A. S. DE W. HERRESHOFF.

OIL BURNING BOILER.

APPLICATION FILED JULY 13, 1917.

1,348,563.

Patented Aug. 3, 1920.

4 SHEETS—SHEET 1.

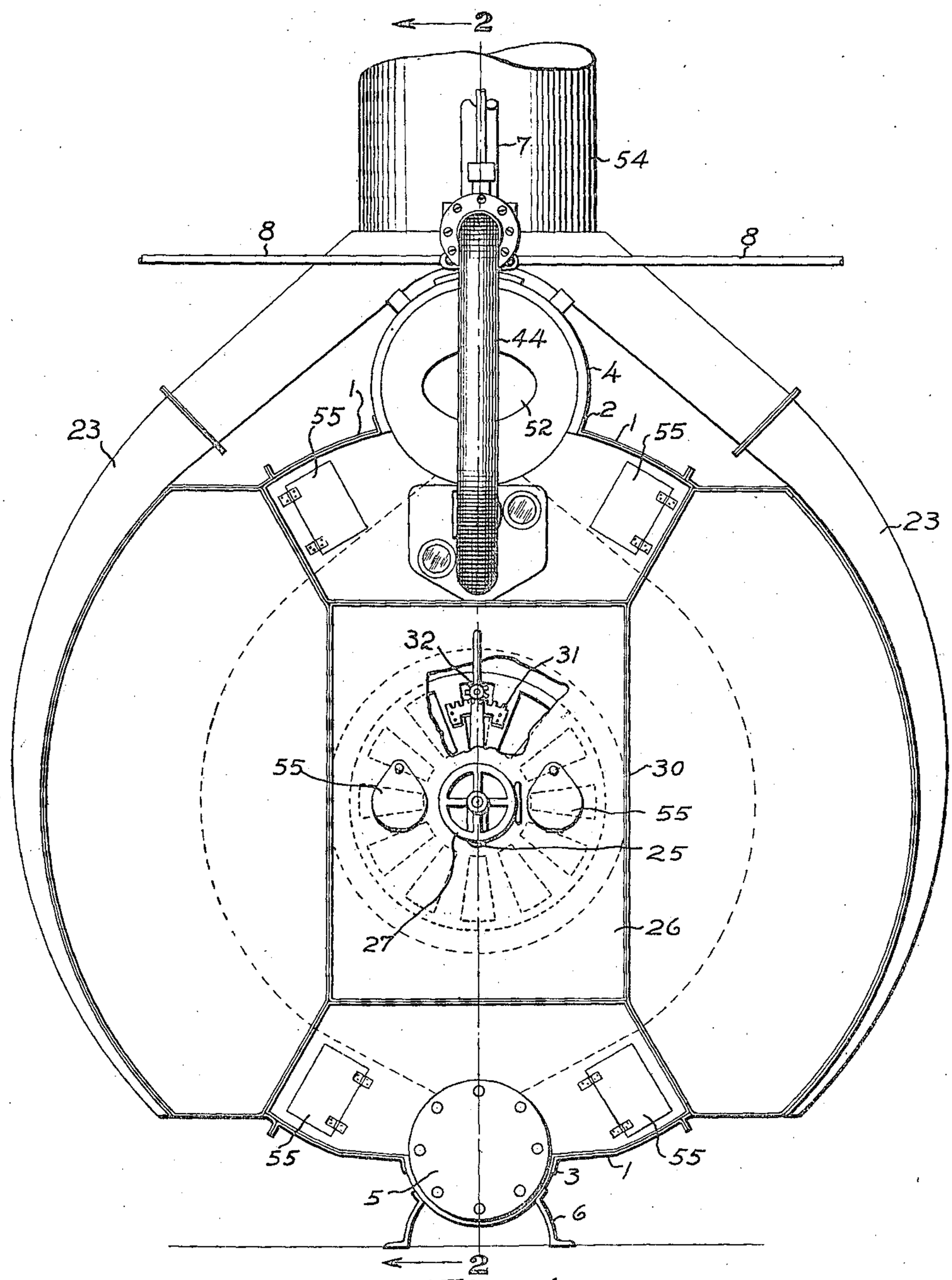

Fig. 1

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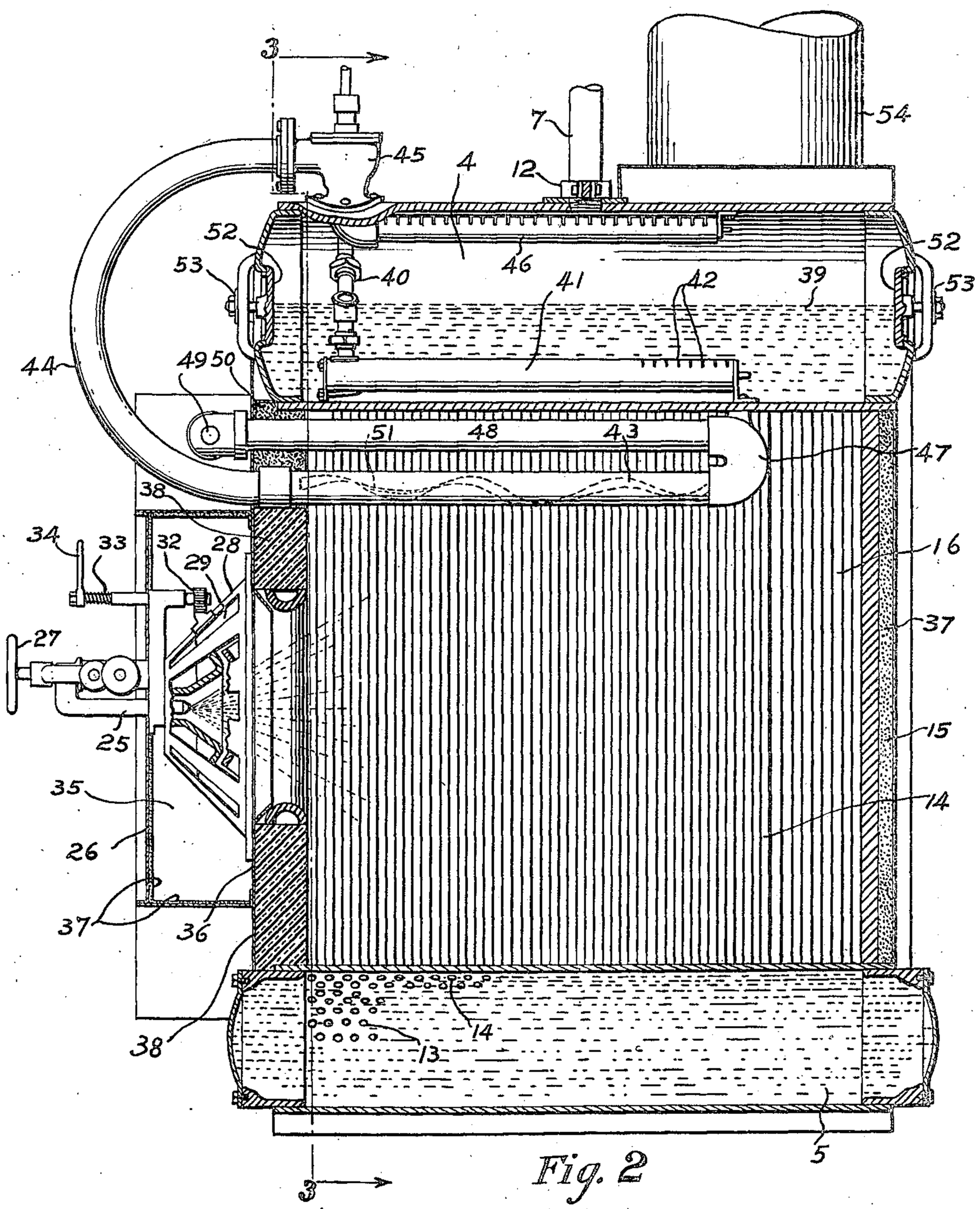

Fig. 2

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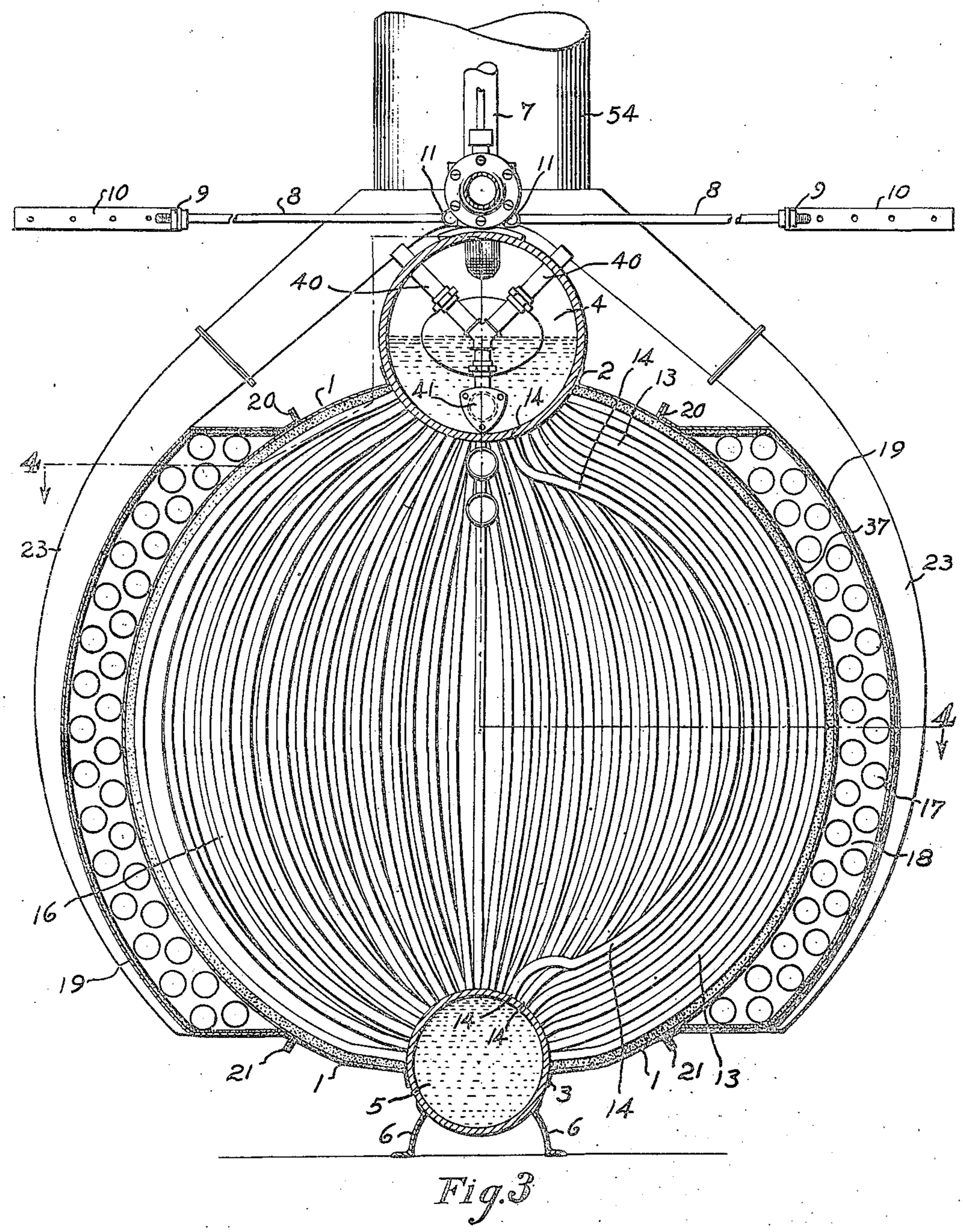

Fig. 3

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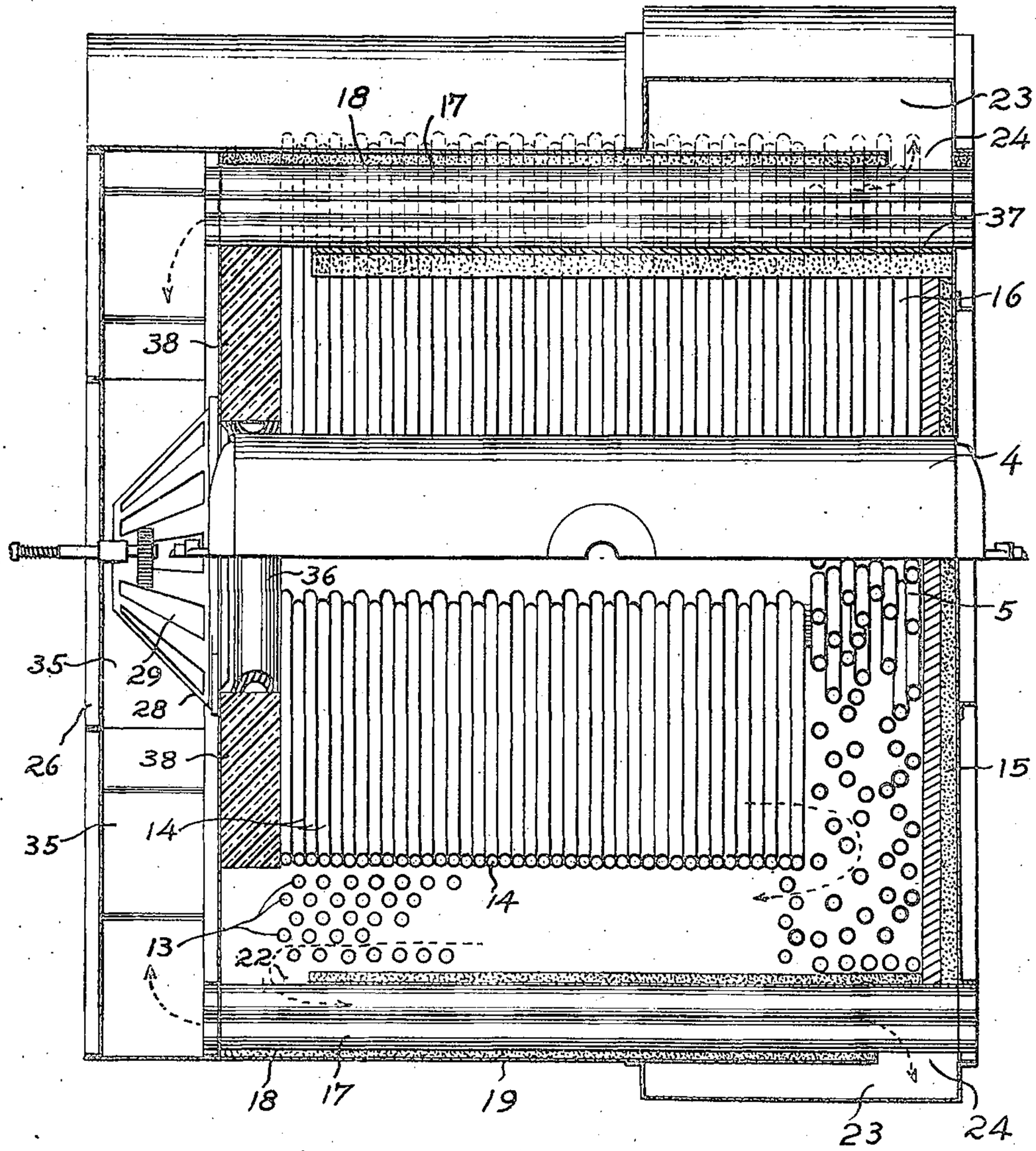

Fig. 4

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UNITED STATES PATENT OFFICE.

ALGERNON S. DE W. HERRESHOFF, OF BRISTOL, RHODE ISLAND.

OIL-BURNING BOILER.

1,348,563. Specification of Letters Patent. Patented Aug. 3, 1920.

Application filed July 13, 1917. Serial No. 180,477.

To all whom it may concern:

Be it known that I, ALGERNON S. DE W. HERRESHOFF, a citizen of the United States, residing at Bristol, in the county of Bristol and State of Rhode Island, have invented an Improvement in Oil-Burning Boilers, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawing representing like parts.

The invention to be hereinafter described relates to steam generators, and more particularly to such generators using fluid fuel.

In this general type of steam generator, especially those designed for marine purposes where great steam-producing capacity is requisite in a small space, it has been found expedient to effect the mixture of the fuel and air in a combustion chamber. Owing to the character of such chamber, as heretofore formed, the disposition of the water tubes with respect thereto and the relation of the steam and water drums, the generator has not reached the high degree of efficiency desired. An important feature of the present invention, therefore, consists in so forming the combustion chamber and relating the water-tubes with respect thereto, that a greater steam-producing capacity is given to the generator. In the present instance of the invention, this feature is carried into effect by connecting an upper and a lower compartment by a cluster of water-tubes, a series of which intermediate the upper and lower compartments are closely related to form the walls of the combustion chamber and a passageway between the shell of the boiler or generator and such series of tubes for the escape of the products of combustion.

Another feature of the present invention consists in leading the products of combustion from the combustion chamber about a series of water tubes connecting the upper and lower compartments then through an air tube chamber for heating the ingoing air before it reaches the combustion chamber to mix with the fluid fuel.

A further feature of the invention consists in a series of air inlet tubes disposed about the shell of the generator in a conduit connected to an uptake by openings which are larger in cross-section near the bottom of the generator than at the top, that a more even distribution of the products of combustion may be attained.

In addition to the above, the invention also comprises various features of construction and combination of parts which will best be made clear from the following description and accompanying drawings of one good, practical embodiment thereof, it being understood that the invention is not limited to the exact details shown and described, which may be varied within the true scope of the invention as defined by the claims.

In the drawings:

Figure 1 is a front or end elevation of a generator or boiler involving the present invention;

Fig. 2 is a longitudinal section of the generator on the line 2—2, Fig. 1;

Fig. 3 is a cross-section of the generator on the line 3—3 of Fig. 2, also showing at the right of said Fig. 3 the cluster of water tubes forming the combustion chamber, and at the left of said figure, representing the water tubes beyond the end or back of the combustion chamber; and

Fig. 4 is a section on the broken line 4—4 of Fig. 3.

In the present instance of the invention as illustrated, the generator or boiler is shown of substantially cylindrical form and comprises the shell 1 preferably formed in half-portions and secured at the top and bottom as at 2, 3, to an upper and lower compartment. The upper compartment, which is preferably of general cylindrical form, constitutes the steam chamber or drum, while the lower compartment, which may likewise be of general cylindrical form and extend longitudinally of the generator or boiler, constitutes a water compartment or drum.

The upper compartment 4, as illustrated in Fig. 3, has a portion thereof included between the side walls of the generator shell 1, and similarly, the lower compartment 5 has a portion thereof included between the side walls or shell of the generator, the side walls or shell of the generator preferably being secured to the upper and lower compartments by any suitable means, as well understood by those skilled in the art.

Where the generator is employed for marine purposes, the limited space for its installation necessitates economy in the disposition and relation of parts and compactness of structure; and in the present instance of the invention, the generator as a whole may be supported from the lower compartment

5 as by means of the legs or flanges 6 secured to the portion of the lower compartment 5 outside of the shell or walls of the generator.

Secured to and extending upward from the upper compartment 4 is a heavy metal pipe 7 which leads to the safety valve. Owing to the unsteady platform on which the generator is carried when used for marine purposes, it is desirable to steady or brace the generator as a whole; and to this end, suitable stay-rods 8 are adjustably secured as at 9 to a strap 10 secured to a suitable part of the structure on which the generator is supported. The stays 8 are connected at 11 to a collar 12, Fig. 2, which may be clamped about the heavy iron pipe 7 leading to the safety-valve. This manner of bracing the generator is simple and convenient, but as will be readily understood, other forms of bracing may be employed.

Secured to and extending between the upper compartment 4 and the lower compartment 5, are a cluster of water-tubes 13, Figs. 3 and 4, the ends of the tubes being passed through the walls of the said compartments and properly secured thereto as usual. A series of tubes of this cluster are utilized to form a combustion chamber wherein the fluid fuel and air may properly unite for complete combustion, and the production of the maximum amount of heat energy. To this end, the inner tubes 14 of this cluster are arranged in close relation between the upper and lower compartments 4, 5. This close relation may be such that the products of combustion cannot pass between the adjacent tubes 14. The series of tubes 14 thus forming the combustion chamber intermediate the upper compartment 4 and the lower compartment 5 extend from the front or fuel inlet portion of the generator toward the rear thereof, but stop short of the rear wall 15 thereof, as indicated in Fig. 2, the end tube of the series 14 thus terminating the rear portion of the combustion chamber.

Inasmuch as the ends of the water tubes 14 which constitute the walls of the combustion chamber require to be secured to the inner portions of the upper and lower compartments 4 and 5 respectively, it is found desirable to offset alternately the ends of the tubes 14 as indicated in Fig. 3, so that sufficient separation of the ends of the tubes may be had to enable said ends to be properly secured to the upper and lower compartments while the body portion of the tubes themselves extending between said compartments are in close contacting relation. The openings between the offset portions of the tubes will preferably be filled with fire clay mixture.

Beyond the end of the combustion chamber, that is at the rear of the combustion chamber and between it and the adjacent rear wall 15 of the generator, there is another cluster of water-tubes 16, which establish communication between the upper and lower compartments 4 and 5, but in this cluster the water-tubes are in separated relation in order that the products of combustion may freely circulate in the space around and about the water-tubes. As illustrated in Fig. 3, the water-tubes 16 are more or less deflected from the vertical plane passing through the upper and lower compartments 4 and 5, depending upon the position of the tubes, those nearer the wall or shell 1 of the generator being more curved or deflected than those more remote therefrom, the effect being that the products of combustion may find a free circulating space around the cluster of water-tubes 16 as such products of combustion pass from the combustion chamber toward the uptake, as will presently appear.

As hereinbefore described, a series of water-tubes 14 of the cluster 13 are arranged in close relation intermediate the upper and lower compartments and form the combustion chamber where the fluid fuel and air may be properly mixed for purposes of combustion; and inasmuch as the series of water-tubes 14 are inwardly disposed with reference to the shell or wall 1 of the generator, they form between themselves and the shell or walls of the generator, a passageway for conducting the products of combustion to the uptake, as will presently appear. In the space or passageway thus provided between the tube-constituted walls of the combustion chamber and the shell or walls of the generator, the present invention contemplates that the series of water-tubes of the cluster 13 outwardly of the series 14 may be arranged in separated relation to afford space between them for the passage of the products of combustion to the uptake.

Arranged about the exterior of the generator shell are a series of air inlet tubes 17, Figs. 3 and 4, contained within an air tube conduit 18 formed by the walls 19 connected at 20 and 21, Fig. 3, to the exterior of the generator shell. In the present instance of the invention there is one of these conduits at each side of the generator, but this may not always be necessary. The air inlet tubes 17 extend longitudinally of the generator in the conduit 18 and supply the necessary air to be delivered for mixture with the fluid fuel, as will presently appear. In order that the air thus delivered for mixture with the fluid fuel may be in a highly-heated condition when it reaches the point of mixture, the present invention contemplates that the conduit 18 which extends longitudinally of the generator, may be utilized for the passage of the products of combustion to the uptake. In the present in-

stance of the invention, as indicated in Fig. 4, the shell or wall 1 of the generator is provided with an opening 22 extending throughout the height of the air conduit 18 and through which opening 22 the products of combustion pass on the way to the uptake 23.

From the construction thus far described, it will be apparent that the combustion chamber is formed intermediate the upper and lower compartments 4 and 5 by a series of closely-related tubes connected to the upper and lower compartments at that portion thereof which is inclosed by the shell or walls of the generator; that the combustion chamber thus formed extends partway lengthwise of the generator; and that the products of combustion pass from the combustion chamber through a second cluster of separated water-tubes connecting the upper and lower compartments, and then through the air tube conduit for heating the ingoing air before it reaches the combustion chamber.

Connected to each of the air tube conduits 18 is the uptake 23 having an opening 24 establishing communication between the uptake and the air tube conduit 18, substantially throughout the height of the air tube conduit. In order that there may be a uniform distribution of the heated gases of combustion, the opening 24 between the uptake and the air tube conduit is preferably made larger in cross-section at the lower portion of the generator than at the top portion thereof, the effect being that the more free exit offered to gases at the lower portion of the generator induces the heated gases, which naturally rise, to more evenly and uniformly distribute themselves throughout the generator. Referring to Fig. 4: the variation in cross-sectional area of the opening 24 between the air tube conduit and the uptake is indicated.

In the present instance of the invention, the fuel is of the liquid type, and is introduced to the generator at one end of the combustion chamber. Referring to Fig. 2: the injector nozzle 25 is properly supported on the plate 26, Fig. 1, secured to the front of the generator, and the flow of liquid fuel through the nozzle or injector 25 is regulated by a suitable device, such as indicated at 27.

Surrounding the nozzle or injector 25 is an air-controlling device 28, which, in the present instance of the invention consists of a plate of substantially frusto-conical form as indicated in Fig. 2 extending between the plate 26 and the front wall of the generator. The plate 28 is provided with a series of openings 29 which are adapted to be more or less covered by a series of plates 30 provided with a rack 31, Fig. 1, and movable by means of an intermeshing pinion 32. The pinion 32 is mounted on a shaft 33 which may be operated by a suitable hand-piece 34, the construction being such that by turning the shaft 33 more or less, the amount of air admitted to the combustion chamber may be regulated.

As indicated in Fig. 4, the heated air passing through the series of air tubes 17 enters the air chamber 35 which surrounds the fuel nozzle or injector and the air-controlling means.

In order that the products of combustion as delivered to the combustion chamber may be thrown upon the water-tubes forming the walls of the combustion chamber, the end portion of the generator is provided with an open ring 36 supporting the fire-brick 38 and of sufficient diameter to permit the liquid fuel and air as they pass to the combustion chamber, to spread or assume a conical formation, substantially as indicated in Fig. 2.

Inasmuch as the shell or walls of the generator may come in contact with the highly-heated gases of combustion, the present invention contemplates that the inner surface of the shell or walls of the generator may be lined with asbestos 37. This asbestos may also be employed to produce the rear wall 15 of the generator. The ring 36 may be properly supported at the front of the generator as by a non-combustible support 38. This may be fire brick or any other suitable non-combustible material.

As indicated in Fig. 2, the water level will usually assume the position 39 in the upper compartment or steam drum 4; and in order that feed water may be properly introduced, the upper compartment 4 is provided with an inlet pipe 40 which may be connected to a suitable supply and communicate with the distributing pipe 41 having openings 42, preferably directing the inlet water upwardly. If desired, particles of zinc or like substance may be placed in the distributing pipe 41 to prevent corrosion.

Extending into the combustion chamber formed by the series of closely-adjacent water tubes 14 and intermediate the upper and lower compartments 4 and 5 is a superheater. In the present form of the invention, the super-heater comprises the conduit or pipe 43 which may be connected through the pipe 44 and the connection 45 with the steam-take pipe 46. Communicating with the super-heater 43 by means of the elbow 47, is a return portion of the super-heater 48 which passes through a suitable opening in the front wall of the generator and is in communication with the pipe 49 leading to the point of use or engine. The pipes 43 and 48 which constitute the super-heater will be preferably

surrounded where they pass through the walls of the generator by non-combustible material 50.

In order that the steam taken from the steam drum or upper compartment 4 may have all portions thereof subjected to the super-heating action of the super-heater, it is desirable that the steam shall be agitated as it passes through the super-heater; and to this end one or both of the pipes 48 may be provided with a spiral or twisted ribbon 51 extending longitudinally thereof, the construction being such that as the steam passes longitudinally through the super-heater, the twisted ribbon or spiral will throw all portions of the steam or particles of vapor carried thereby against the walls of the super-heater and effectually gasify them.

The end portions of the upper compartment or steam drum 4 may have openings therein, closed by man-hole plates 52, as indicated in Fig. 2, said plates being properly held in place by suitable clamps 53.

Where the uptake extends about both sides of the generator as indicated in Fig. 3, it is convenient to join the uptakes 23 at their upper portions to a smoke-stack or other exit 54.

As indicated in Fig. 3, the feed water is preferably taken into the distributing pipe 41 through the connections 40, one leading to the distributing pipe 41 from either side of the generator.

In order that access may be had to the various parts for cleaning and inspection, suitable openings may be provided, as indicated in Fig. 1, and such openings be closed by doors or cover-plates 55.

What is claimed is:

1. In a boiler, the combination of a shell, an upper and a lower compartment, series of inner tubes establishing communication between said compartments, the tubes of each series being in close relation for forming a combustion chamber and passageways for the products of combustion between the combustion chamber and shell, an uptake having an opening for receiving the products of combustion from said passageways of larger cross sectional area adjacent the lower portion of the boiler than at the upper portion of the boiler, and a series of separated water-tubes in the shell between the combustion chamber and uptake.

2. In a boiler, the combination of a shell, an upper and a lower compartment partially inclosed by the shell, water-tubes connecting the inclosed portions of the upper and lower compartments, and an uptake having an opening extending vertically of the boiler to admit the products of combustion to the uptake, the cross sectional area of the uptake opening being greater at the lower portion than at the upper portion thereof to introduce uniform distribution of the heated products of combustion as they pass to the uptake.

3. In a boiler, the combination of a shell, an upper and a lower compartment partially inclosed by the shell, water tubes connecting the inclosed portions of the upper and lower compartments, said tubes closely positioned and arranged to form a substantially cylindrical combustion chamber extending toward the rear wall of said shell but terminating short of said wall, a wall surrounding said combustion chamber in spaced relation thereto and extending forward from said rear wall to direct the products of combustion forwardly, a rearwardly-extending wall inclosing said second wall and arranged to direct the combustion products rearwardly about the outer surface of the second wall and toward an uptake for receiving said products, a cluster of water tubes arranged in spaced relation across the end of the combustion chamber through which the products of combustion pass, and air inlet tubes positioned between the second and third walls within the path of travel of the combustion products.

In testimony whereof, I have signed my name to this specification.

ALGERNON S. DE W. HERRESHOFF.