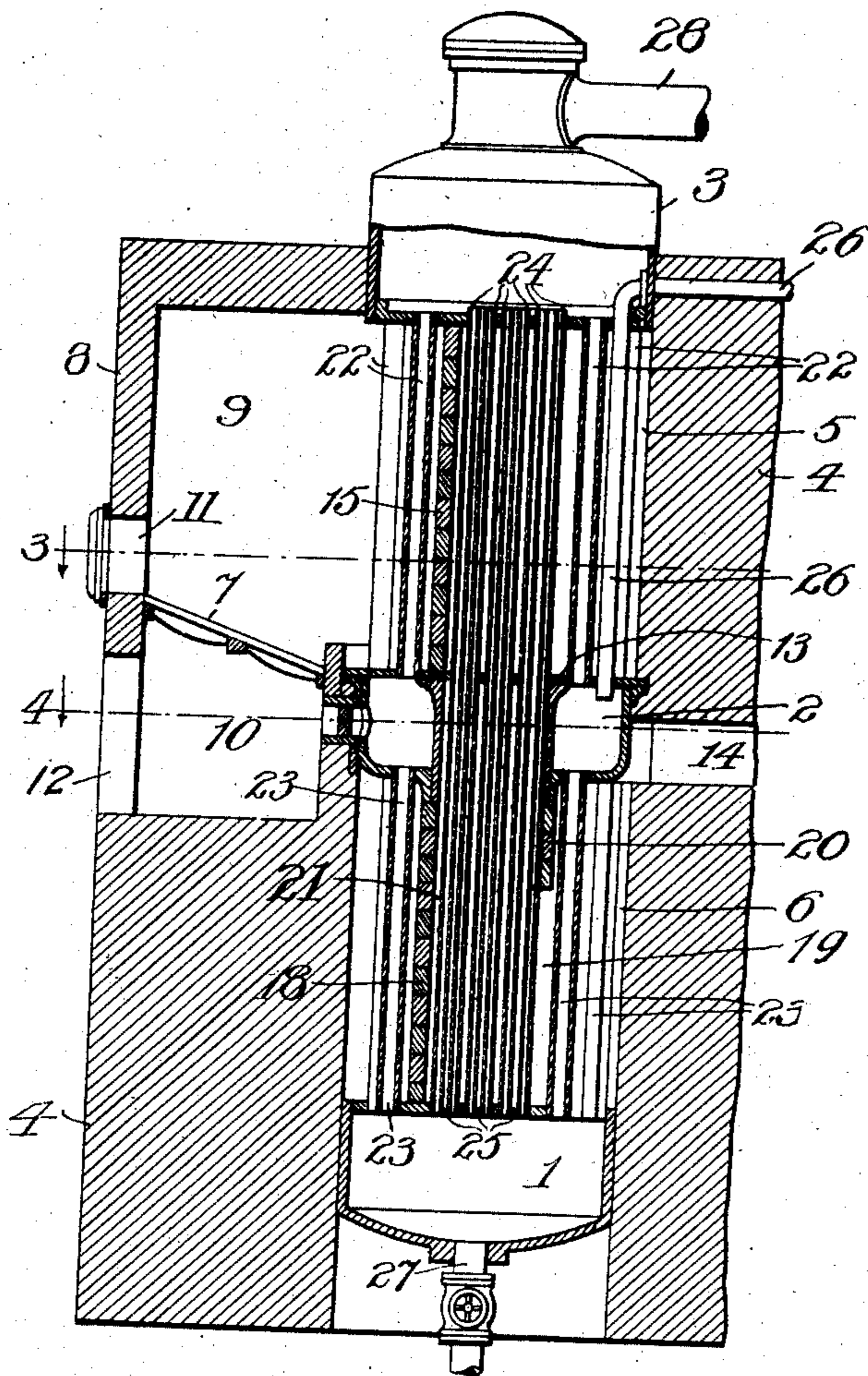
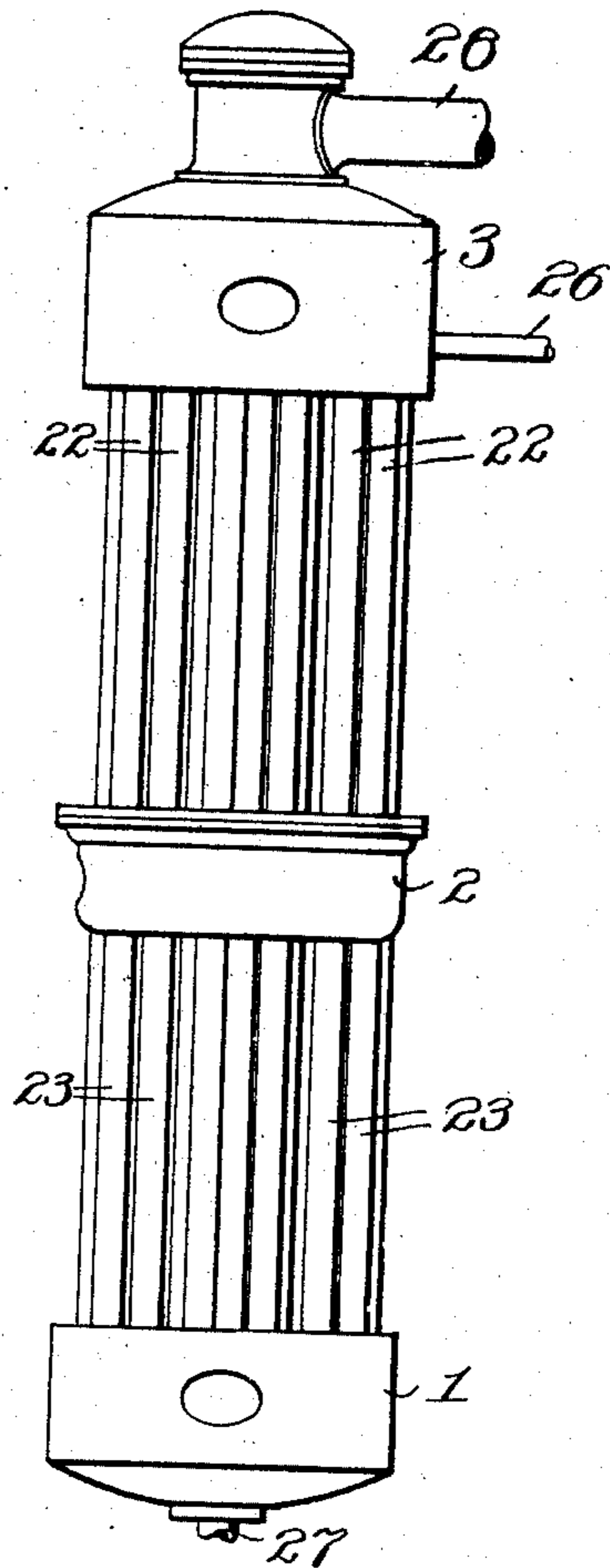


Fig. 2.



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3 SHEETS—SHEET 2.

Fig. 3.

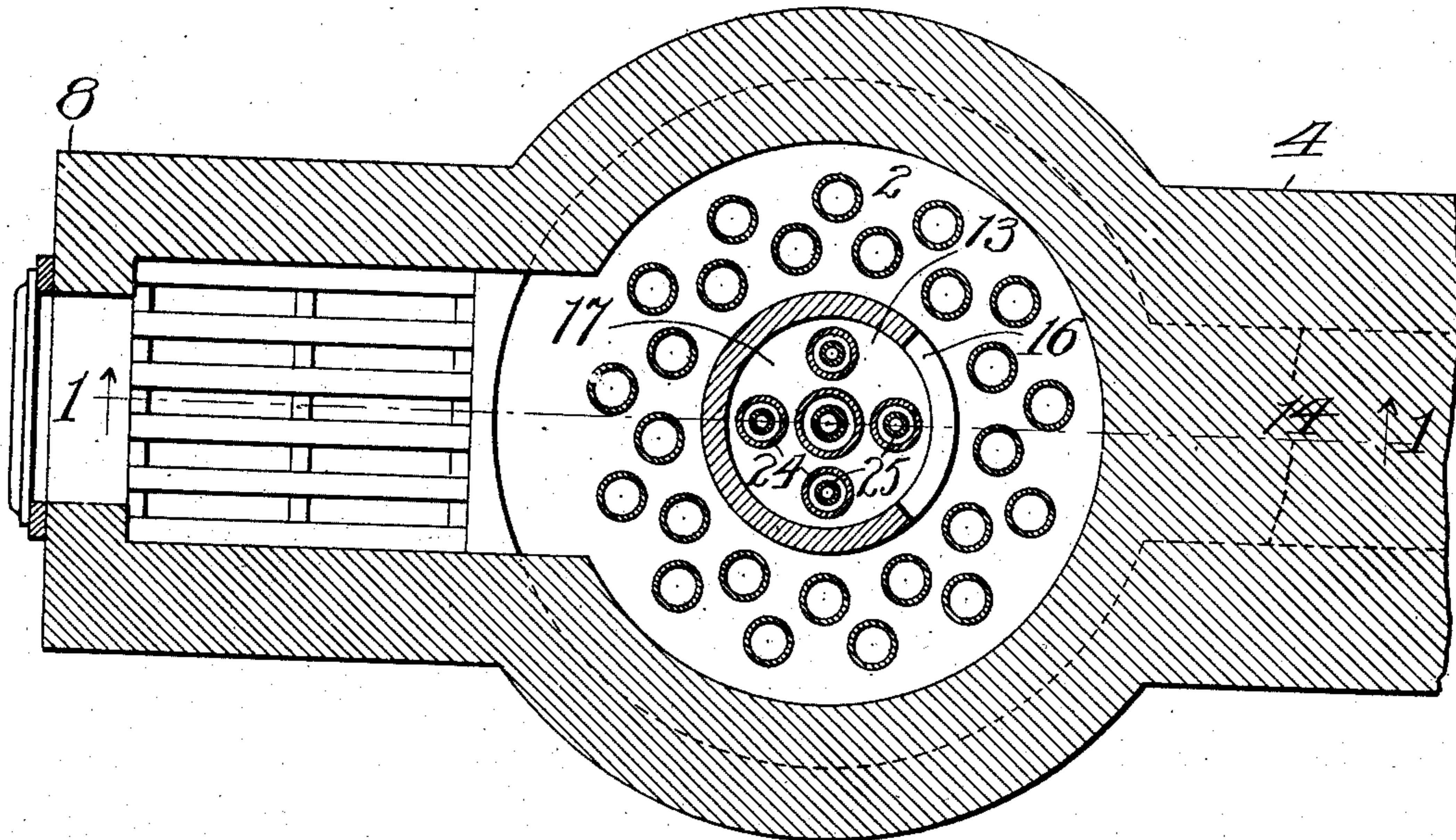
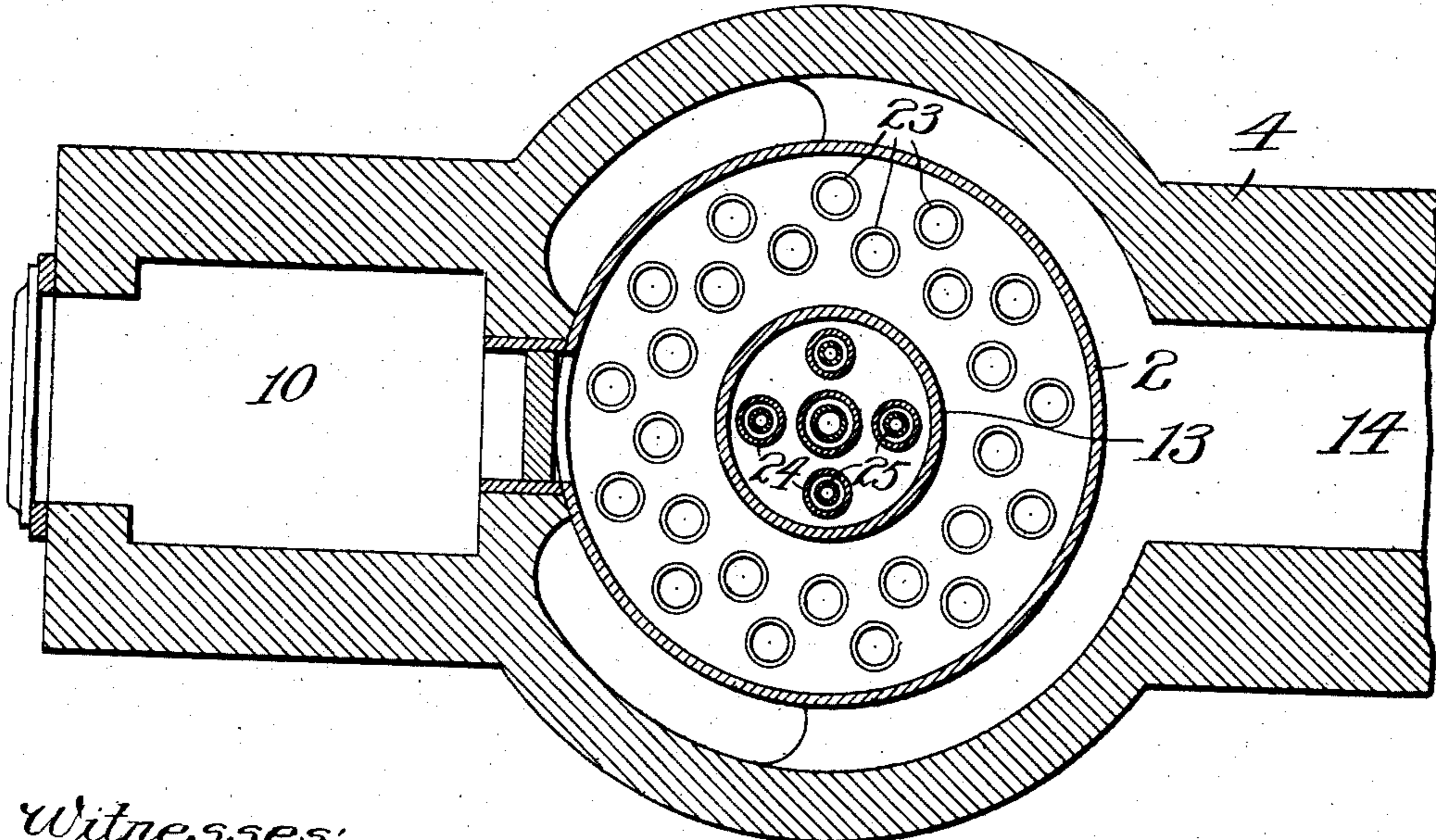


Fig. 4.



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3 SHEETS—SHEET 3.

Fig 5.

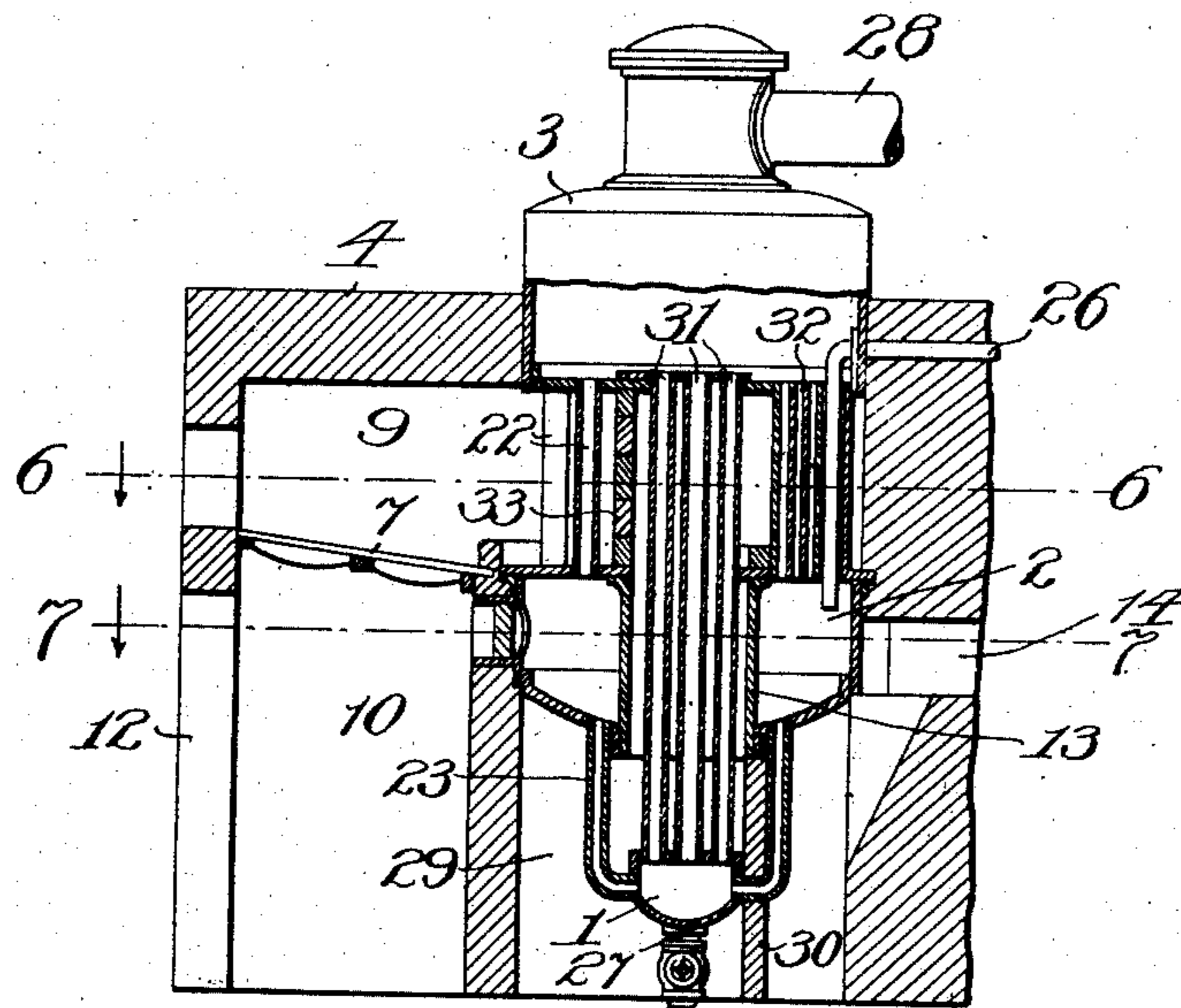


Fig 6

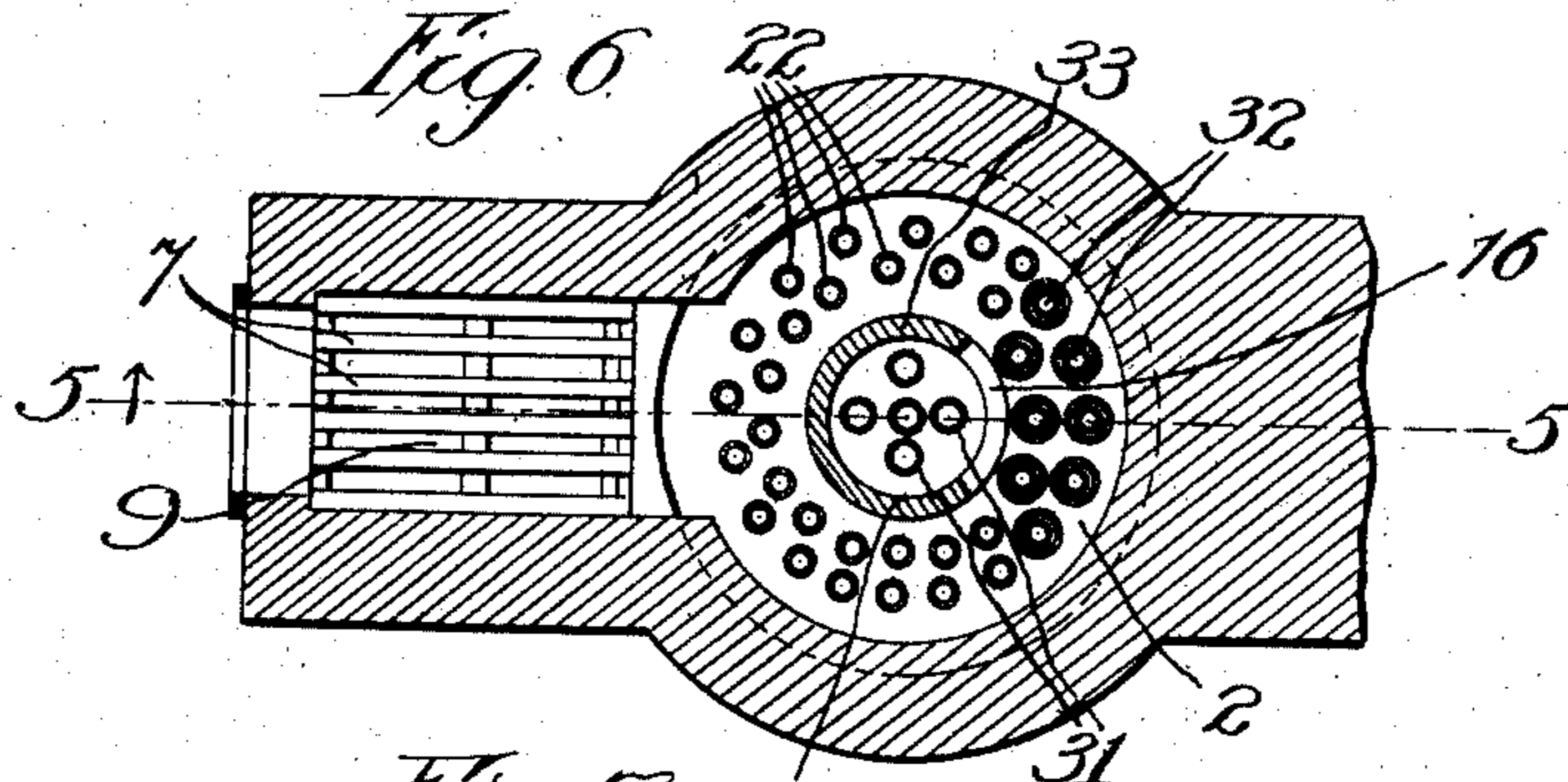
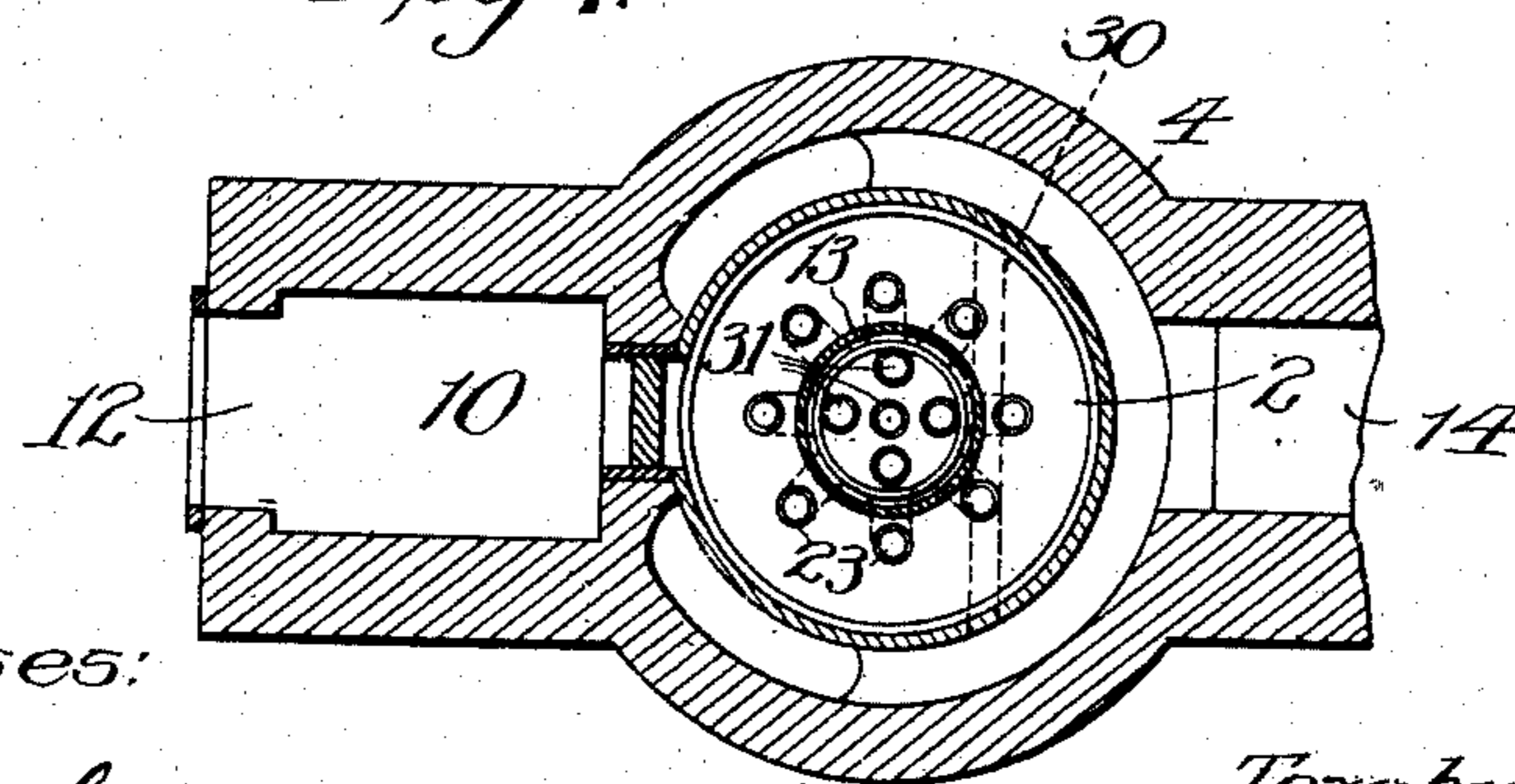


Fig 7



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UNITED STATES PATENT OFFICE.

TOZABURO SUZUKI, OF SUNAMURA, JAPAN.

VERTICAL BOILER.

No. 864,211.

Specification of Letters Patent.

Patented Aug. 27, 1907.

Application filed April 1, 1907. Serial No. 365,838.

To all whom it may concern:

Be it known that I, TOZABURO SUZUKI, a subject of the Emperor of Japan, residing at No. 401 Jibei-shinden, Sunamura, in the county of Minami-Kat-sushika, in the Province of Tokio, Japan, have invented certain new and useful Improvements in Vertical Boilers, of which the following is a full, clear, and exact specification.

This invention relates to improvements in vertical boilers and consists broadly in the provision of steam water and sediment chambers arranged in superposed relation and connected by relatively long and short tubes or pipes.

The invention also includes the provision of one or more deflectors associated with said chambers and pipes in a manner to obtain a highly advantageous circulation or distribution of the products of combustion so as to fully and efficiently utilize the heating surfaces.

In order to effectively promote water circulation certain of the tubes or pipes communicating between the several chambers are made double and the invention is characterized by other features which will be hereinafter more fully described in connection with the accompanying drawings and will be more particularly pointed out and ascertained in and by the appended claims.

In the drawings:—Figure 1 is a vertical section of an improved boiler embodying the main features of my invention taken on line 1—1 of Fig. 3. Fig. 2 is an elevation of the boiler structure removed from its housing. Fig. 3 is a horizontal section taken on line 3—3 of Fig. 1. Fig. 4 is a horizontal, section on line 4—4 of Fig. 1. Fig. 5 is a vertical section of another form of the invention taken on line 5—5 of Fig. 6. Fig. 6 is a horizontal section taken on line 6—6 of Fig. 5. Fig. 7 is a sectional view taken on line 7—7 of Fig. 5.

As shown the invention consists of a sediment chamber 1, a water chamber 2 and a steam chamber 3 arranged in superposed relation and surrounded and inclosed by a suitable boiler housing indicated as a whole by 4. The steam and sediment chambers are spaced apart from the water chamber in a manner to form intermediate combustion chambers 5 and 6 whose lateral walls are formed by the housing or inclosure 4.

As shown the grate which is designated by 7 is located at one side of the boiler and preferably slightly above the water chamber 2 and to this end the housing 4 is elongated at 8 to accommodate the fire chamber or box 9 above the grate and the ash pit 10 below the same. Openings 11 and 12 are provided for the admission of fuel to the grate and for withdrawal of ashes from the pit 10 and said openings may if desired be provided with any form of doors.

Fire box 9 is in direct communication with and delivers the product of combustion to chamber 5. Said chamber 5 communicates with chamber 6 by means of a flue 13 formed in the water chamber 2 and the products of combustion are discharged through said chambers to a suitable outlet such as is indicated at 14.

In order to prevent the products of combustion passing from the fire box directly to the outlet, and to more fully utilize the heat units thereof in connection with heating surfaces to be hereinafter more fully described, I provide a deflector 15 which as shown is interposed between the water chamber 2 and the steam chamber 3. As shown said deflector 15 extends from the water chamber 2 up to and in contact with the steam chamber 3 and as shown in Fig. 1 is preferably circular in cross-section there being provided an opening 16 at a point farthest from the fire box. Said deflector 15 is preferably located adjacent the margin of the flue 13 and forms in effect a subsidiary combustion chamber 17.

It will be seen by reference to Fig. 1 that the products of combustion are prevented from passing directly through the flue 13 and that they are forced to travel completely around the combustion chamber 5 until they reach the opening 16 through which they are admitted to the flue. I also desire to provide a deflector 18 which is interposed between and extends from the sediment chamber 1 to the water chamber 2 which deflector is of substantially the same construction as is the deflector 15. The deflector 18 is provided with an opening 19 which extends from the sediment chamber 1 upwardly to a point below the water chamber 2, a depending wall 20 forming in effect a deflecting wall preventing direct egress of the products of combustion. The deflector 18 like the upward deflector forms in effect a subsidiary combustion chamber 21 the function of which will hereinafter more fully appear.

The water chamber 2 is connected with the steam chamber 3 by a plurality of relatively short tubes or pipes 22 preferably disposed outside of the deflector 15. Said water chamber is also connected with the sediment chamber 1 by a plurality of pipes or tubes 23 also located outside of the deflector 18. The steam chamber 3 and sediment chamber 1 are connected directly by a plurality of pipes or tubes 24 which preferably extend through the flue 13 of the water chamber 2 and inside of the deflectors 15 and 18 or in other words said tubes 24 are contained in the subsidiary combustion chambers 17 and 21. If desired the tubes 24 may be in the form of double tubes the same having inner tubes 25 which like the tubes 24 are in direct communication with chambers 1 and 3. A water feed pipe 26 is provided which preferably enters through the steam chamber 3 and projects downwardly through the combustion chamber 5 and into the water chamber 2 where-

in the feed water is first delivered to the boiler. The sediment chamber 1 is provided with a suitable outlet 27 wherethrough the collected sediment may be withdrawn and the steam chamber 3 is provided with a suitable outlet 28. It will be seen from the foregoing that the products of combustion coming from the firebox are very effectively directed around and upon the heating surfaces formed by the tubes 22 and the upper wall of the water chamber and the lower wall of the steam chamber by the deflector 15 before said products of combustions can escape from the combustion chamber 5. It will also be noted that the deflector 15 will by the direct play thereupon by the products of combustion be maintained at a very high temperature and will thereby serve to maintain a high temperature in the subsidiary combustion chamber 17. The opening 16 is also proportioned in such a manner with respect to the volume discharged by the fire box as to retard somewhat the progress of the products of combustion and retain the same as long as possible within the combustion chamber 5 without however in any way impairing the draft of the furnace. It will thus be seen that the products of combustion are concentrated to a greater or less extent upon the pipes 22 in such a manner that water passing therethrough to the steam chamber 3 will be at the highest possible temperature. It will also be seen that by concentrating the heat units upon the surfaces presented in the combustion chamber 5 the cold water entering chamber 2 will even before it leaves said chamber be quickly heated. After the products of combustion have entered the subsidiary chamber 17 they are directed effectively against the tubes 24 and travel downwardly through flue 13 into chamber 21 where they are discharged into chamber 6. At this point it may be noted that the water at its coolest temperature will pass downwardly from the water chamber 2 through those tubes 23 which are nearest the pipe 26, such tubes 23 being closely adjacent the outlet 19 of the subsidiary combustion chamber 21 therefore the products of combustion issuing therefrom will be very effectively utilized in heating the cool water in the rear pipes 23. To complete the course of the products of combustion it may be stated that the same pass upwardly from the opening 19 direct to the main outlet 14 and from thence to the chimney.

The water entering the chamber 2 will first descend through pipes 23 into the sediment chamber 1 and will deposit therein such foreign matter as it may contain. The more intense heat to which the pipes 24 are subjected will cause the water to rise therein and issue therefrom in the form of steam in the chamber 3. This construction alone affords an efficient water circulation but I desirably promote or enhance this circulation still farther by the provision of the inner tubes 25 which being inclosed in the tubes 24 are heated to a lesser temperature. This structure causes a more rapid production of steam in the pipes 24 than in the pipes 25 which results in the water in the pipes 25 descending and that in the pipes 24 ascending. This arrangement provides for a unitary circulating unit complete in itself and independent of pipes 22 and 23. However in addition to the circulation afforded by the pipes 24 and 25 it will be seen as hereinbefore set forth that the concentration of heat units in chamber 5 results in rapid steam production in pipes 22 which causes an ascending

movement of the water therein toward the steam chamber 3. Thus it will be noted that that portion of the feed water which is below the heating sphere of the top wall of the water chamber will travel downwardly through the tubes 23 while that portion of the water which is within the heating sphere of the upper wall of the chamber 2 will travel upwardly through pipes 22 there being a travel of the water from the chamber 2 in reverse directions.

The modified form shown in Figs. 4 to 6 inclusive differs from the preferred construction mainly in the lower combustion chamber 29 wherein the circular deflector 18 is supplanted by a flat deflector 30 leaving all of the tubes or pipes projecting beneath the water chamber uniformly open to the action of the products of combustion. In this form of the invention the tubes 31 are single and a plurality of double tubes 32 is provided which connect the water chamber and steam chamber and are located at the rear of the upper deflector 33 this form being otherwise characterized and identified the same as the preferred form.

I claim:—

1. A vertical boiler comprising in combination, sediment water and steam chambers arranged in superposed relation and spaced apart from each other, said water chamber being provided with a centrally disposed flue, relatively long double tubes connecting the sediment and steam chambers and passing through said flue, relatively short pipes connecting said water chamber and steam chamber and said water chamber and sediment chamber, a grate located at one side of the boiler and above said water chamber and discharging through said flue, a circular deflector located at the margin of said flue and interposed between said long and short pipes and extending from said water to said steam chamber, a second deflector interposed between said long and short pipes and extending from said sediment to said water chambers, and an outlet for the products of combustion located below said water chamber.
2. A vertical boiler comprising in combination, sediment water and steam chambers arranged in superposed relation and spaced apart from each other, said water chamber being provided with a centrally disposed flue, relatively long double tubes connecting the sediment and steam chambers and passing through said flue, relatively short pipes connecting said water chamber and steam chamber and said water chamber and sediment chamber, a grate, a circular deflector located at the margin of said flue and interposed between said long and short pipes and extending from said water to said steam chamber, a second deflector interposed between said long and short pipes and extending from said sediment to said water chambers, and an outlet for the products of combustion.
3. A vertical boiler comprising in combination, sediment water and steam chambers arranged in superposed relation and spaced apart from each other, said water chamber being provided with a centrally disposed flue, relatively long tubes connecting the sediment and steam chambers and passing through said flue, relatively short pipes connecting said water chamber and steam chamber and said water chamber and sediment chamber, a circular deflector located at the margin of said flue and interposed between said long and short pipes and extending from said water to said steam chamber, and a second deflector interposed between said long and short pipes and extending from said sediment to said water chambers.
4. A vertical boiler comprising in combination, sediment water and steam chambers arranged in superposed relation and spaced apart from each other, said water chamber being provided with a centrally disposed flue, relatively long tubes connecting the sediment and steam chambers and passing through said flue, relatively short pipes connecting said water and steam chambers and said water and sediment chambers, and a deflector interposed between said long and short pipes and extending from said water to said steam chamber.

5. A vertical boiler comprising in combination, sediment water and steam chambers arranged in superposed relation and spaced apart from each other, said water chamber being provided with a centrally disposed flue, relatively long pipes connecting the sediment and steam chambers and passing through said flue, relatively short pipes connecting said water and steam chambers and said water and sediment chambers, and deflectors interposed between said water and steam chambers and said water and sediment chambers.

6. A vertical boiler comprising in combination, sediment water and steam chambers arranged in superposed relation and spaced apart from each other, said water chamber being provided with a flue, a pipe connecting the sediment and steam chambers and passing through said flue, and deflectors interposed between said water and steam chambers and said water and sediment chambers.

7. A vertical boiler comprising in combination, sediment water and steam chambers arranged in superposed relation and spaced apart from each other, said water chamber being provided with a flue, a pipe connecting the sediment and steam chambers and passing through said flue, and deflectors interposed between said water and steam chambers and said water and sediment chambers, said deflectors surrounding said pipe and being provided with openings forming with said flue a passage for the products of combustion.

8. A vertical boiler comprising in combination, sediment water and steam chambers arranged in superposed relation

and spaced apart from each other, a pipe connecting the sediment and steam chambers, and deflectors interposed between said water and steam chambers and said water and sediment chambers.

9. A vertical boiler comprising in combination, sediment water and steam chambers arranged in superposed relation and spaced apart from each other, a pipe connecting said sediment and steam chambers, pipes connecting the sediment and water chambers, pipes connecting the water and steam chambers, and deflectors interposed between said water and steam chambers and said water and sediment chambers.

10. A vertical boiler comprising in combination, sediment water and steam chambers arranged in superposed relation and spaced apart from each other, a pipe connecting said sediment and steam chambers, and a deflector interposed between said water and steam chambers.

11. A vertical boiler comprising in combination, sediment water and steam chambers arranged in superposed relation and spaced apart from each other, a pipe connecting said sediment and steam chambers, pipes connecting said water and sediment chambers, and a deflector interposed between said sediment and water chambers.

In testimony whereof I affix my signature in presence of two witnesses.

TOZABURO SUZUKI.

Witnesses:

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