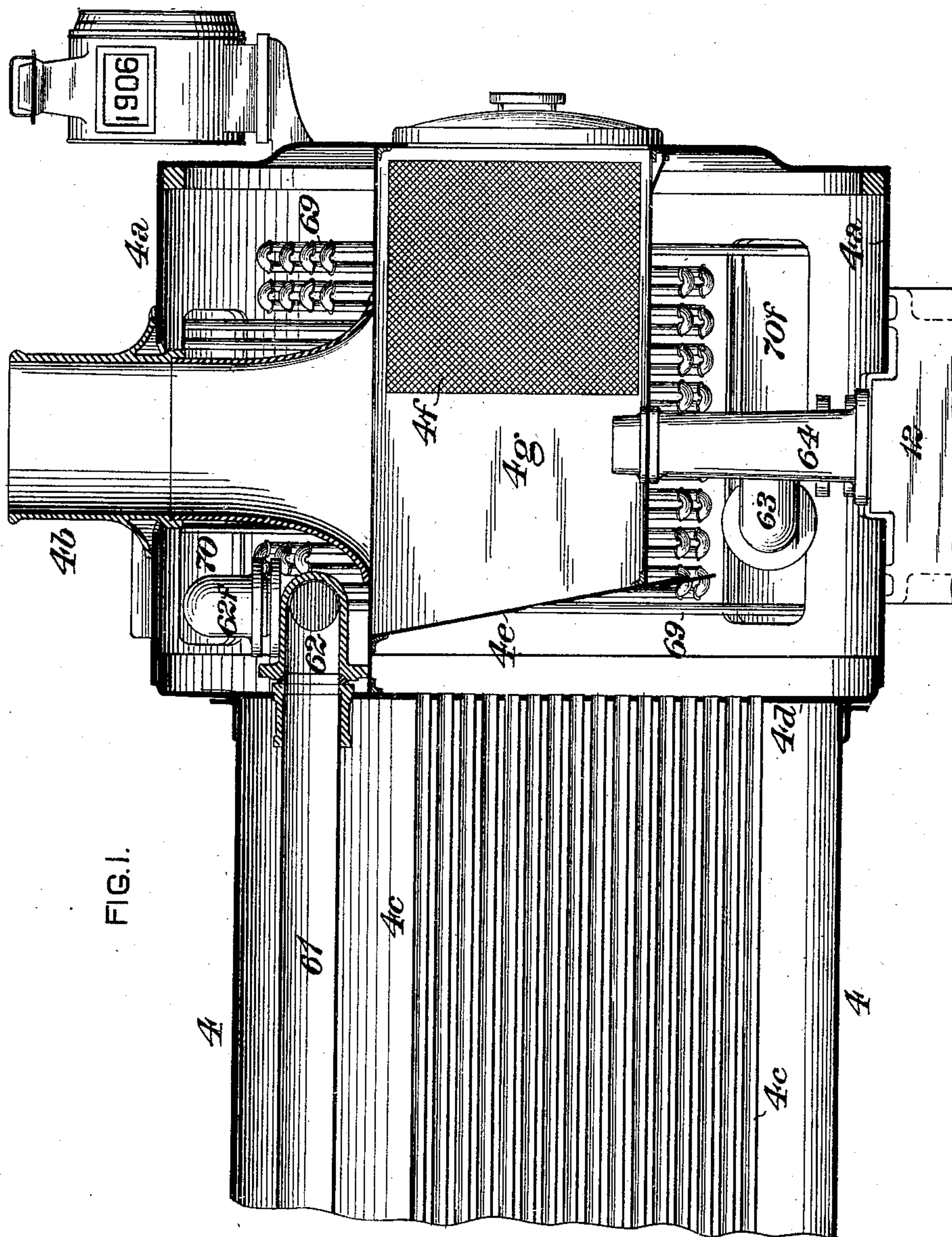


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STEAM BOILER SUPERHEATER.
APPLICATION FILED MAR. 13, 1907.

978,987.

Patented Dec. 20, 1910.

7 SHEETS—SHEET 1.

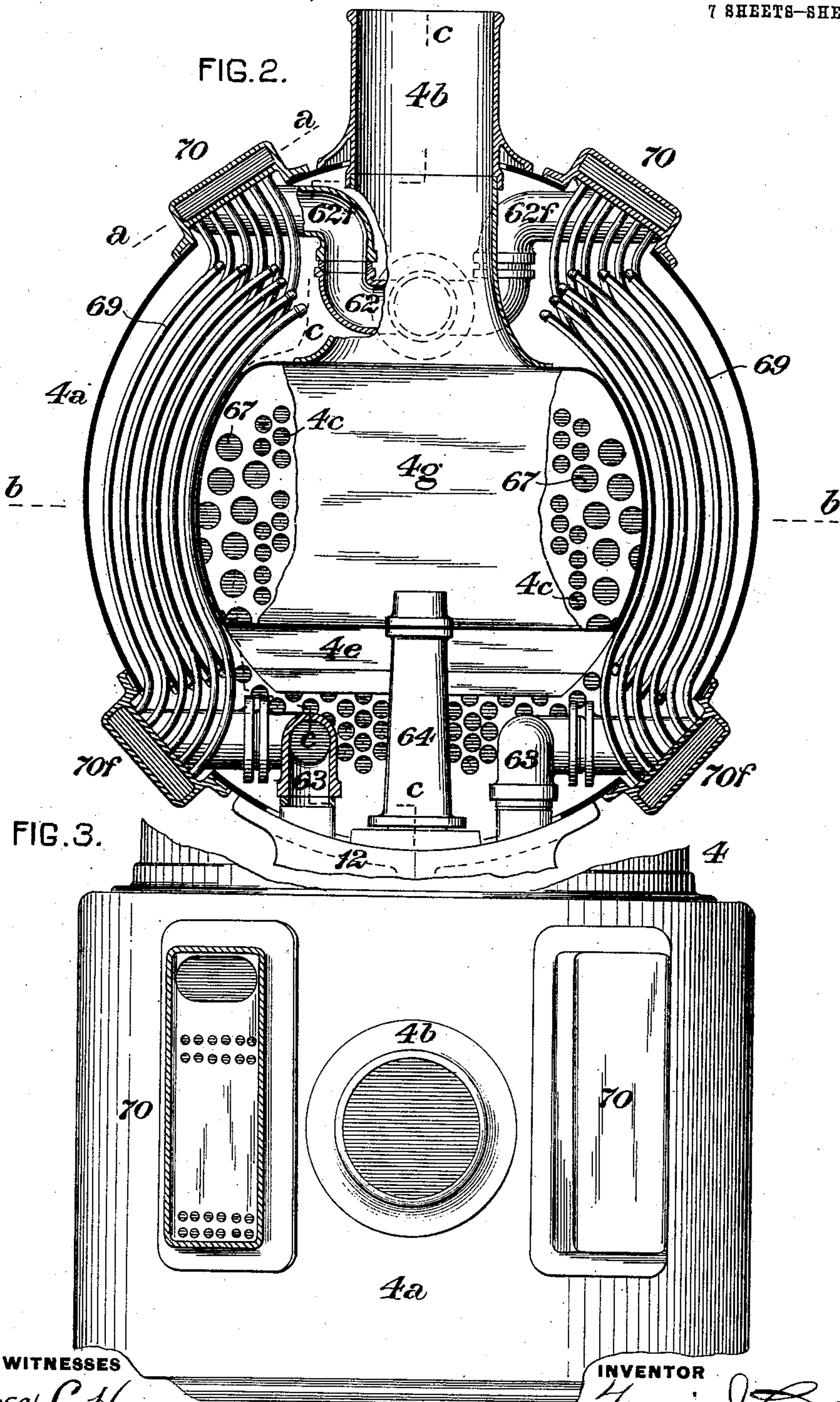


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7 SHEETS—SHEET 2.



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7 SHEETS—SHEET 3.

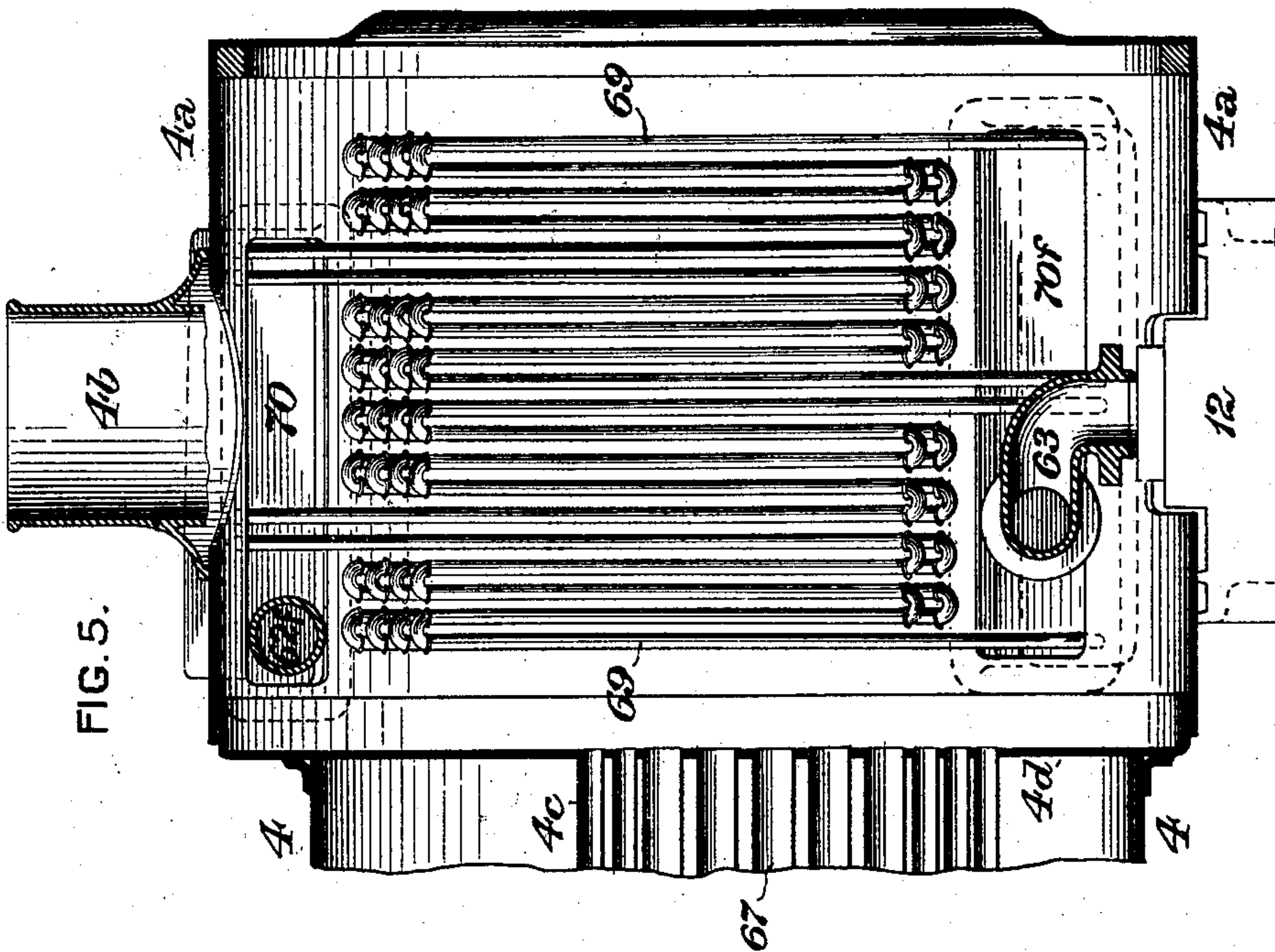


FIG. 5.

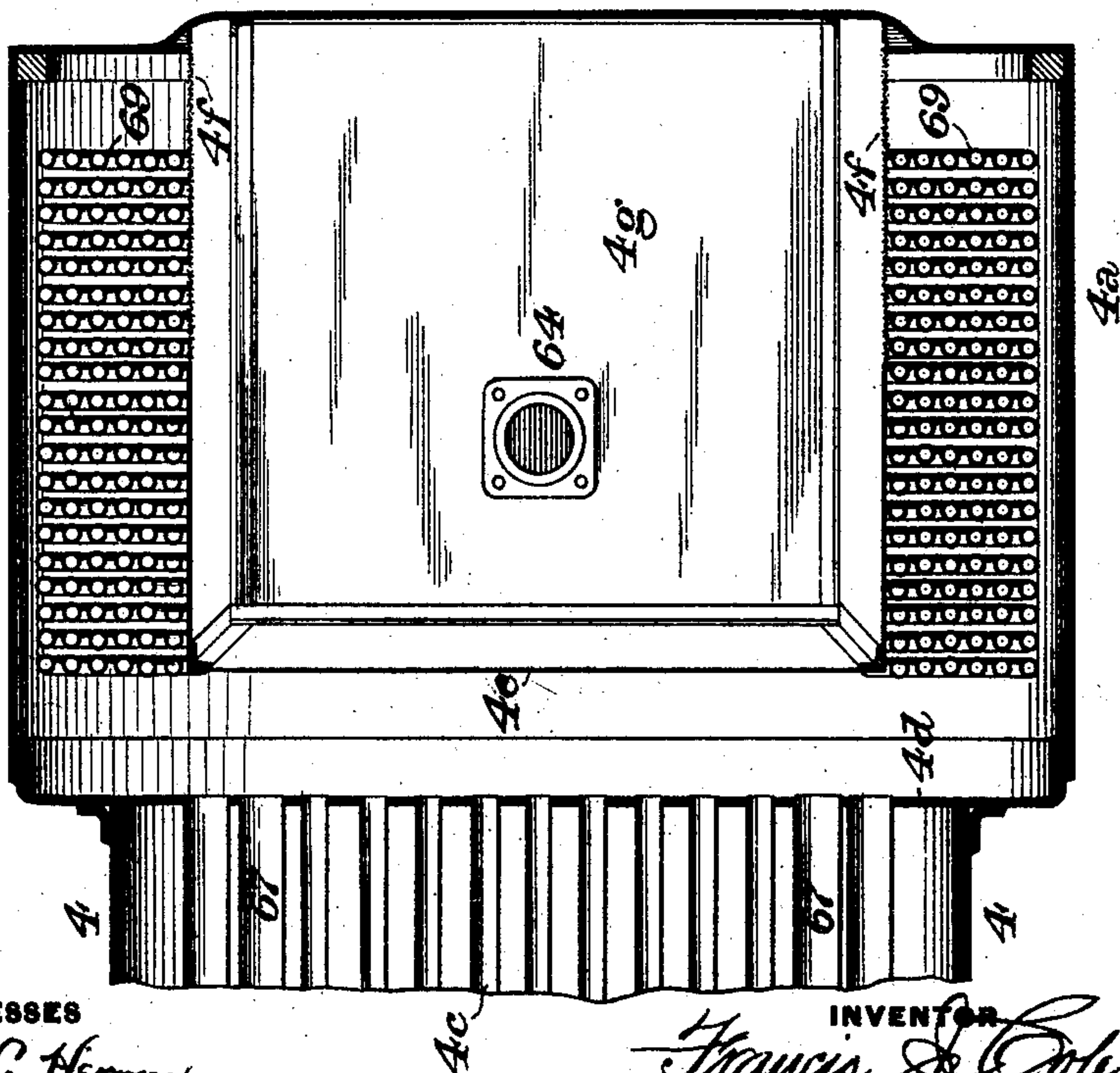


FIG. 4.

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7 SHEETS—SHEET 4.

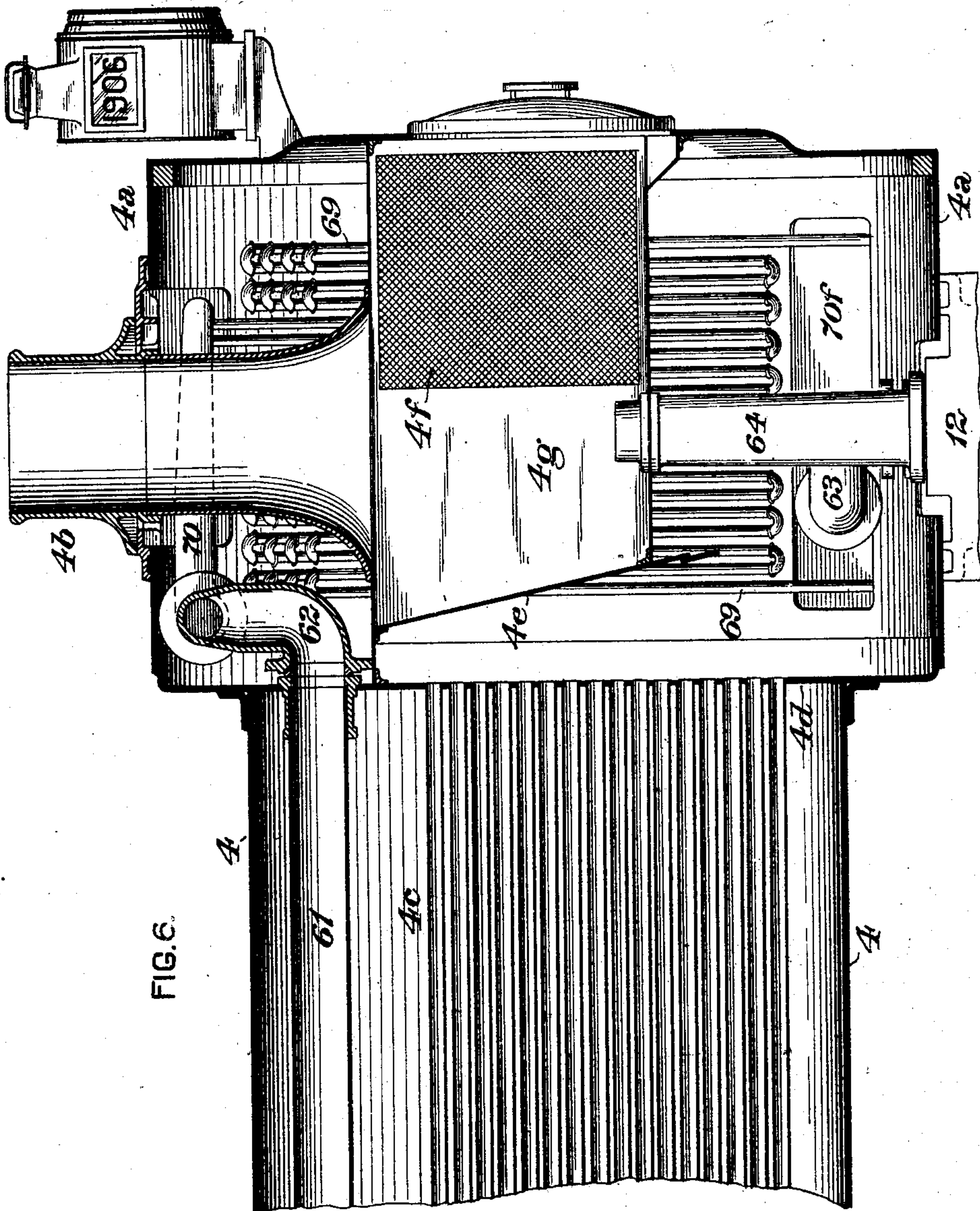


FIG. 6.

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7 SHEETS—SHEET 5.

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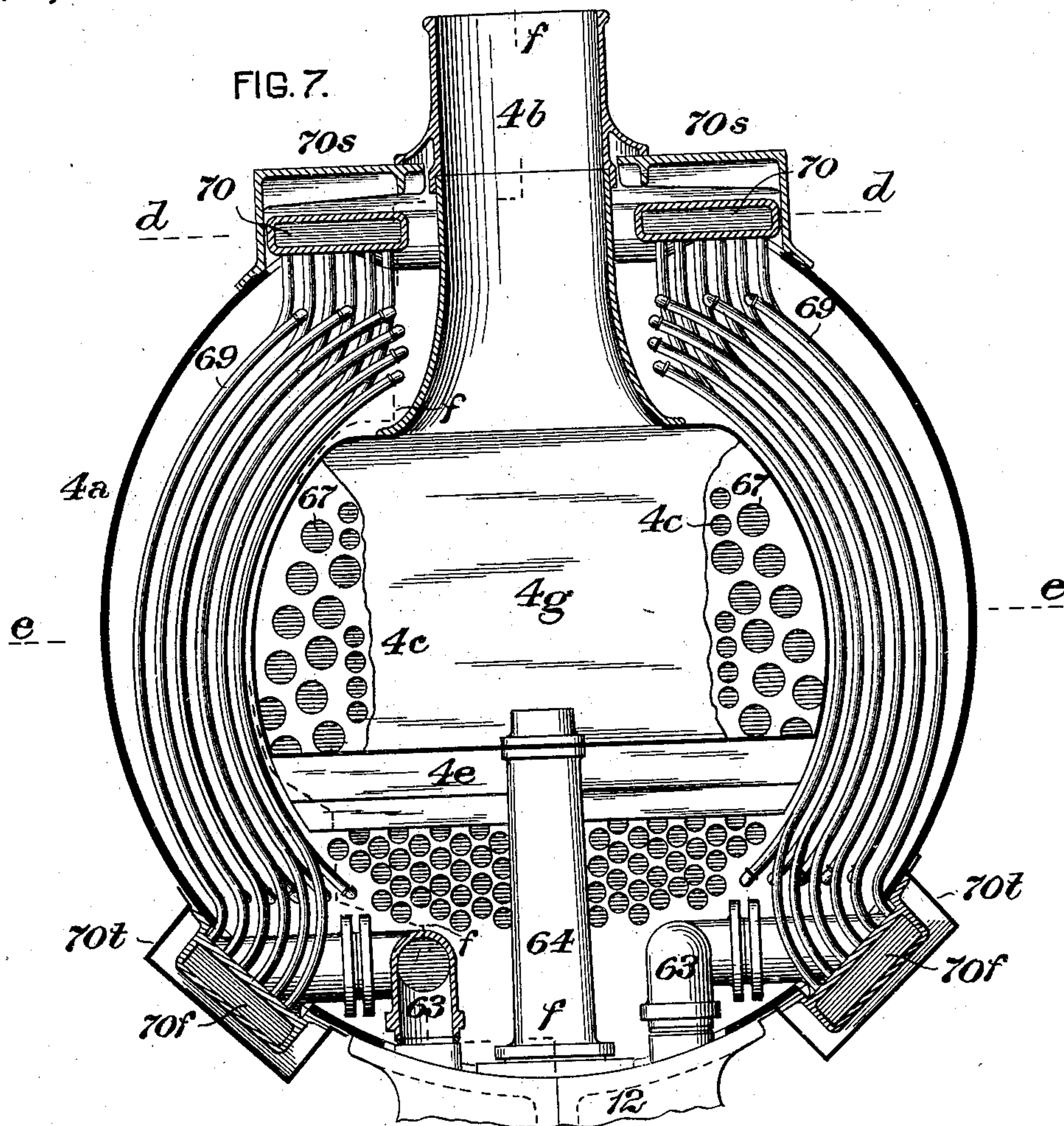
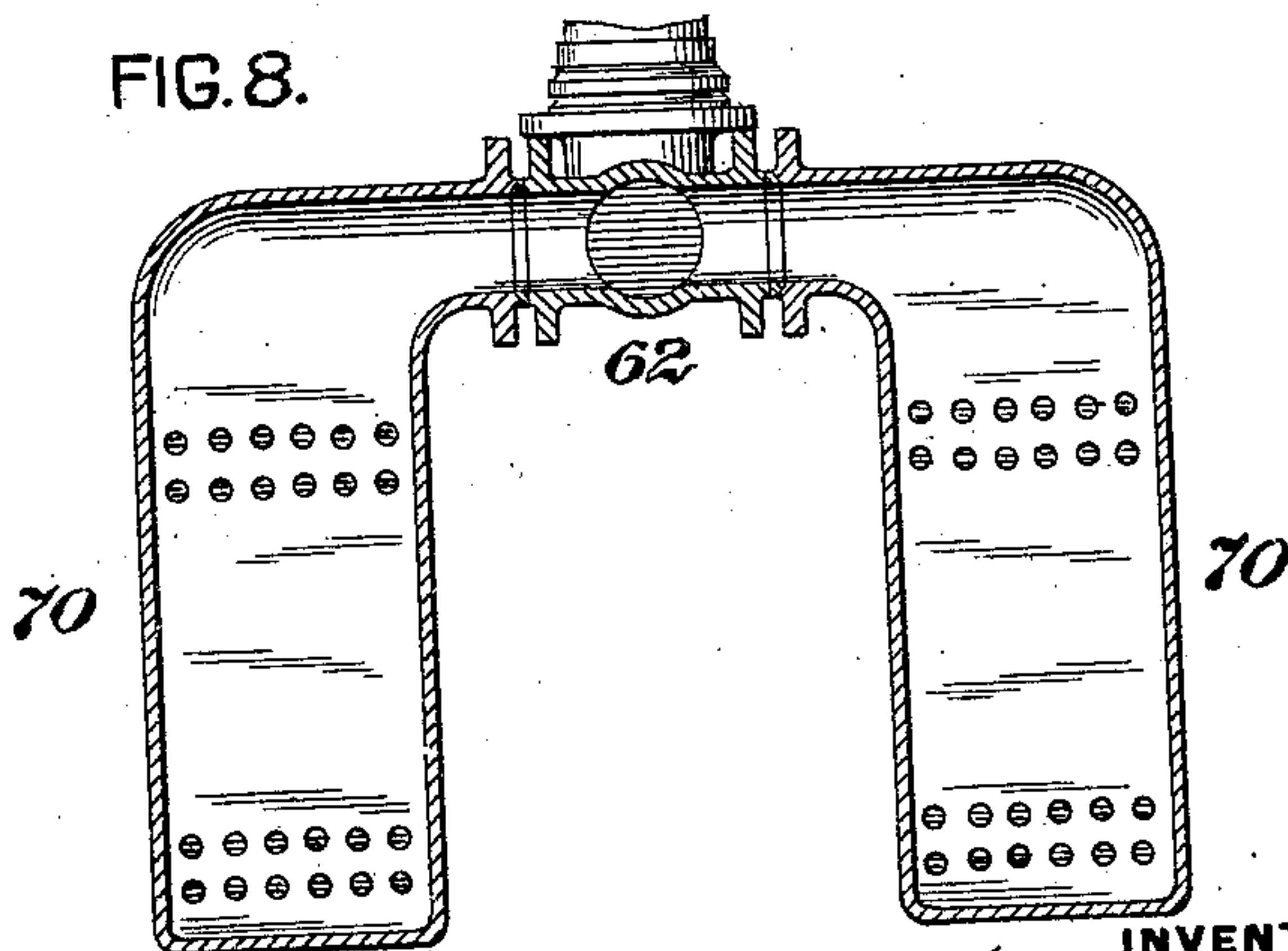


FIG. 8.



WITNESSES

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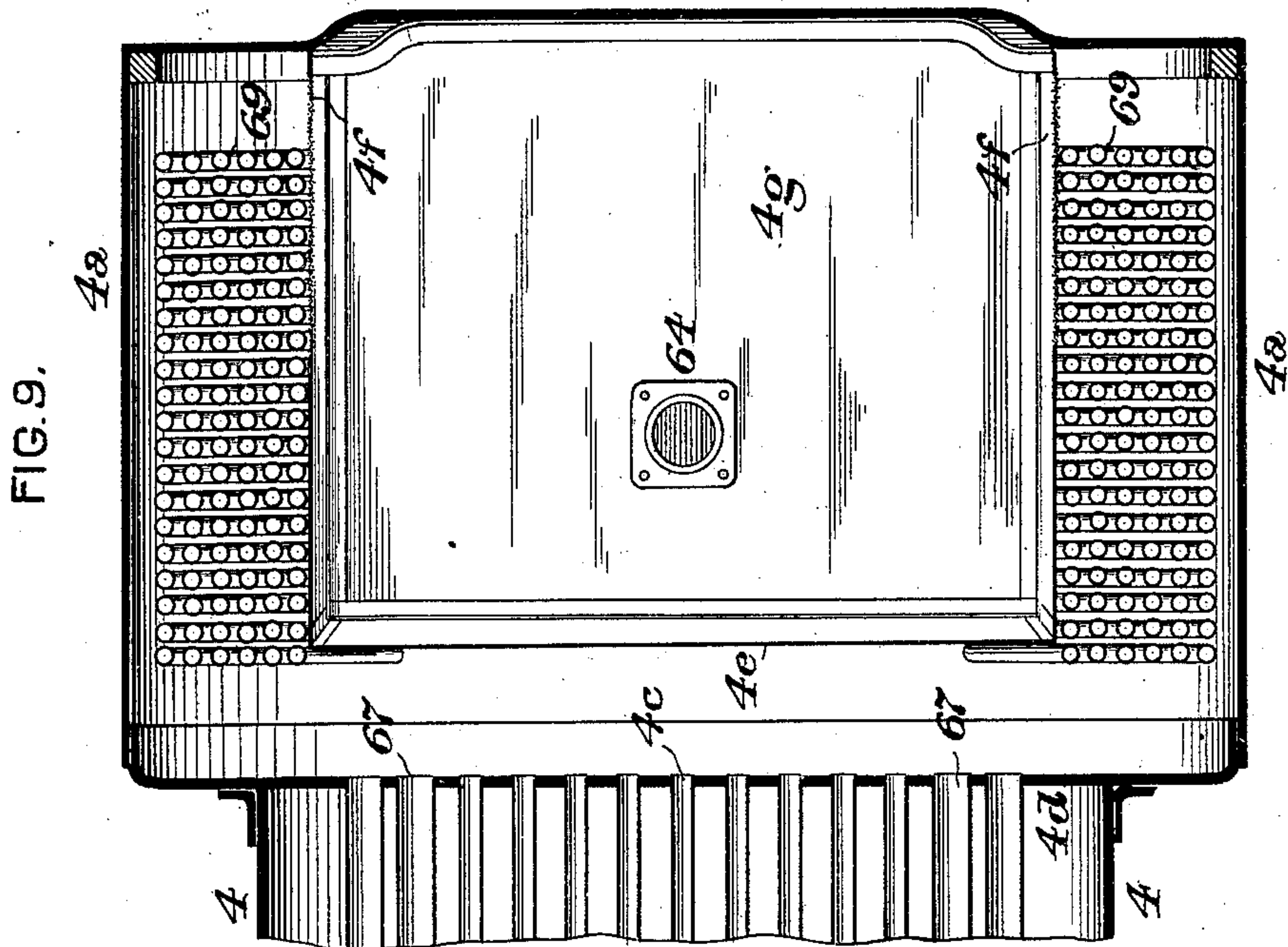
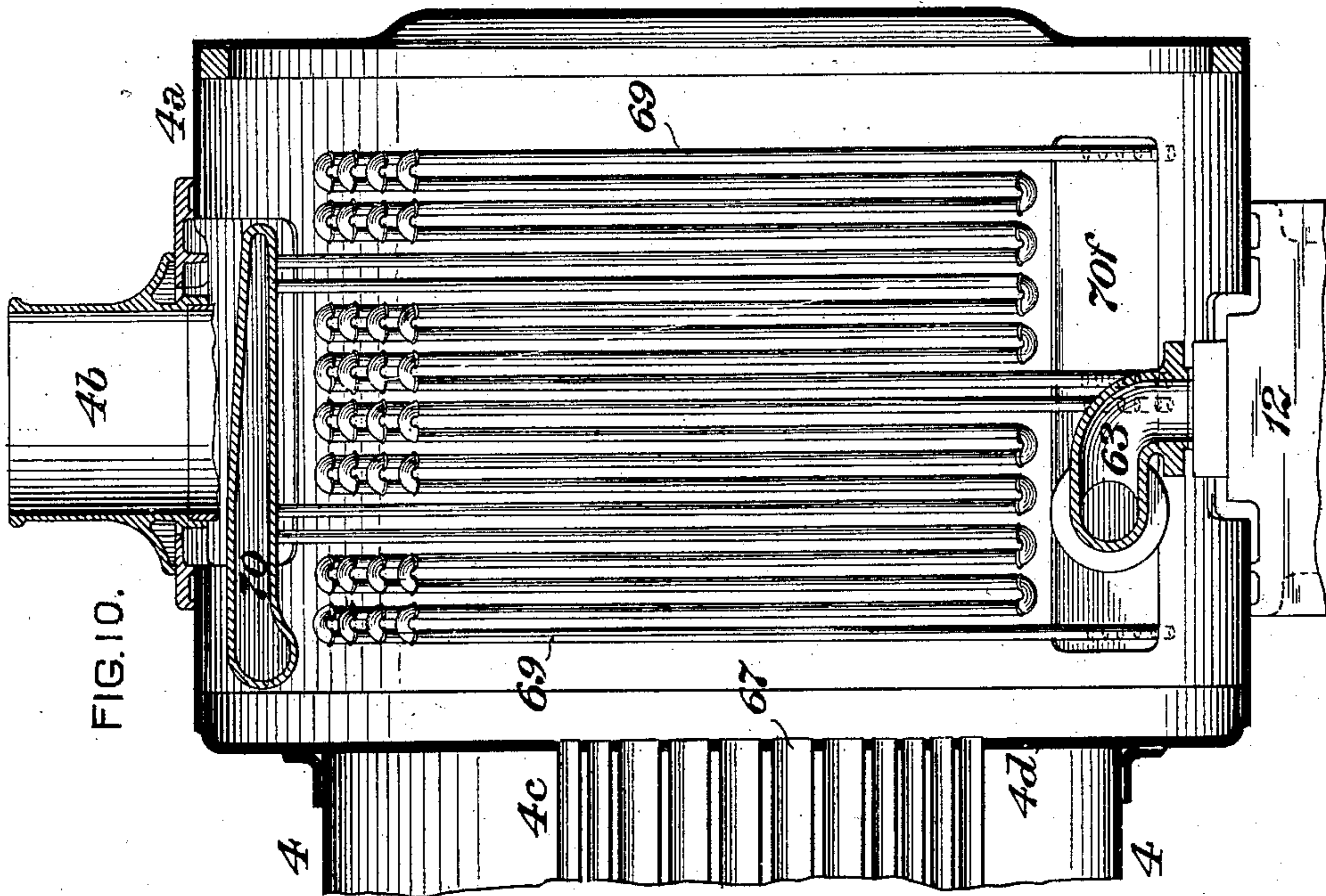
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7 SHEETS—SHEET 6.



WITNESSES
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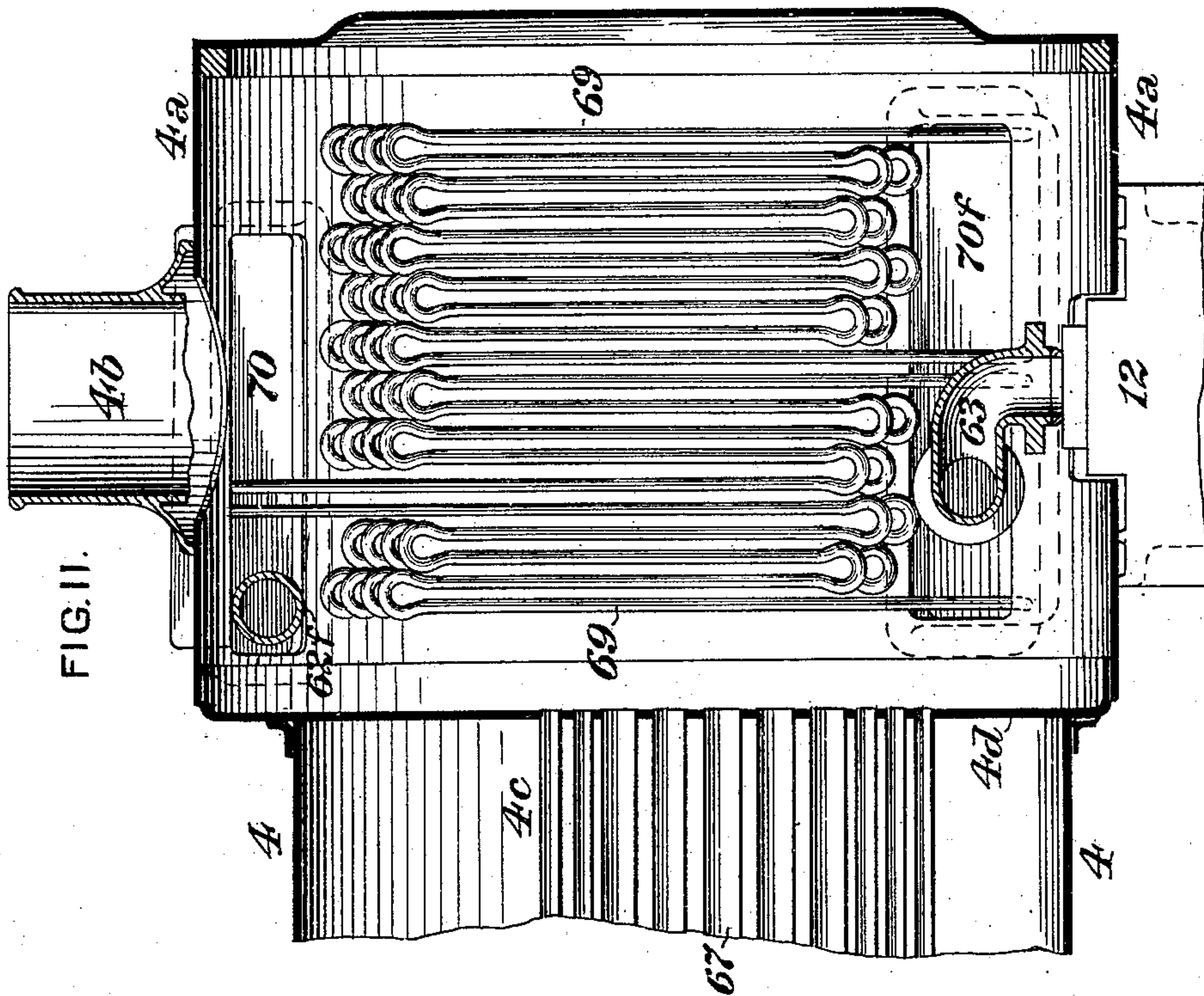
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STEAM BOILER SUPERHEATER.
APPLICATION FILED MAR. 13, 1907.

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Patented Dec. 20, 1910.

7 SHEETS—SHEET 7.



WITNESSES

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UNITED STATES PATENT OFFICE.

FRANCIS J. COLE, OF NEW YORK, N. Y.

STEAM-BOILER SUPERHEATER.

978,987.

Specification of Letters Patent.

Patented Dec. 20, 1910.

Application filed March 13, 1907. Serial No. 362,106.

To all whom it may concern:

Be it known that I, FRANCIS J. COLE, of the borough of Manhattan, in the city and State of New York, have invented a certain
5 new and useful Improvement in Steam-Boiler Superheaters, of which improvement the following is a specification.

My present invention relates to superheaters of the so-called "smoke box" type, that
10 is to say, of the general class or type in which the superheating appliances are located in the smoke box of a fire tube steam boiler, and its object is to provide a superheater of such type in which as large an
15 amount of superheating surface as practicable may be presented, and the heat of the smoke box gases may be effectively and thoroughly imparted thereto during their traverse from the tubes to the stack.

20 The improvement claimed is hereinafter fully set forth.

In the accompanying drawings: Figure 1 is a vertical longitudinal central section through the forward portion of a locomotive boiler, illustrating an application of my
25 invention; Fig. 2, a vertical transverse section, taken in the plane of the axis of the stack and exhaust pipe; Fig. 3, a plan or top view, partly in section on the line *a a* of Fig. 2, of the smoke box; Fig. 4, a horizontal section on the line *b b* of Fig. 2; Fig. 5, a
30 a vertical longitudinal section on the line *c c c c* of Fig. 2; Fig. 6, a vertical longitudinal central section, illustrating a modification of structural detail; Fig. 7, a vertical
35 transverse section, taken in the plane of the axis of the stack and exhaust pipe of Fig. 6; Fig. 8, a horizontal section through the T head and saturated steam headers, on the
40 line *d d* of Fig. 7; Fig. 9, a horizontal section, on the line *e e* of Fig. 7; Fig. 10, a vertical longitudinal central section, on the line *f f f f* of Fig. 7; and Fig. 11, a section taken on the same plane as Fig. 5, but showing
45 the downwardly and upwardly extending superheater pipes as connected by loops or U bends, instead of by separate return bend fittings.

Referring first to Figs. 1 to 5 inclusive
50 and to Fig. 11, my invention is herein set forth as embodied in a locomotive boiler, 4, which is substantially of the ordinary construction and is provided, at its forward end, with a smoke box, 4^a. A plurality of
55 fire tubes extend from the firebox at the

rear end of the boiler, which is not shown, to the front flue sheet, 4^d, and the products of combustion pass through said tubes to the smoke box, 4^a, from which they are discharged, through the stack, 4^b, in the ordinary
60 manner. Steam is supplied from the boiler to the cylinders through a main steam pipe or dry pipe, 61, passing through the front flue sheet, and connected, in front thereof, to a transverse T head, 62, from
65 which it is conducted through superheater pipes, 69, which, with their connections, will be presently described, and, after being superheated in said pipes, passes to the cylinders through branch delivery steam pipes, 70
75 63, located on opposite sides of the smoke box, in the lower portion thereof.

In order to attain, for superheating purposes, the most effective utilization of the heated gases in the smoke box, it is desirable
75 that they should be delivered thereto, from the firebox and tubes, at a higher temperature, as, say, 100 to 150 degrees Fahrenheit, than under ordinary conditions, and, for this purpose, I substitute for a number of the
80 ordinary boiler tubes, 4^c, a smaller number of "superheating tubes," 67, of larger diameter, these being preferably located adjacent to the sides of the boiler, as indicated in Fig. 2, and being unobstructed by inserted
85 superheater pipes, so as to afford free passage for products of combustion from the firebox. The same end may, however, be attained, if preferred, by making all the tubes of slightly enlarged diameter as compared with the tubes ordinarily used, as,
90 say, 2½ inches instead of 2 inches, in which case all of them may be considered as superheating tubes.

For the purpose of providing sufficient
95 volume in the smoke box to enable the desired number of superheating pipes and their connections to be located therein without substantial interference with access to the tubes for renewal or repair, the smoke
100 box, 4^a, is preferably, as shown, made of larger diameter than the adjoining ring of the waist of the boiler, 4, and in applications in locomotive boilers of the ordinary construction, it will usually be found desirable
105 to locate it eccentrically to the waist of the boiler with its axis above that of the latter. In the case of locomotives of the consolidation or 2-8-0 type, or others in which cylinder saddles having comparatively high
110

necks are used, a smoke box concentric with, or having its axis in line with that of the boiler will be found equally applicable.

Two saturated steam headers, 70, each of which is in the form of a case or chest of rectangular section, are bolted or riveted to the smoke box, 4^a, on opposite sides thereof and near its top, each of said headers communicating, by a branch supply steam pipe, 62^f, with the T head, 62. Two substantially similar superheated steam headers, 70^f, are similarly secured to the opposite sides of the smoke box, as near its bottom as the width of the cylinder saddles, 12, will permit, each of said headers communicating with a branch delivery steam pipe, 63, leading to the valve chest of one of the cylinders of the locomotive. In the instance shown, the headers, 70 and 70^f, are located on the outside of the smoke box, and are secured thereto over rectangular openings formed therein, this location being preferred by reason of the increased length of superheater pipes which is thereby rendered available. It is not, however, an essential of my invention, and the headers may, if desired, be secured to the inside of the smoke box. When located on the outside thereof they should be suitably cased or lagged with non-conducting material and may be provided with removable caps or cover plates.

Each of the saturated steam headers, 70, is connected with the superheated steam header, 70^f, below it, by a plurality of superheater pipes, 69, which are disposed in groups or nests, each composed of alternate downwardly and upwardly extending pipe members, connected, so as to form a continuous steam channel, either by return bend fittings, if in separate pieces, or by being bent into loops or U bends when two or more adjacent members are in a single length of pipe, as shown in Fig. 11. The downwardly extending member at one end of each nest is expanded into one of the saturated steam headers, 70, and that at the opposite end, into the superheated steam header, 70^f, beneath it, and all the pipes of each nest are curved so as to conform, as nearly as their positions will permit, to the curvature of the smoke box.

By reference to Figs. 5 and 11, it will be seen that, in the instance shown, the steam connections between the saturated and superheated steam headers on each side, comprehend four nests of superheater pipes lengthwise of the smoke box, each nest having five pipe members, and, as shown in Figs. 2 and 4, that six rows of nests are disposed concentrically on each side, thus aggregating for the entire superheater, forty-eight nests, or two hundred and forty lengths, of alternately downwardly and upwardly extending pipe members. It will be manifest that a very considerable area of superheat-

ing surface is rendered available by this construction, without a substantial or objectionable increase of diameter of the smoke box.

As shown in Figs. 2 and 4, the superheater pipes, 69, are located as close as practicable to the sides of the smoke box, so as to facilitate access to the tubes by affording as much open space as possible at its middle portion. In order that the most effective utilization of the heat of the smoke box gases may be made, it is important that their direction of traverse should be such that they will circulate around the superheater pipes in passing to the stack. For the purpose of directing the gases toward the superheater pipes and of enabling a proper disposition of draft appliances to be made a discharge casing, 4^g, is fixed centrally in the smoke box, said casing extending from a deflecting plate, 4^e, fixed in front of the boiler tubes, to the front of the smoke box, and having lateral draft openings which are covered by sheets of wire netting or perforated plate, 4^f. The side walls of the discharge casing are located as closely as practicable to the inner rows of nests of superheater pipes, and are curved in conformity therewith, and the bottom wall of the casing is located a short distance below the top of the exhaust pipe, 64, which passes through it. The stack, 4^b, is extended downwardly to the top wall of the discharge casing and is tapered or bell mouthed at its lower end, which is open to the casing.

The construction above described, being located between the sets of superheater pipes on opposite sides of the smoke box, and extending to the front of the latter, deflects the gases which pass from the tubes to the spaces at its sides, in passing through which spaces the hot gases surround the superheating tubes and give off a portion of their heat thereto, thereafter passing through the netting, 4^f, of the draft openings into the casing, 4^g, and thence out of the stack, at a temperature substantially the same as that which is found in ordinary practice. The casing, 4^g, also admits of the use of as low an exhaust nozzle as desired, of the provision of ample area of netting or perforated plate for preventing the discharge of live sparks, and of an inward extension of the stack, the advantages of all of which features are well recognized.

Figs. 6 to 10, inclusive, illustrate an application of my invention which accords in all essential particulars with that above described, and differs therefrom only as to structural detail. The smoke box, 4^a, is, in this instance, shown as concentric with the waist of the boiler, and, as in the former case, upper saturated steam headers, 70, and lower superheated steam headers, 70^f, are fixed to the opposite sides of the smoke box,

and are connected by nests of alternate downwardly and upwardly extending members of superheater pipes, 69, in the manner before described. A discharge casing, 4^g, is also applied, similar to that before described. As more clearly shown in Fig. 8 the saturated steam headers, 70, are connected directly to the T head, 62, the intermediate pipes, 62^f, not being used in this case. Said headers also project outwardly through openings in the smoke box, and are inclosed by covers or casings, 70^s. The superheated steam headers, 70^f, are also inclosed by casings, 70^t.

15 I claim as my invention and desire to secure by Letters Patent:

1. The combination, with a tubular steam boiler, of saturated steam headers fixed to the upper portion of the smoke box and communicating with the main steam supply pipe of the boiler, superheated steam headers fixed to the lower portion of the smoke box and communicating with branch steam pipes leading to engine cylinders, sets of superheater pipes located on opposite sides of the smoke box and connecting the saturated and superheated steam headers on each side thereof, a deflecting plate extending transversely in the smoke box in front

of the flue head, a discharge casing extending longitudinally from the deflecting plate to the smoke box front and vertically from the exhaust pipe to the lower opening of the stack, and grated or perforated plates covering lateral draft openings in the discharge casing. 30 35

2. The combination, with a tubular steam boiler, of a T head, saturated steam headers fixed to the smoke box on opposite sides of the T head and communicating therewith, superheated steam headers secured to opposite sides of the smoke box near the lower portion thereof, sets of superheater pipes located on opposite sides of the smoke box and connecting the saturated and superheated steam headers on each side thereof, a deflecting plate extending transversely in the smoke box in front of the flue head, a discharge casing extending longitudinally from the deflecting plate to the smoke box front and vertically from the exhaust pipe to the lower opening of the stack, and grated or perforated plates covering lateral draft openings in the discharge casing. 40 45 50

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