

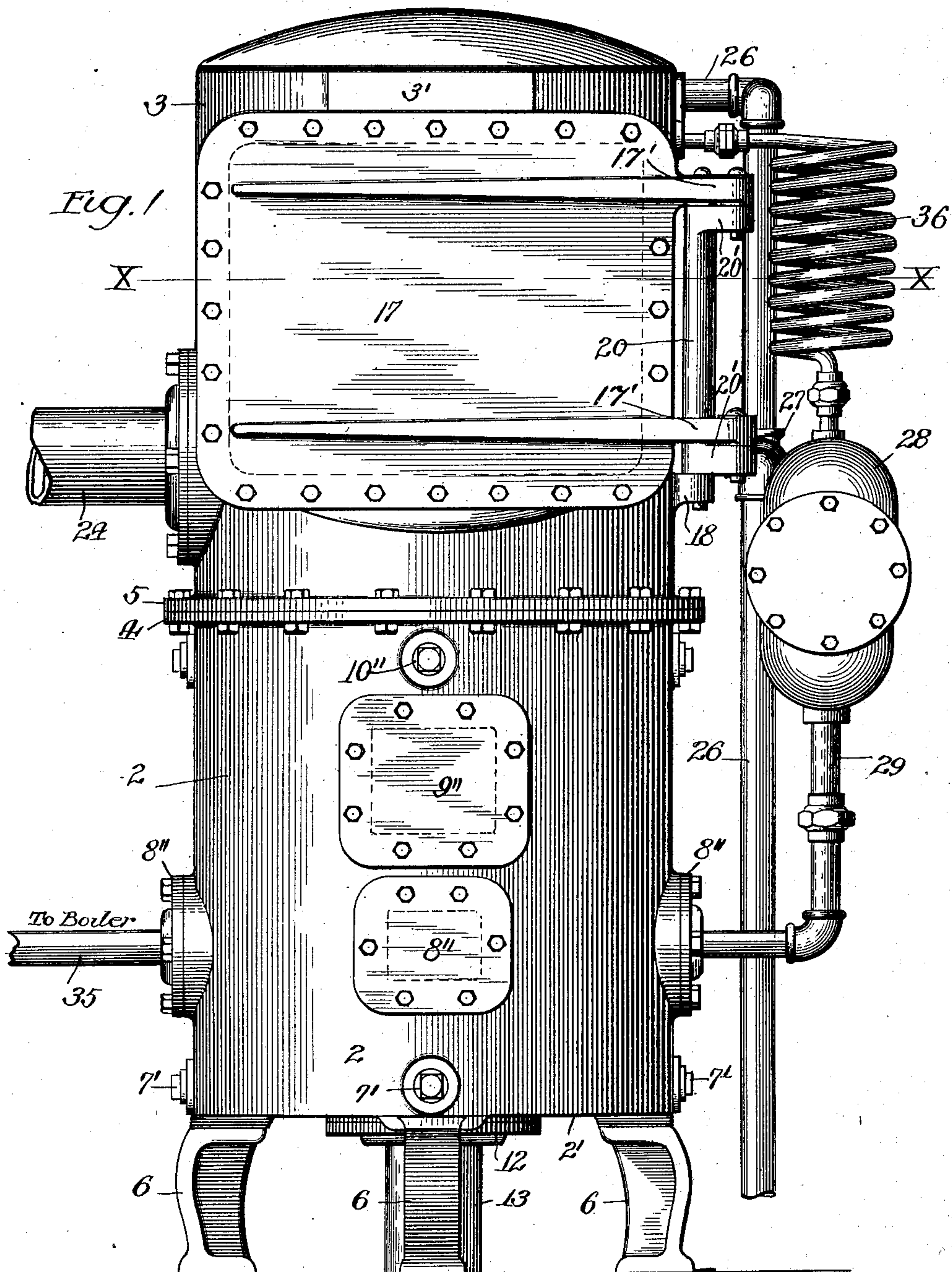
No. 744,525.

PATENTED NOV. 17, 1903.

H. J. GEBHARDT.
FEED WATER HEATER.
APPLICATION FILED SEPT. 8, 1902.

NO MODEL.

4 SHEETS—SHEET 1.



Witnesses
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Inventor:
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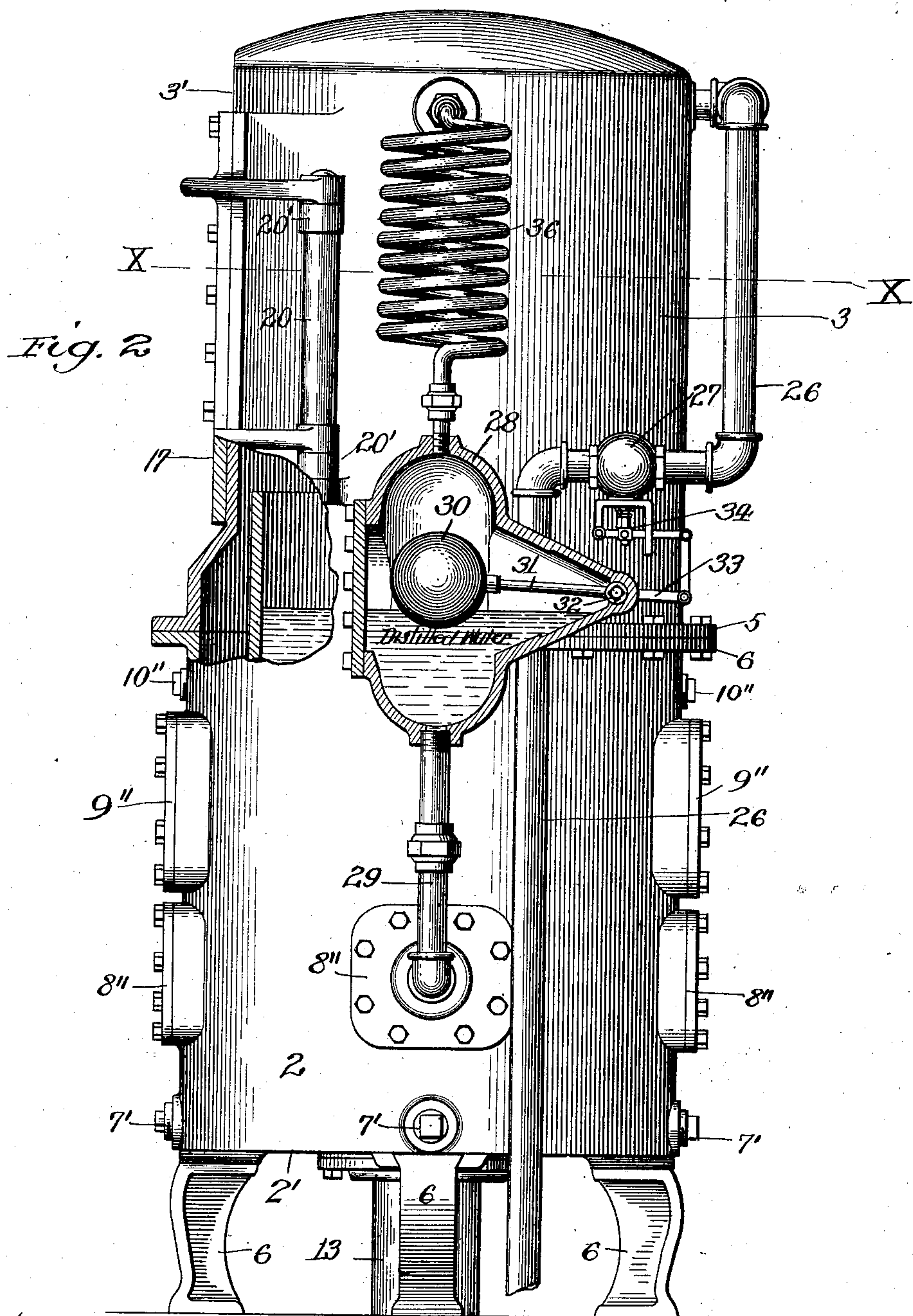
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4 SHEETS—SHEET 2.



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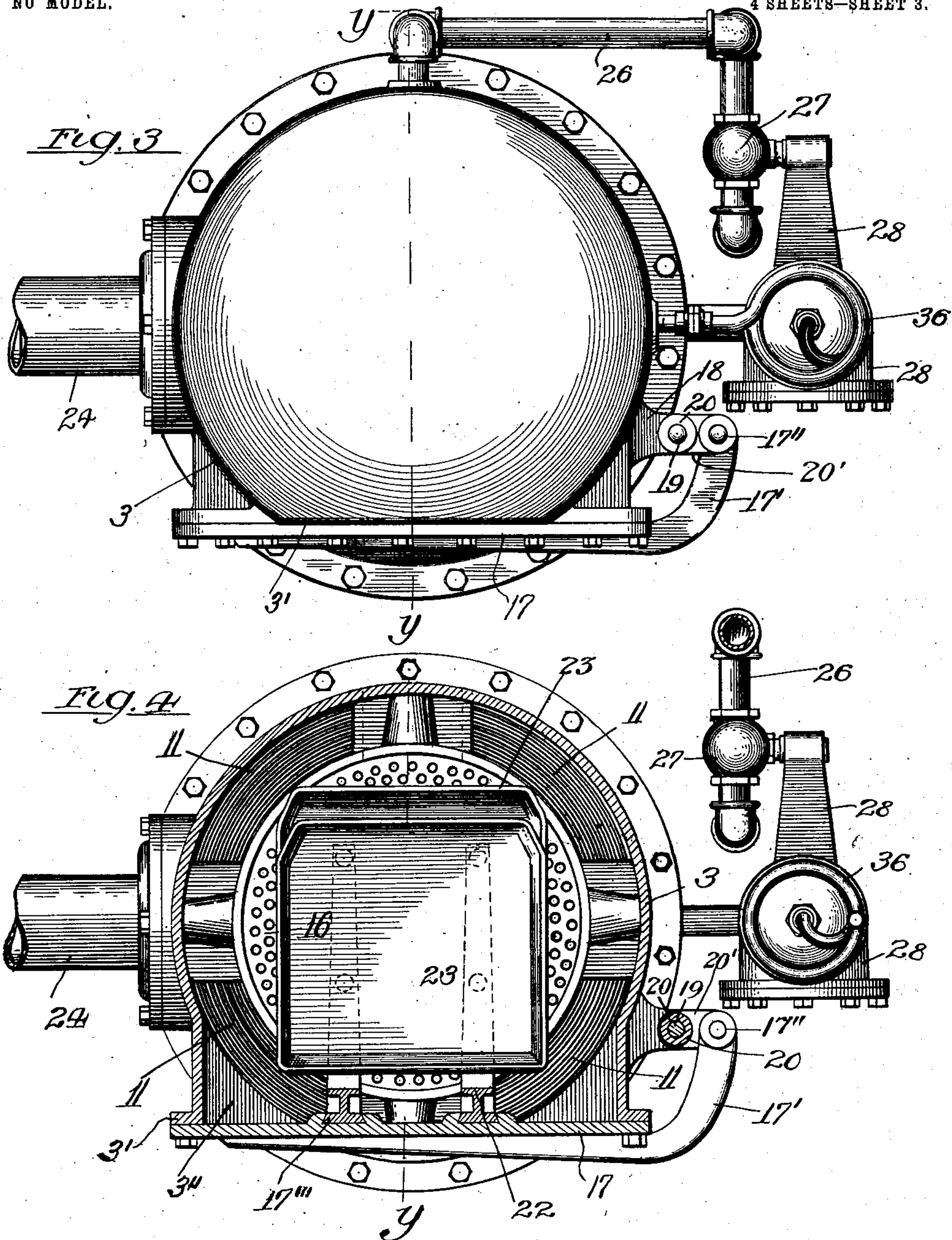
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4 SHEETS—SHEET 3.



Witnesses:
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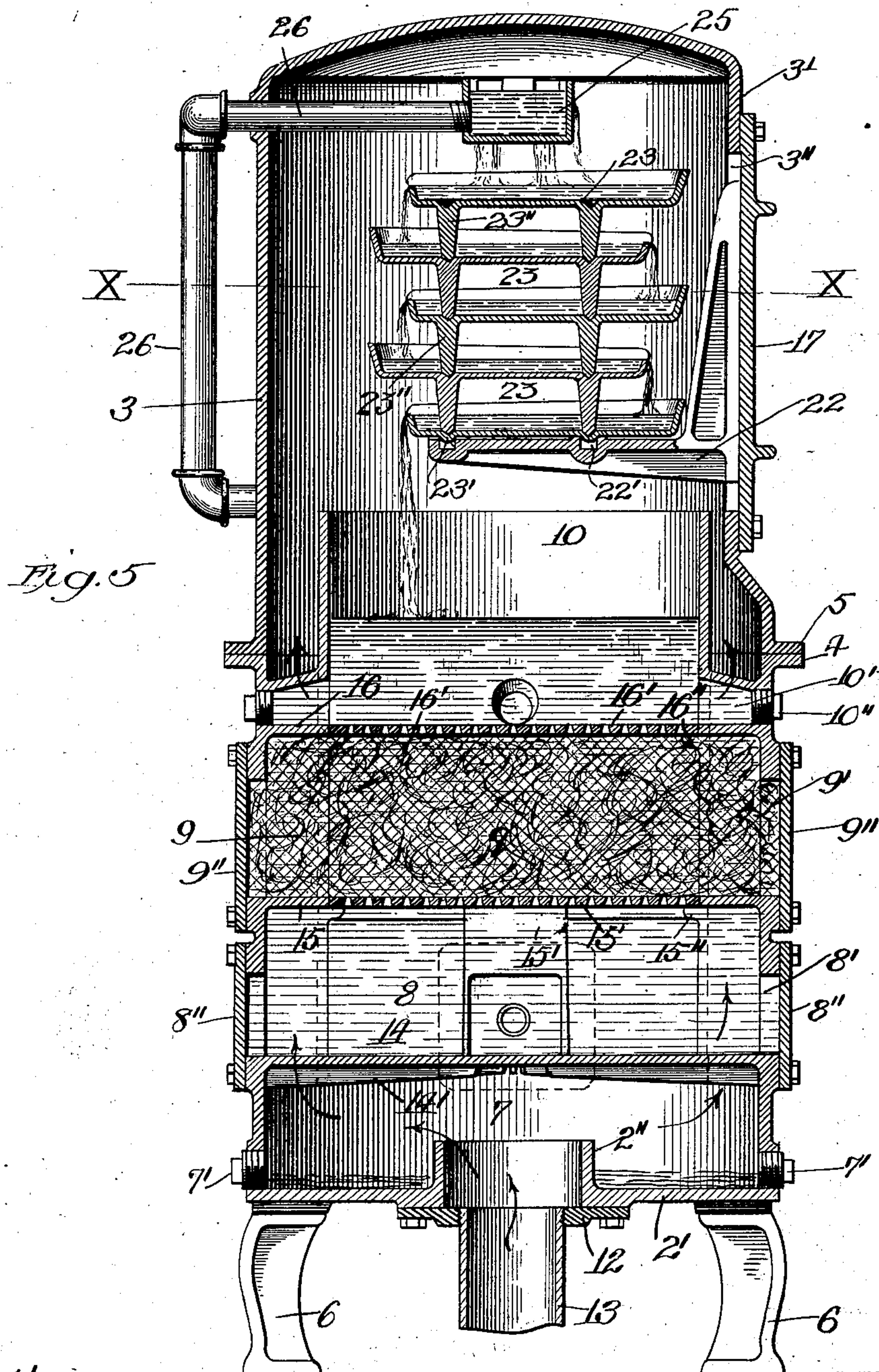
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NO MODEL.

4 SHEETS—SHEET 4.



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UNITED STATES PATENT OFFICE.

HENRY J. GEBHARDT, OF CHICAGO, ILLINOIS.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 744,525, dated November 17, 1903.

Application filed September 8, 1902. Serial No. 122,555. (No model.)

To all whom it may concern:

Be it known that I, HENRY J. GEBHARDT, a citizen of the United States, residing at Chicago, in Cook county, Illinois, have invented certain new and useful Improvements in Feed-Water Heaters, of which the following is a specification.

My invention relates to feed-water heaters, and has particular reference to improvements in open exhaust-heaters—that is, those in which the feed-water for the boiler is heated by exposure to the exhaust-steam from the steam-engine.

The object of my invention is to provide an open feed-water heater which shall be equally or more efficient than other heaters, which shall be compact in form and neat in appearance, which shall be made up of parts that are all readily accessible for purposes of cleaning or repair, and which shall have few moving parts and those so arranged and connected with the others as to render them durable and reliable.

A further object of my invention is to provide a feed-water heater that shall be of low cost as to manufacture, maintenance, and operation.

A particular object of the invention is to provide an open feed-water heater which shall have simple water and filter spaces and yet have large heating areas for the attainment of a higher efficiency than is common.

My invention consists generally in a feed-water heater comprising a shell or casing containing a steam-inlet chamber, a hot-well, a filter-space, and a supply well or reservoir, arranged one above the other, with large vertical steam-ducts leading from the inlet-chamber and substantially inclosing said wells and filter-spaces; and my invention further consists in the combination, with said casing, of a plurality of settling-pans arranged in the upper part thereof and attached to a movable section forming a part of said casing for removal therewith; and my invention further consists in a novel valve-regulating float device for regulating the flow of water to said casing in combination with a condensing-coil or like device taking steam from said casing and furnishing the float device with water that is free from impurities, whereby the incrustation of said device is

avoided; and, further, my invention consists in various details of construction and in combination of parts, all as hereinafter described, and particularly pointed out in the claims.

The invention will be more readily understood by reference to the accompanying drawings, forming a part of this specification, and in which—

Figure 1 is an elevation of a feed-water heater embodying my invention. Fig. 2 is another elevation thereof, showing the regulator-float casing in vertical section. Fig. 3 is a top view of the heater. Fig. 4 is a horizontal section substantially on the line *xx* of Figs. 1, 2, and 5. Fig. 5 is a vertical section of the heater substantially on the line *yy* of Figs. 3 and 4.

My heater is a tall cylinder in shape, the cylinder being the shell or casing of the device. This shell or casing is made in two parts 2 and 3, open at adjoining ends and connected by the flanges 4 5, bolted together. The lower part or section is a single casting erected upon the legs 6 and containing the following compartments—to wit, the steam-inlet and grease-separating chamber 7, the hot-water well 8, the filter-space 9, the water-supply well or reservoir 10, and the four vertical ducts 11, which together practically surround the compartments or spaces 8, 9, and 10. The bottom 2' is an integral part of the casting and is provided with the upwardly-extending hollow boss 2'', which makes the bottom of the chamber 7 a grease-pocket to contain the grease that is separated from the exhaust-steam. The grease is withdrawn from this pocket by removing one of the plugs 7'.

12 represents the coupling flange or plate bolted to the bottom 2' and wherein the upper end of the exhaust-steam pipe or inlet 13 is secured.

14, which is the floor of the hot-well 8, is an integral part of the casting and on its under side is provided with a large number of grease and oil separating wing or ribs 14', by means of which the greater portion of the oil and grease in the incoming steam is removed therefrom before the steam ascends from the chamber 7. Several openings 8' are provided in the shell 2, communicating with the hot-well 8, and these are closed by plates 8'',

which may be removed for the purpose of cleaning out the hot-well.

15 and 16 are the floors of the chambers 9 and 10, and these contain the gratings 15' and 16', respectively, which rest upon the ribs 15" and 16", formed upon the inner walls of the chambers. Large openings 9' are provided in the casing 2 opposite the filter-space and are closed by plates 9" for removal when it is desired to renew the filter material.

10' represents small holes leading into the bottom of the reservoir 10 and closed by plugs 10".

As best shown in Figs. 4 and 5, the spaces or chambers 8, 9, and 10 are arranged directly above one another and are of considerably less diameter than the shell or casing 2, to which, however, the common cylindrical wall of the three spaces is connected by the radial ducts terminating at the openings 8', 9', and 10' in the part 2. The walls of the vertical steam-ducts 11 are constituted by the casing 2, the cylindrical wall of the internal spaces, and the walls of said radial ducts, which latter separate the several vertical ducts 11. Said radial ducts, which contain water, are comparatively narrow, so that the internal cylinder of the device is practically exposed, throughout its bottom and side walls, to the heat of the exhaust-steam that is admitted to the chamber 7.

The upper portion or casting 3 of the casing is provided with a preferably flat side 3', having a large rectangular opening 3", outlined by the box extension on the side of the cylindrical part 3. The opening is closed by the large door 17, which is normally held in place by a number of bolts, as shown. The door, however, has a hinge-support for carrying it when the bolts are removed. This support is shown in Figs. 1, 3, and 4, same being a hinge that permits the door to be pulled away from the seat-flange around the opening 3" before the door is swung back on the hinge.

18 represents lugs provided in the part 3 for the pin 19, on which the rock-shaft 20 is journaled. The rock-shaft is provided with the crank-arms 20', to which the ends of the backwardly-extending arms 17' on the door are hinged or pivoted by pins 17". It is obvious that the rock-shaft 20 and the arms thereof permit the door considerable movement toward and from the part 3 when the bolts are removed. This also insures a tight joint around the door when the door is bolted. The inner side of the door is provided with two inverted brackets 22, the horizontal arms of which extend out over the top of the reservoir 10. These arms carry the mud trays or pans 23, arranged one above the other and adapted to swing out through the opening 3" when the door is opened. The brackets 22 are provided with the seats 22', and the bottom tray or pan 23 has lugs 23' to set in the seats 22'. As shown in Fig. 4, the brackets are for convenience in removal held in ver-

tical dovetail slots 17"', that are made in the inner side of the cast-iron door 17. All of the trays have seats or depressions in their bottoms, and all but the bottom tray have the long lugs or legs 23", each of which rests in the seat beneath it. The seats of one tray receive the pointed ends of the legs 23' of the tray above. The trays are of cast-iron, and their weight, with that of the water in them, holds them firmly in place. As shown in Figs. 4 and 5, the low and high sides of the trays are alternated, so that the trays deliver into one another in downward succession, the last tray delivering the water into the reservoir 10. These trays serve to collect the greater part of the heavy earth or mud from the incoming water and are cleaned frequently. The capacities of the trays need not be large, for the reason that they are so easily cleaned as to be sure of attention.

24 is the steam outlet or exhaust of the heater. This outlet or exhaust 24 preferably leaves the heater at a point opposite the top of the reservoir 10. The direct passage for the steam is from the inlet 13 through the ducts 11 to the outgoing pipe 24 at the base of the upper part 3 of the shell; but considerable steam rises into the top or dome of the shell to heat the pans 23 and the water flowing therein.

25 is the water-inlet head arranged in the top of the part 3 of the shell and supplied with water by the pipe 26, which enters the top of the shell. This pipe leads down to any convenient source of cold water and contains the regulating-valve 27 for gaging the supply of cold water according to the rapidity with which the water is drawn from the hot-well by the boiler feed-pump or injector. The arrangement of the regulating-valve in a vertical stand-pipe which leads into the top of the heater, with the valve a considerable distance below the top of the heater, constitutes an essential feature of my invention, such arrangement insuring a column of water above the valve and preventing the incrustation of the valve. I employ an ordinary float-regulator in connection with the valve 27, but adopt means to maintain the regulator in good working order at all times. The general fault in all heaters now on the market is that the water-supply regulator is unreliable and often fails to act, because of the accumulation of foreign substances, such as lime, in and upon the regulator, such substances being freed by the heating or boiling of the feed-water. I am able to overcome this fault by the very simple expedient of a condensing-coil, which delivers pure or distilled water to the float-casing of the regulator, which water being present in the regulator excludes the impure feed-water, although the float-casing is, as usual, connected with the well of the heater, so that the water-level therein may be the same as that in the heater.

Referring now to the drawings, 28 repre-

sents the valve-regulator casing of any suitable design and at the bottom connected with the hot-well 8 by the pipe 29, extending from one of the plates 8". As shown in Fig. 2, the water-levels are the same in the casing as in the reservoir 10. The casing 28 contains the float 30, the arm 31 of which is fixed on the shaft 32, bearing the short lever 33 on its outer end. This lever 33 is connected with the stem 34 of the valve 27 to operate the same by the movement of the float 30, which rises and falls with the water-level in the reservoir 10 according to the withdrawal of water from the hot-well through the boiler feed-pipe 35.

36 represents a condensing-coil, same being a preferably spiral pipe exposed to the air and having its upper and lower ends connected with the dome of the heater and with the float-casing 28, respectively. The steam that rises into the upper part of the shell passes into the coil 36 and is there condensed. The water of condensation flows downward and discharges into the float-casing 28, and in this manner it practically fills the casing 28 with distilled water, which displaces the impure water, which tends to rise through the pipe 29. Thus the incrustation of the inside of the casing 28, the float 30, the float-arm, and the shaft 32 with lime or the like is prevented, and the regulator may be depended upon to operate with accuracy and precision. When the door is swung back with the trays thereon, all of the other parts of the heater are readily accessible to the door-opening 3". The gratings 15' and 16' may be removed at any time through the reservoir and the door in the dome.

The process of heating water and at the same time extracting foreign substances therefrom as carried on in my heater is as follows: The exhaust-steam enters the bottom of the heater without pressure, but with considerable velocity, and the particles of oil and grease contained in the steam are projected against the ribbed top of the compartment 7 and there separated from the steam. The oil goes into the bottom of the compartment 7 to be removed when convenient. The steam escapes from the compartment 7 through the vertical ducts 11 and imparts its heat to the water contained in the hot-well, in the filter-space, and in the reservoir 10. The steam departs from the heater through the pipe 24, but a portion thereof rises by induction and heats the incoming water. In the meantime the water flows in a continuous stream into the top of the heater and traverses the zigzag course of the pans 23, which receive and hold most of the heavier earthy substances which are in suspension in the feed-water. As the water falls from the lower pan into the reservoir it takes on the higher temperature of the main flow of steam, and other impurities, which are more or less intimately combined with the water, are pre-

cipitated upon the grating 16' from the effect of the heat. As the water is drawn away from the hot-well 14 that in the reservoir 10 continuously sinks through the filter substance in the compartment 9 between the gratings 15' and 16' and when it finally reaches the hot-well it is thoroughly purified and has a temperature closely approaching that of the steam. After long use a considerable quantity of pulpy impurities accumulate on the surface of the grating 16'. To remove this accumulation it is only necessary to empty the reservoir through the holes 10', for which drain-pipes are usually provided. This may be done at any time during the operation of the heater. In practice I prefer to provide an extra set of mud-pans, so that when the door 17 is opened the old pans may be quickly replaced and the door closed without its being necessary to shut off the heater.

It is obvious that various modifications of my feed-water heater may be made without departing from the spirit of my invention, and I therefore do not confine my invention to the specific construction herein shown and described.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. A feed-water-heater casing containing in its lower part an open-topped reservoir provided with a filter-space, said reservoir being arranged centrally in the heater-casing and being therein substantially surrounded by steam-ducts, and said casing being provided with a steam-inlet below, and a steam-outlet above, said reservoir, substantially as described.

2. A feed-water heater comprising a casing having a steam-space in its upper part and provided with a water-reservoir in its lower part, surrounded by steam-ducts and surmounting a steam-chamber, substantially as described.

3. A feed-water heater comprising a casing provided with a steam-space in its upper part and having a central water-reservoir in its lower part, said reservoir being practically surrounded by heating ducts or spaces and containing an intermediate filter-space, and the parts of said reservoir being provided with clean-out openings, substantially as described.

4. A feed-water heater comprising a casing provided with a steam-space in its upper part and having a water-reservoir in its lower part in combination with a door for said upper part, and a plurality of mud-trays supported upon and removable with said door, substantially as described.

5. A feed-water heater having a steam-space in its upper part and a water-reservoir in its lower part in combination with a water-regulating valve, a float-casing connected with said reservoir, a float therein, and a steam-condenser taking steam from the upper

part of the heater and delivering water of condensation to said float-casing, substantially as described.

6. A feed-water heater having a steam-space in its upper part, in combination with a water-inlet head in said upper part, a cold-water pipe communicating with said head and having an extended vertical portion, a regulating-valve in the lower part of said vertical portion and hence maintained in a column of cold water, a float-casing connected with said heater, a float therein connected with said valve, and means for maintaining said float in pure water, substantially as and for the purpose specified.

7. The feed-water heater comprising a shell or casing containing a steam-inlet chamber, a hot-well, a filter-space and a reservoir, one above the other, with large vertical steam-ducts leading from the inlet-chamber and substantially inclosing said well, space and reservoir, a water-inlet at the top of said casing and a plurality of mud-trays to receive the water therefrom and deliver it to said reservoir, and the door in said casing carrying said trays and whereby the same are pivotally supported for easy removal, substantially as described.

8. The feed-water heater comprising the vertical casing, containing in its lower part filter and water spaces and a plurality of steam-ducts surrounding the same, in combination with a steam-exhaust midway of said casing, a feed-water inlet at the top of said casing, the feed-water pipe, the valve therein the valve-regulator and a condensing-coil connected with said casing and with said regulator, substantially as and for the purpose specified.

9. The feed-water-heater casing comprising the upper and lower cast-metal parts, said upper part having the hinged door and said lower part being provided with the integrally-formed walls of the compartments 7, 8, 9 and 10 and ducts 11, substantially as described.

10. In a feed-water heater the combination with the heater proper, of the water-supply pipe, the valve therein, the regulating-float and its casing, for said valve, a bottom water connection between said heater and float-casing, and the condenser arranged to take steam from said heater, and supply said float-casing with water of condensation, substantially as described.

11. A feed-water heater provided with a door in its side and suitably hinged, in combination with the inverted brackets detachably secured to said door and the stack of separable pans or trays supported on said brackets, substantially as described.

12. In a feed-water heater, the combination of the casing provided with a large opening in its side, with the door therefor, the inwardly-extending brackets on said door and the stack of pans arranged on said brackets and removable from said casing with said door, substantially as described.

13. In a feed-water heater, the casing provided with the internal cylinder having two perforated floors and a solid bottom and having a steam-chamber beneath said solid bottom and vertical ducts between said casing and said internal cylinder, in combination with steam inlet and outlet connections for said casing, a water-supply pipe, regulating means in connection therewith, means for supplying distilled water to said means and a connection for maintaining the water-level in said internal cylinder and regulating means, substantially as described.

14. In a feed-water heater, the casing in combination with steam-spaces in its bottom and top, interposed water and filter spaces, vertical steam-ducts substantially surrounding said water and filter spaces or compartments, said compartments having clean-out openings extending between said ducts, the steam-inlet and the steam-outlet for said casing and a water-inlet, substantially as described.

15. The feed-water heater comprising a shell or casing containing a steam-inlet chamber, a hot-well, a filter-space, a reservoir and a steam-space having a steam-outlet, one above the other in the order named, the large vertical steam-ducts leading from said steam-inlet chamber to said steam-space, said ducts together substantially inclosing said hot-well, filter-space and reservoir, substantially as described.

16. The feed-water heater comprising a shell or casing containing a steam-inlet chamber, hot-well, a filter-space, a reservoir and a steam-space having a steam-outlet, one above the other in the order named, with large vertical steam-ducts leading from the inlet-chamber to said steam-space and together substantially inclosing said hot-well, filter-space and reservoir, a water-inlet at the top of said steam-space and a plurality of mud-trays arranged in said steam-space above said reservoir, to receive the water and deliver it to said reservoir, substantially as described.

17. The feed-water heater comprising a shell or casing containing a steam-inlet chamber, a hot-well, a filter-space, a reservoir and a steam-space having a steam-outlet, one above the other in the order named, with large vertical steam-ducts leading from said inlet-chamber to said steam-space and together substantially inclosing said hot-well, steam-space and reservoir, a hinged door upon the upper part of said casing, a plurality of mud-trays carried by said door and normally within said steam-space above said reservoir and suitable means for supplying water to said trays, substantially as described.

18. The combination, of the feed-water heater proper, containing a water-reservoir, with the water-supply valve and connections, the valve-operating float, the float-casing wherein the water-level corresponds to the water-level in said reservoir, and a steam-condenser for continuously supplying water

of condensation to said float-casing, for the purpose specified.

19. The feed-water-heater shell or casing, the reservoir therein, having walls that are
5 integral with the walls of said casing and the lateral clean-out ducts provided in the integral connections between said casing and reservoir, substantially as described.

20. The feed-water-heater casing or shell
10 containing the water-reservoir and integral therewith, said casing having a steam-inlet chamber in its lower part beneath said reservoir and said casing containing vertical ducts which, together, substantially surround said
15 reservoir, substantially as described.

21. The feed-water-heater casing of cast metal, having for its upper part the hinged door and its lower part provided with the integrally-formed walls of the compartments 7,
20 8, 9 and 10, said casing being made in convenient sections, substantially as described.

22. The feed-water heater comprising the

casing containing a water-reservoir and steam inlet and outlet chambers, the door for the upper part of said casing, the compound hinge
25 for said door, means for securing the door on the casing, the mud-trays supported on said door and suitable water inlet and outlet connections, substantially as described.

23. The feed-water heater comprising the
30 casing, in combination, with the water-reservoir therein, a plurality of ducts arranged around said reservoir and having their outer walls formed by said casing, and suitable steam inlet and outlet connections with said
35 ducts, substantially as described.

In testimony whereof I have hereunto set my hand, in the presence of two subscribing witnesses, this 3d day of September, 1902.

HENRY J. GEBHARDT.

In presence of—

C. G. HAWLEY,

J. W. BECKSTROM.