D. W. CUNNINGHAM.

WATER HEATER.

APPLICATION FILED JULY 6, 1906.

927,494.

Patented July 13, 1909.

2 SHEETS—SHEET 1.

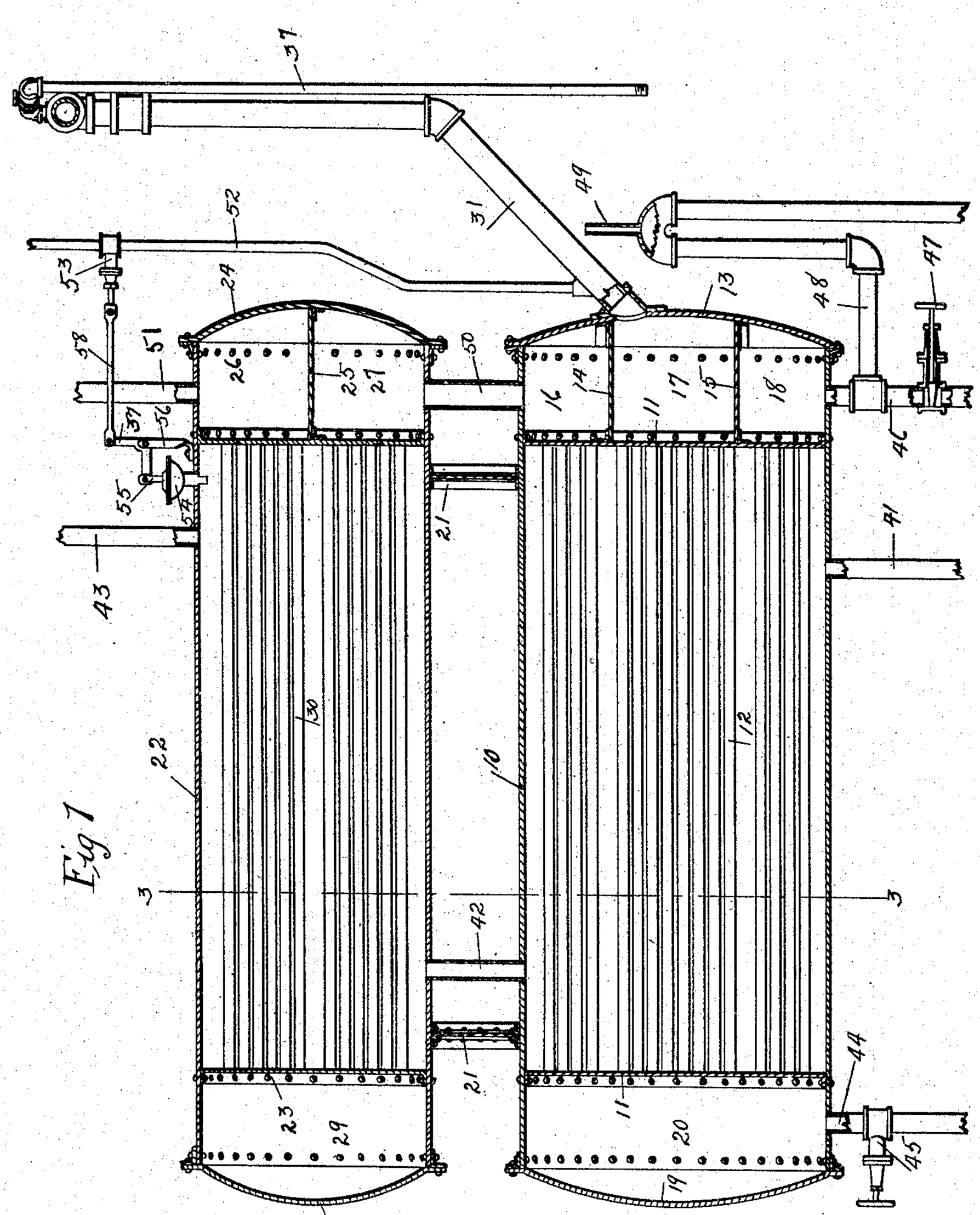

Fig 1

Witnesses:

K. K. Keffer.

S. F. Christy.

Inventor:

D. W. Cunningham.

by Orwig Lane & Atty's.

ANDREW. B. GRAHAM CO., PHOTO-LITHOGRAPHERS, WASHINGTON, D. C.

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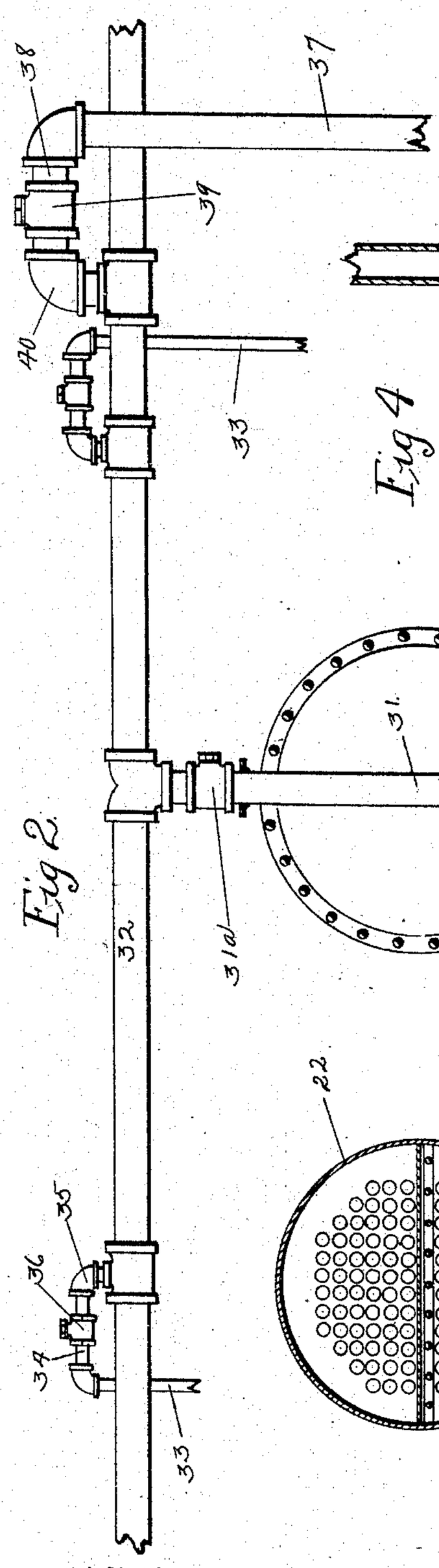


Fig 2.

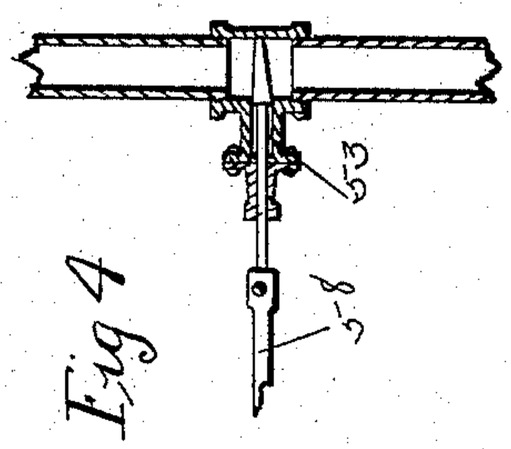


Fig 4

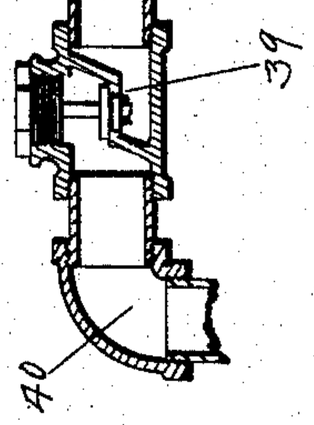
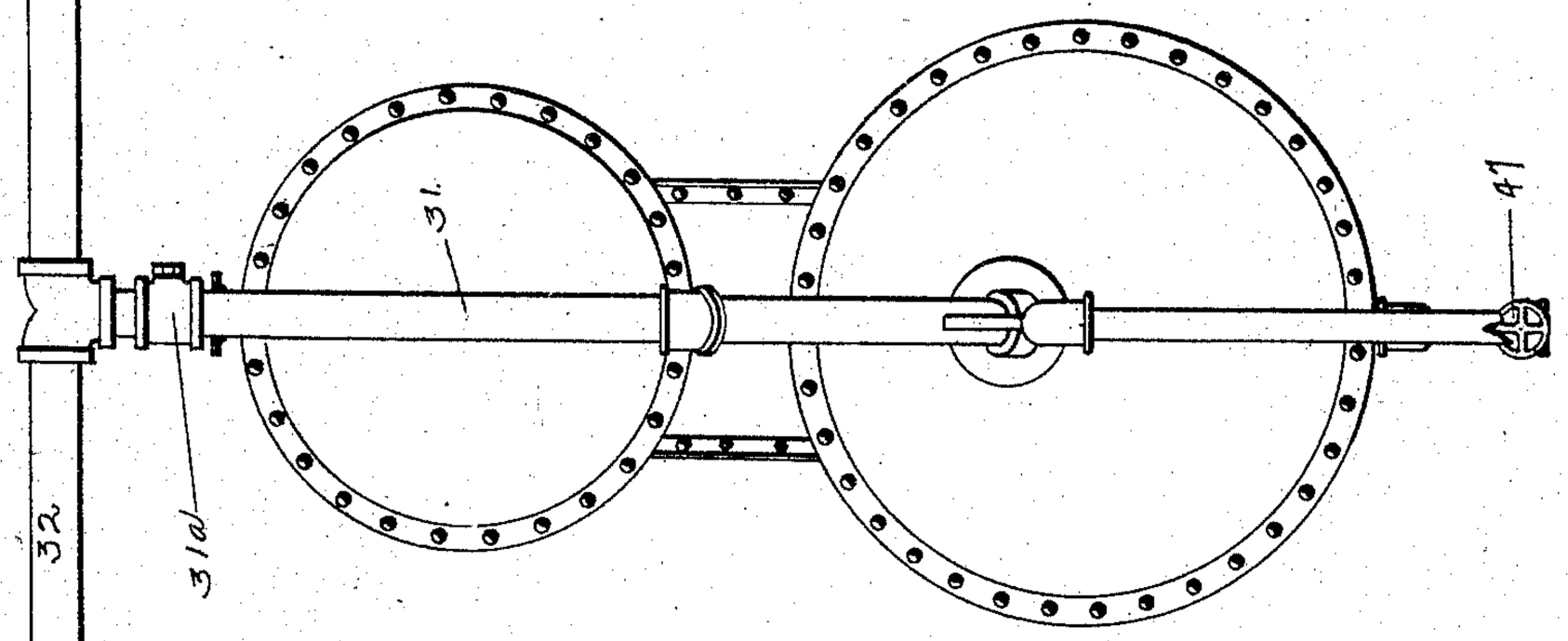


Fig 5



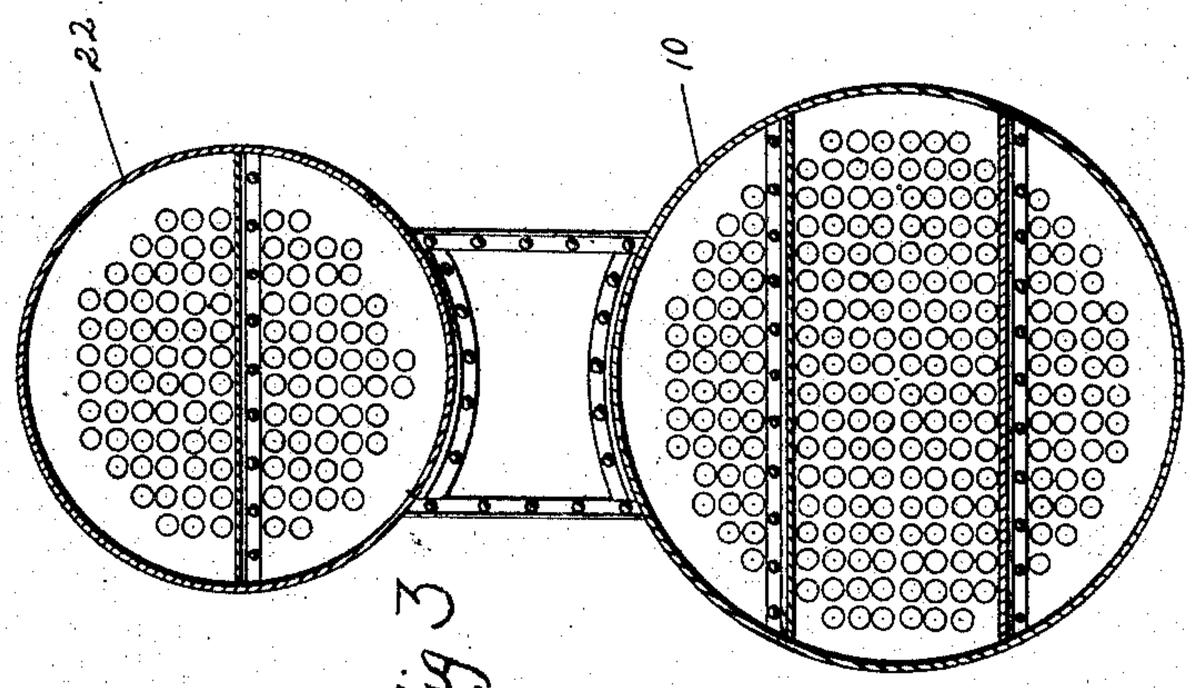


Fig 3

Witnesses.

K K Keffer.

S. F. Christy.

Inventor.

D. W. Cunningham.

by Owing Lane Atty's.

ANDREW. B. GRAHAM CO., PHOTO-LITHOGRAPHERS, WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

DAVID W. CUNNINGHAM, OF DES MOINES, IOWA.

WATER-HEATER.

No. 927,494. Specification of Letters Patent. Patented July 13, 1909.

Application filed July 6, 1906. Serial No. 325,394.

To all whom it may concern:

Be it known that I, DAVID W. CUNNINGHAM, a citizen of the United States, residing at Des Moines, in the county of Polk and State of Iowa, have invented a certain new and useful Water-Heater for Locomotive-Boilers, of which the following is a specification.

My object is to provide a water heater of simple, durable and inexpensive construction especially designed for use in connection with the cleaning of locomotive boilers and it is intended to receive the steam and hot water from a locomotive boiler which will heat the water in the apparatus and the water thus heated is to be used for cleaning out the boiler of the locomotive that supplied the steam and also for refilling the same locomotive boiler with clean water at such a temperature that its introduction into the locomotive boiler will not tend to cause undue contraction or expansion and so that the water thus supplied to the locomotive boiler may be quickly and easily brought to boiling point so that steam may be raised in the locomotive boiler without delay.

A further object is to provide a heater of this kind in which the steam and hot water from a number of boilers may be introduced simultaneously and the pressure of steam from one boiler will not cause a backward flow into another boiler in which the steam is at lower pressure.

A further object is to provide a heater that will utilize the steam and hot water from locomotive boilers in such manner as to impart a maximum of its heat to the water in the heater without becoming commingled therewith.

My invention consists in the construction, arrangement and combination of the various parts of the heater whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims, and illustrated in the accompanying drawings, in which—

Figure 1 shows a vertical, longitudinal, sectional view through a heater embodying my invention. Fig. 2 shows an end elevation of same. Fig. 3 shows a vertical, transverse, sectional view on the line 3—3 of Fig. 1. Fig. 4 shows an enlarged, detail, sectional view of the gate valve for controlling the admission of live steam to the heater, and Fig. 5 shows an enlarged, detail, sectional view of the check valve in the pipe for supplying steam and hot water from a locomotive boiler to the heater.

Referring to the accompanying drawings, I have used the reference numeral 10 to indicate the main cylinder of the heater which is provided, near its ends, with the cylinder heads 11. A series of tubes 12 is connected with these heads 11 and extended through them to communicate with the ends of the cylinder beyond the heads 11. An outer cylinder head 13 is formed at the front of the cylinder 10 and the space between the heads 11 and 13 is divided, by means of the horizontal partitions 14 and 15, into three chambers 16, 17 and 18, for purposes hereinafter made clear. A cylinder head 19 is placed at the rear of the cylinder 10 forming a compartment 20 between it and the head 11. On top of the cylinder 10 are two supporting braces 21 on which is mounted a superheating cylinder 22. This superheating cylinder has, near its ends, two cylinder heads 23 and at its forward end is a cylinder head 24. The space between the forward head 23 and the head 24 is divided by a central horizontal partition 25 into the upper compartment 26 and the lower compartment 27 and at the rear of the cylinder 22 is a cylinder head 28 forming a compartment 29 between it and the rear cylinder head 23. A series of tubes 30 is fixed to and extended through the cylinder heads 23 to communicate with the spaces between the heads 23 and the heads 24 and 28.

Communicating with the compartment 17 of the main heater cylinder is a heater supply pipe 31 for steam and hot water communicating with the horizontal pipe 32. Near the top of the pipe 31 is a check valve 31[a] arranged to permit passage of steam and water downwardly through the pipe 31 and to prevent passage of water or steam upwardly. Communicating with the horizontal pipe 32 is a number of pipes to be connected with the blow-off pipes of locomotive boilers. Each of these blow-off pipes comprises an upright pipe 33 extending to a point above the pipe 32 and communicating with a horizontal pipe 34 above the pipe 32, which horizontal pipe 34 has an elbow 35 which communicates with

the pipe 32. In the said horizontal pipe 34 is a check valve 36 similar to the check valve shown in detail in Fig. 5 and so arranged that steam and hot water may enter from the pipe 33 to the pipe 32 but may not return. I have also provided means for admitting exhaust steam from a stationary engine or other source of supply to the pipe 32 as follows: The numeral 37 indicates a vertical pipe of substantially the same diameter as the pipe 32 designed to communicate with the exhaust pipe of a stationary engine and extended to a point above the pipe 32. It is provided with a horizontally arranged portion 38 containing a check valve 39 and beyond the check valve is an elbow 40 communicating with the pipe 32.

The main cylinder and the superheating cylinder are provided with a number of pipes for steam and water as follows: At the bottom of the main cylinder between the heads 11 is a pipe 41 for admitting fresh water to the interior of the cylinder. A pipe 42 connects the top of the cylinder 10 with the bottom of the cylinder 22 to permit water to freely pass from one cylinder to the other around the heating tubes thereof. At the top of the superheating cylinder 22 is a discharge pipe 43 from which the heated water is withdrawn. Communicating with the compartment 20 of the main cylinder is a pipe 44 provided with a gate valve 45 designed to be used for cleaning out any sediment or deposit that may be gathered therein. A similar pipe communicates with the compartment 18 at the front of the main cylinder and is indicated by the numeral 46. It is provided with a gate valve 47. Communicating with the pipe 46, above the gate valve, is an overflow pipe 48 extended upwardly to a point slightly above the center of the main cylinder and then downwardly to a point of discharge, a vent tube 49 being provided in said pipe at its highest point to prevent siphonage of water from the main cylinder. The compartment 16 at the top of the front of the main cylinder communicates by means of a pipe 50 with the compartment 27 at the bottom of the front of the superheating cylinder and a steam discharge pipe 51 extends from the compartment 26 to a point of discharge.

The means for automatically supplying steam to the heater, from a source other than a locomotive boiler when the supply from a locomotive boiler is deficient is as follows: The numeral 52 indicates a steam supply pipe communicating with the pipe 31 and provided with a gate valve 53. Mounted on top of the superheating cylinder is a thermostatic valve 54 so arranged that its valve stem 55 will be drawn downwardly when the temperature of the interior of the superheating cylinder falls below a certain predetermined degree. Adjacent to the thermostatic valve 54 is a bracket 56 supporting a bell crank lever 57, which lever is connected by a link 58 with the stem of the gate valve 53.

In practical use and assuming that two locomotive boilers have their blow-off pipes connected to the pipes 33 and assuming further that one of these boilers contains steam at a hundred and fifty pounds pressure to the square inch and the other contains steam at fifty pounds pressure to the square inch and assuming further that the pipe 37 connects with the exhaust of a stationary engine and the pipe 52 connects with a stationary boiler, then the steam and hot water will flow through both of the pipes 33 into the horizontal main 32, downwardly through the pipe 31 to the compartment 17 of the main heater cylinder. The check valves 36 will prevent the steam from the locomotive boiler having a high pressure from flowing backwardly toward the locomotive boiler under low pressure and the check valve 39 will prevent the steam from flowing back into the steam pipe 37, and the check valve 31[a] will prevent the steam or water from flowing upwardly in the pipe 31 in the event that the pressure from below should exceed that from above. After the steam and hot water enters the chamber 17, the steam will rise to the top tubes communicating with said chambers and the water will fall to the lower tubes and both will pass to the opposite end of the cylinder. There the steam will rise and return through the tubes to the chamber 16 while the water will fall and return through the tubes into the chamber 18 from which it will gradually and slowly run through the drain 48 to a point of discharge. Its heat in the meanwhile will be utilized in heating the water surrounding the tubes. The steam that enters the chamber 16 will rise through the pipe 50 to the chamber 27 of the superheater and will then flow through the lower tubes thereof to the rear ends and will rise and return through the upper tubes to the chamber 26 and what remains of the steam at this point will discharge through the pipe 51. By this arrangement of the partitions in the front ends of the lower cylinder, steam and hot water will be quickly separated and both will be caused to flow back and forth in the tubes without commingling with each other and both will also give off practically all of their heat which will be utilized in heating the water surrounding the tubes. After one locomotive boiler has discharged its steam and water, the operator uses water from the pipe 43 for the purpose of washing out the locomotive boiler. This water will be at substantially the same temperature as the interior of the locomotive boiler and hence will not tend to cause undue expansion or con-

traction of the boiler. After the locomotive has been thoroughly cleaned, its boiler is filled with water from the pipe 43. This water, being approximately at boiling point, will permit the operator to quickly get up steam so that the boiler may be used again with a minimum of delay for cleaning purposes. As fast as the water is withdrawn from the pipe 43, it will enter through the pipe 41 so that both the main heating cylinder and the superheating cylinder are maintained full of water at all times. In the event that it should be desired to clean out the sediment or deposit that may gather in the chambers 18 and 20, the operator opens the gate valves 45 and 47. Assuming further that the supply of steam from the locomotive boilers should be insufficient at any time to maintain the proper degree of heat within the heater, then the thermostatic valve 54 operates to open the gate valve 53 and permit the introduction of steam from a boiler into the pipe 31 which will cause the water in the heater to be quickly heated to the desired temperature, whereupon the gate valve 53 will be automatically closed.

The chambers 16, 17 and 18 at one end of the heater body are for the purpose of providing a separating device to separate the steam and the water from a locomotive boiler and to give to each an independent circulation through the heater body. In order to get the best results, it is desirable that the steam be arranged to pass through the tubes of the heater body and then back again toward the separating chamber. It is also desirable that the hot water be permitted to flow from the separating chamber through the tubes in the boiler and then down and back again through the heater body toward the separating chamber. By this arrangement, the steam and hot water will each be given an independent circulation and they will not interfere with each other. Furthermore, by having the heater body so arranged as to contain water under pressure, a pipe may be extended from the heater body directly to the point where the hot water is to be used and no pump need be provided in said pipe as the cold water may be supplied to the heater under pressure and if any pumping is necessary, it may be done in connection with the cold water pipe leading to the heater body.

I claim as my invention.

1. In a device of the class described, a heater body portion having closed ends, partitions within the body spaced apart from the ends to form compartments, tubes within the body portion communicating with the compartments, a horizontal partition dividing the compartment at one end into upper and lower chambers, a heater supply pipe communicating with one of said chambers and a steam discharge pipe communicating with the other chamber.

2. In a device of the class described, the combination of a heater body portion having closed ends, transverse partitions within the body portions spaced apart from the ends to form compartments, two horizontal partitions in one compartment to form upper, middle and lower chambers therein, tubes within the body portion communicating with the compartments in the ends, a heater supply pipe introduced into the said middle chamber, a steam discharge pipe communicating with the said upper chamber and a water drain pipe communicating with the said lower chamber.

3. In a device of the class described, the combination of a heater body portion having closed ends, transverse partitions within the body portions spaced apart from the ends to form compartments, two horizontal partitions in one compartment to form upper, middle and lower chambers therein, tubes within the body portion communicating with the compartments in the ends, a heater supply pipe introduced into the said middle chamber, a steam discharge pipe communicating with the said upper chamber and a water overflow pipe communicating with the said lower chamber, said overflow pipe being extended upwardly to a point near the center of the middle chamber and then downwardly.

4. In a device of the class described, the combination of a heater body portion having closed ends, transverse partitions within the body portions spaced apart from the ends to form compartments, two horizontal partitions in one compartment to form upper, middle and lower chambers therein, tubes within the body portion communicating with the compartments in the ends, a heater supply pipe introduced into the said middle chamber, a steam discharge pipe communicating with the said upper chamber and a water overflow pipe communicating with the said lower chamber, said overflow pipe being extended upwardly to a point near the center of the middle chamber and then downwardly and having a vent opening at its upper portion.

5. In a device of the class described, the combination of a main cylinder having closed ends, transverse partitions within the cylinder spaced apart from the ends to form compartments, two horizontal partitions in one of said compartments forming upper, middle and lower chambers, tubes within the cylinder communicating with said compartments, a heater supply pipe communicating with said middle chamber, a steam discharge pipe communicating with said upper chamber, an overflow pipe communicating with the lower chamber, a valve therein, a branch above the

valve extending upwardly to a point near the center of the middle chamber and then downwardly and formed with a vent opening, a drain pipe in the compartment at the other end, and a valve therein.

6. In a device of the class described, a heater body portion having closed ends, partitions within the body spaced apart from the ends to form compartments, tubes within the body portion communicating with the compartments, a horizontal partition dividing the compartment at one end into upper and lower chambers, a heater supply pipe communicating with one of said chambers, a steam discharge pipe communicating with the other chamber, a superheater body portion above the main body portion and having closed ends, transverse partitions therein spaced apart from the ends to form compartments, tubes within the superheater body portion communicating with the compartments, a horizontal partition in the compartment at one end dividing it into upper and lower chambers, said steam discharge pipe of the main heater body portion communicating with said superheater chamber and a steam escape pipe communicating with said superheater chamber.

7. In a device of the class described, the combination of a heater body portion having closed ends, transverse partitions within the body portion spaced apart from the ends to form compartments, two horizontal partitions in one compartment to form upper, middle and lower chambers therein, tubes within the body portion communicating with the compartments in the ends, a heater supply pipe introduced into the said middle chamber, a steam discharge pipe communicating with the said upper chamber, a water overflow pipe communicating with the said lower chamber, a superheater body portion above the main body portion and having closed ends, transverse partitions therein spaced apart from the ends to form compartments, tubes within the body portion communicating with the compartments, a horizontal partition in the compartment at one end dividing it into upper and lower chambers, said steam discharge pipe of the main heater body portion communicating with said lower chamber and a steam escape pipe communicating with said upper compartment of the superheater.

8. In a device of the class described, the combination of a main cylinder having closed ends, transverse partitions therein spaced apart from the ends to form compartments, two horizontal partitions in one of said compartments dividing it into upper, middle and lower chambers, tubes extended through the body portion and communicating with the compartments, pipes leading from the bottoms of the compartments, valves therein, a heater supply pipe communicating with said middle chamber, a superheater cylinder supported on top of the main cylinder and having closed ends, transverse partitions therein spaced apart from the ends to form compartments, a horizontal partition in the compartment at one end dividing it into upper and lower chambers, a steam pipe communicating between the upper chamber of the main cylinder and the lower chamber of the superheater cylinder, a steam escape pipe leading from the upper chamber of the superheater cylinder, a water supply pipe communicating with the bottom of the main cylinder, a pipe communicating between the bodies of the cylinders, and a water discharge pipe communicating with the top of the superheater cylinder.

9. In a device of the class described, the combination of a heater body portion having a water inlet and a water outlet, a separating device, tubes communicating with the upper portion of the separating device and extended through the heater body and back toward the separating device to a point of discharge, tubes communicating with the lower portion of the separating device and extended through the body to a point of discharge, and means for introducing steam and water into the separating compartment.

10. In a device of the class described, the combination of a heater body portion, a water inlet and a water outlet pipe communicating with it, said heater body portion being inclosed to be capable of containing water under pressure, a separating device, tubes communicating with the upper portion of the separating device and extended through the heater body and back toward the separating device to a point of discharge, tubes communicating with the lower portion of the separating device and extended through the heater body to a point of discharge, and means for supplying steam and hot water to the separating device.

11. In a device of the class described, the combination of a heater body capable of being filled with water under pressure and having a water inlet and a water outlet, a separating device formed with an upper and a lower chamber, tubes communicating with the upper portion of the lower chamber and extended through the body portion and back to the upper chamber, said upper chamber being provided with a steam discharge pipe, tubes leading from the lower chamber through the body portion of the heater to a point of discharge, and means for introducing steam and hot water into said lower chamber.

12. In a device of the class described, the combination of a heater body designed to contain water under pressure and having a

water inlet and a water outlet, a separating device having upper, middle, and lower chambers therein, tubes communicating with the upper portion of the middle chamber and extended through the body portion and back to the upper chamber, a steam discharge pipe communicating with the upper chamber, tubes extended from the middle chamber through the heater body and back to the lower chamber, a water discharge pipe communicating with the lower chamber, and means for introducing steam and hot water into the middle chamber.

Des Moines, Iowa, June 15, 1906.

DAVID W. CUNNINGHAM.

Witnesses:

S. F. CHRISTY,

J. RALPH ORWIG.