No. 661,933. Patented Nov. 13, 1900.

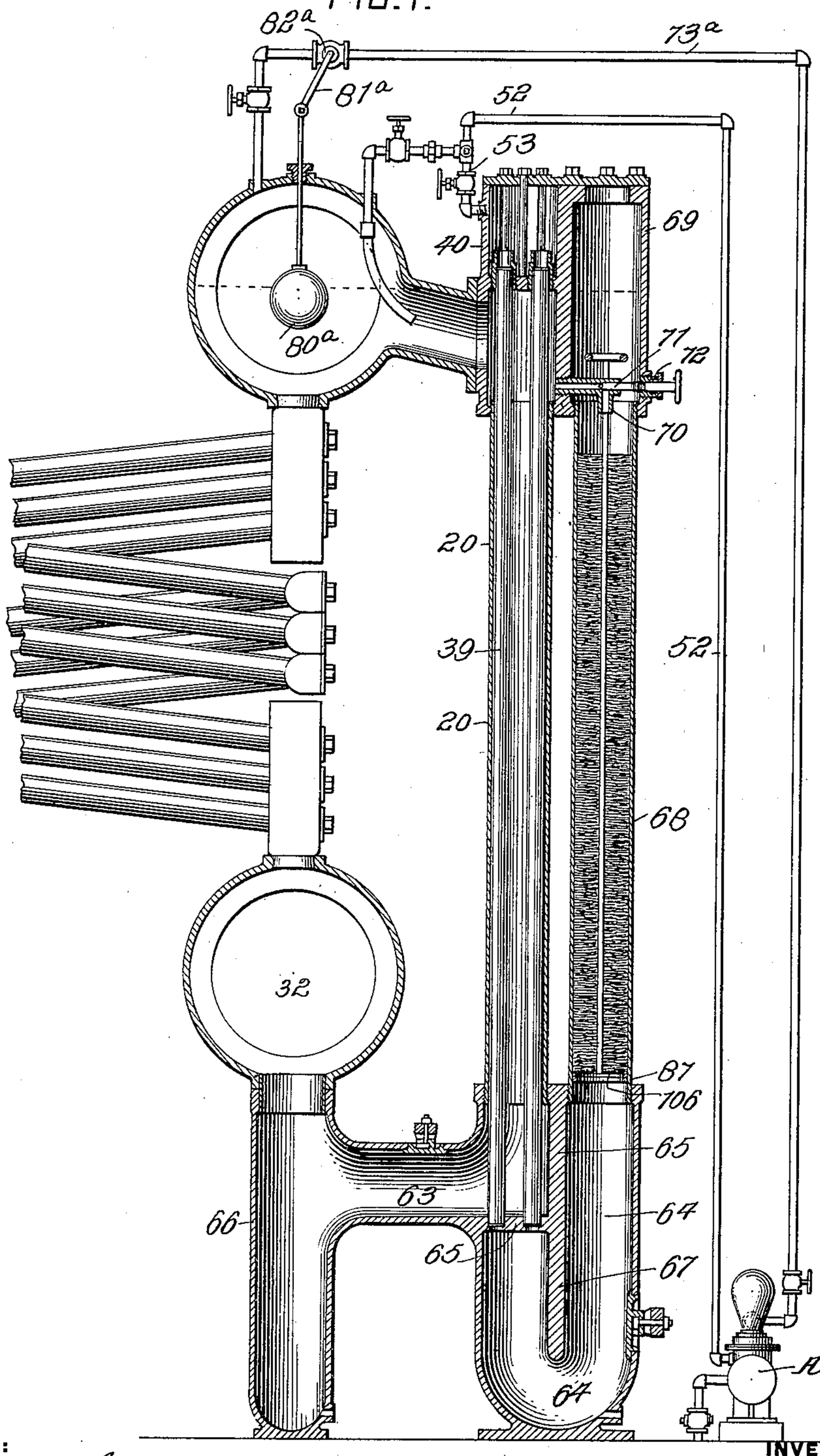
A. G. HOHENSTEIN.

WATER HEATER, PURIFIER, AND SEPARATOR.

(Application filed July 30, 1900.)

(No Model.) 3 Sheets—Sheet 1.

FIG. 1.



WITNESSES:
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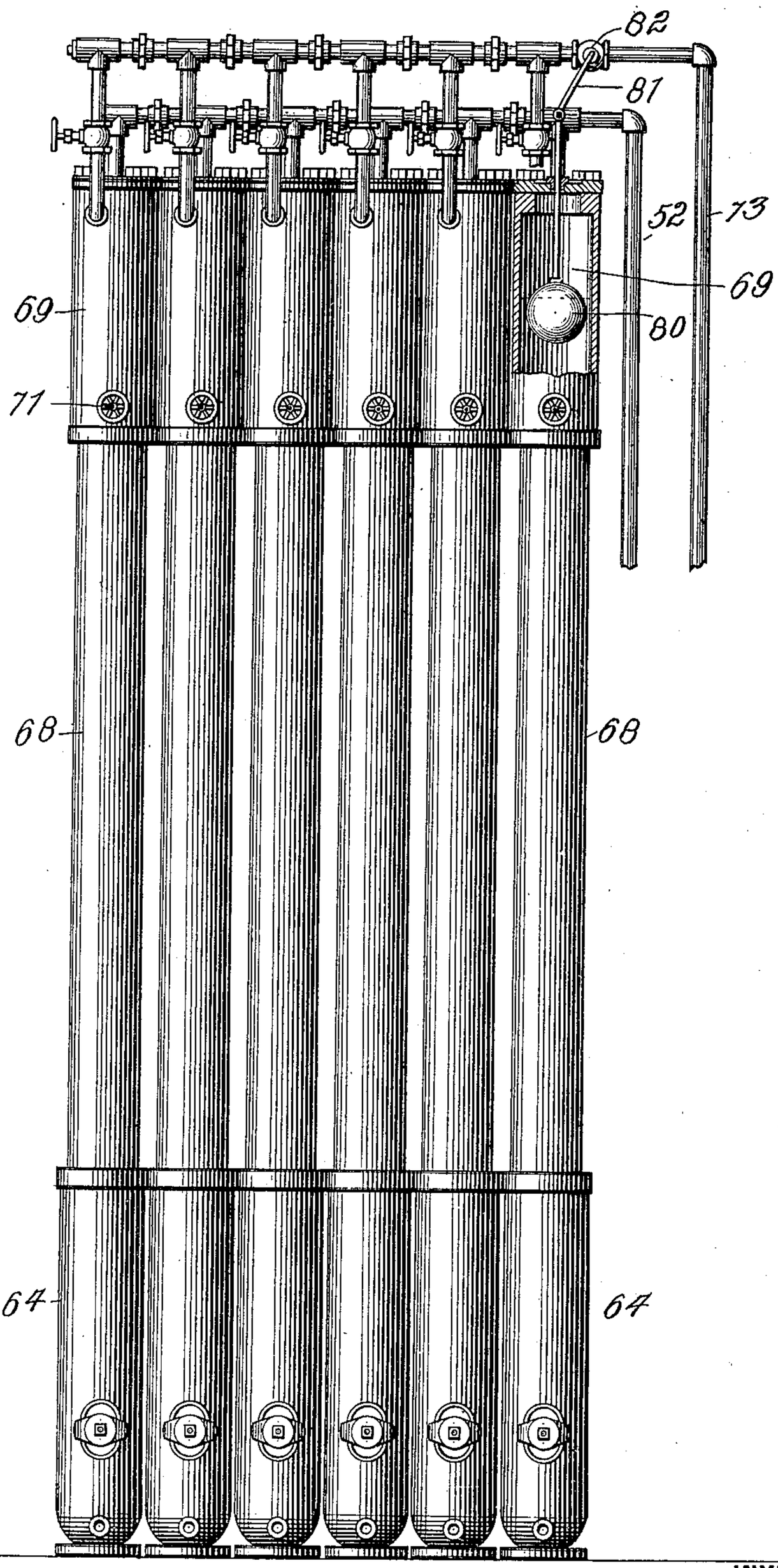
(No Model.) 3 Sheets—Sheet 2.

FIG. 2.



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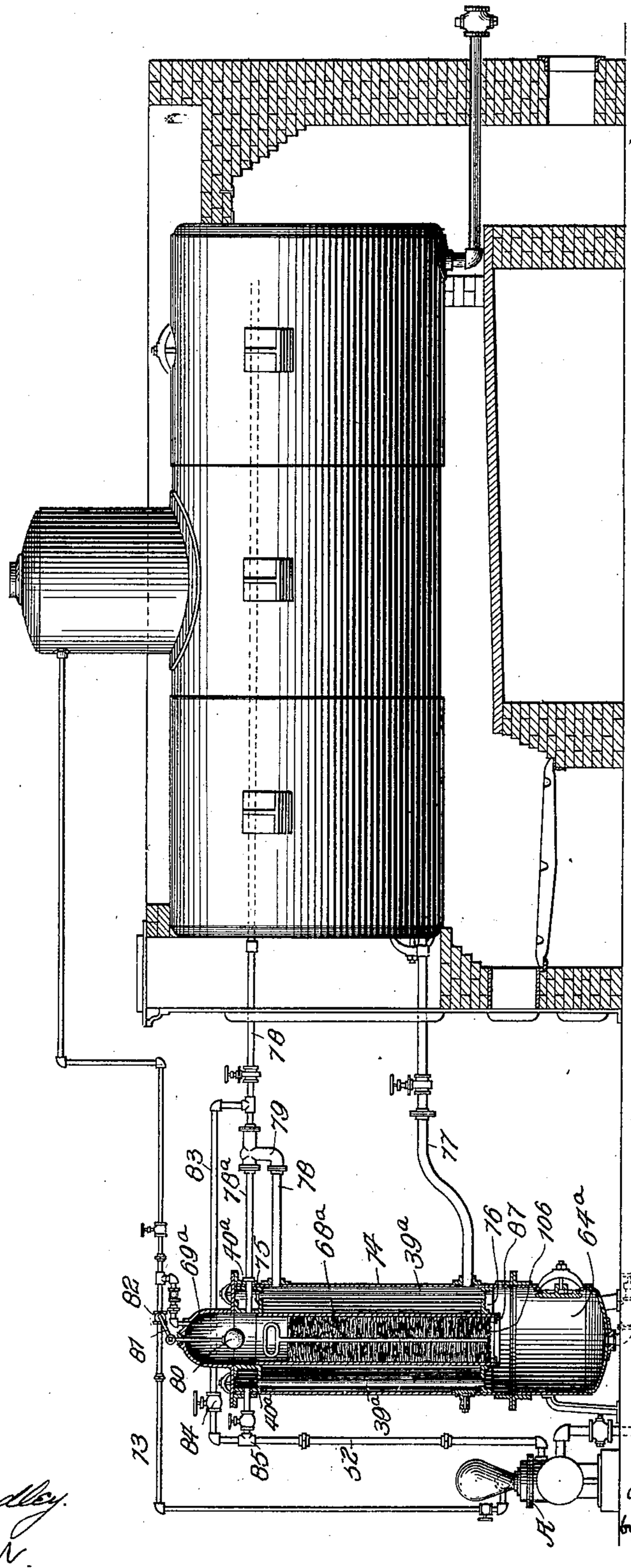
(No Model.) 3 Sheets—Sheet 3.

FIG. 3.



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UNITED STATES PATENT OFFICE.

ARCHIE G. HOHENSTEIN, OF NEW HAVEN, CONNECTICUT.

WATER HEATER, PURIFIER, AND SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 661,933, dated November 13, 1900.

Application filed July 30, 1900. Serial No. 25,265. (No model.)

To all whom it may concern:

Be it known that I, ARCHIE G. HOHENSTEIN, a citizen of the United States, residing at New Haven, in the county of New Haven and State of Connecticut, have invented or discovered certain new and useful Improvements in Water Heaters, Purifiers, and Separators, of which improvements the following is a specification.

It is a well-known fact that when certain gases, such as air and carbonic oxid are present in a boiler having clean surfaces such surfaces are attacked and rapidly pitted to a dangerous degree. In order to avoid this destructive action, it is customary when the boiler-surfaces are clean and the water used is free of any ingredients which would be precipitated and form a coating on the boiler-surfaces to add a small amount of lime or other suitable material, whereby a thin protective coating may be formed on the boiler-surfaces.

The invention described herein relates to certain improvements in feeding water to boilers, and has for its object not only the precipitation and separation of carbonates, &c., from the water prior to its entering the circulating system of the boiler, but also the separation of air and gases, such as carbonic oxid from the water prior to its direct entry into the boiler.

The invention is hereinafter more fully described and claimed.

In the accompanying drawings, forming a part of this specification, Figure 1 is a sectional elevation of a portion of a boiler having my improved heater and separator applied thereto. Fig 2 is a rear elevation of the same. Fig. 3 is a view, partly in section, showing my improvement applied to the ordinary form of tubular boiler.

For convenience of illustration and description I have shown my improvement applied to the form of boiler forming the subject-matter of application Serial No. 5,440, filed February 16, 1900, and also in connection with the form or construction of feed-water heater and purifier shown and described in application Serial No. 1,379, (1900,) filed March 31, 1900.

As described in said application Serial No. 1,379, (1900,) the feed-water is conducted by suitable tubes 39 down through the downtake-pipes 20, so as to be subjected to full boiler temperature to effect the precipitation of the carbonates and sulfates. The lower ends of the downtakes are formed by hollow castings, which are divided into two chambers or compartments 63 and 64 by the angular diaphragm 65. One of these compartments, as 63, forms a continuation of the downtake and is connected in any suitable manner to the boiler-drum 32. A desirable manner of forming the connection with the drum consists in the casting with a T-shaped extension 66, the vertical portion of which forms a support for the drum and is preferably made hollow, so as to receive any solid matter which may enter the circulation.

The feed-water tubes 39 extend through the horizontal portion of the diaphragm 65 and have their lower ends secured therein in any suitable manner known in the art. A trap is formed in the chamber 64 by the curtain 67, extending down and dividing the chamber into two compartments, said curtain being preferably in line with the vertical portions of the diaphragm 65. The rising portion of the trap or chamber 64 is connected by a tube or pipe 68 to a chamber 69, preferably formed integral with the shell 40, forming the upper portion of the downtake, as described in application Serial No. 11,379, (1900,) referred to. It is preferred that the shell 40 should extend a short distance above the normal level of water in the boiler, (indicated by the dotted line in Fig. 1,) so as to form an open space for the separation of the gases from the water at the upper end of the rising tube. This rising tube 68 is connected in any suitable manner with the downtake-tubes 20, but preferably by an angular pipe 70, provided with a regulating-valve 71, the stem of which extends out through a stuffing-box 72. The vertical portion of the pipe 70 extends below the normal level of water in the boiler, as shown.

The tubes 39, the chamber 64, and the rising tube or tubes 68 are preferably made of a capacity greater than that necessary to feed the boiler, so that the rate of flow of the feed-water through these parts will be slow and afford ample opportunity for the heating of the water to the required temperature for

effecting precipitation and settling of the solid matter in the chamber 64 and the sepation of the gases from the water at the upper ends of the rising tube or tubes.

The feed-water is introduced into the chambers in the shell 40 by branches 53 from the feed-pipe 52, which is connected to the pump A or other suitable means for feeding water.

In Fig. 3 I have shown my improvement as applied to a different form of boiler, either of the horizontal tubular type or of the flue-boiler type. The heater for these types of boiler consists of an external shell 74, provided with annular tube sheets or heads 75 and 76, in which are secured in any suitable manner the vertical tubes 39ª. Through these tube-sheets passes the rising tube 68ª, which communicates at its lower end with a settling chamber or reservoir 64ª and with a drum or steam-space 69ª at its upper end. The lower portion of the space between the tube sheets or heads is connected by a pipe 77 with the boiler, and a return connection from the heater to the boiler is formed by a pipe 78 and an injector 79, interposed at a suitable point in the pipe between the heater and the boiler or steam-generator. Feed-water is forced by a pump A or by suitable means through pipe 52 into a chamber 40ª at the upper ends of the tubes 39ª. In operating this device the water enters into the chamber 40ª, passes down through the tubes 39ª into the settling-chamber 64ª at the lower end of the heater, and then flows up through the rising tube or separating-chamber 68ª, and thence by the pipe 78ª and injector 79 into the boiler. During this circuit the feed-water is brought up to the same temperature as the water in the boiler or to a sufficiently high temperature to effect a separation of the carbonates, sulfates, &c., by the water drawn from the boiler through the pipe 77 into the shell 74, where it circulates around tubes 39ª and returns to the boiler through the pipe 78 and injector 79, commingling with the feed-water in the injector. The movement of the water from the boiler through the heater and back to the boiler is effected by the feed-water operating through the injector 79. Hence in case a small amount of water is being freed by the pump into the boiler the injector will draw a less amount of heated water from the boiler; but if the pump is working rapidly the feed-water yet in the injector will have a higher speed, and therefore draw a proportionately greater amount of water from the boiler to heat the feed-water.

Ordinarily sufficient steam or gases will be obtained from the separating chamber or chambers of the heater and separator to operate the pump A, to which the separating-chamber is connected by a pipe 73. In order to maintain the water in the boiler and heater at as constant a level as possible, a float 80 is arranged in the rising tube of the heater, as shown in Figs. 2 and 3. The stem of this float passes out through a stuffing-box and is connected to an arm 81, attached to the stem of a controlling-valve 82 in the steam-supply pipe 73.

In order that the water may be kept at a constant level in the boiler when the heaters are cut out, a float 80ª may be arranged in the steam-drum of the boiler and connected to the stem of a valve 82ª in the steam-supply pipe 73ª.

In the operation of the boiler and the heater the water should be maintained in both at a level somewhat above the point of connection of the pipe 78ª with the heater, so that a solid column of water will be constantly supplied to the pipe 78ª for replenishing the boiler. As the feed-water passes up through the rising tube the solids separated by the heat are precipitated and settled down into the collecting-chamber, which it will be observed is entirely outside of the circulating system of the boiler. During this upward movement of the feed-water through the rising tube any gases or air contained in the feed-water will free themselves from the water and collect with any steam generated in the heater in the space above the water-level in the rising tube and can be utilized in operating the feed-pump A or for any other purpose.

As shown in Fig. 3, the feed-water pipes with suitable valves are so arranged that the feed-water may be caused to pass through the heater or directly to the boiler itself. To this end a by-pass pipe 83, provided with a valve 84, is connected to the pipe 52, as shown, and a valve 85 is arranged in the pipe 52, as shown, to cut out the heater.

If desired, a filtering material, preferably excelsior or other material which will not be injured by the hot water or steam, may be placed in the rising tube or tubes 68 for the purpose of preventing the passage of any solid matter to the boiler. This material is supported in position by a disk 106, formed of wire-netting or perforated metal, which is held in position by any suitable means—as, for example, by lugs 87, projecting inwardly from the wall of the tube 68.

While describing my improvement in connection with a specific form of feed-water heater, said improvements can be readily adapted by the skilled mechanic to other forms or types of feed-water heaters. Hence as regards the broad terms of the claims the invention is not limited to any particular type or form of water-heater.

I claim herein as my invention—

1. The combination of a boiler, a chamber connected to the boiler so as to permit boiler-water to circulate therethrough, one or more tubes for the passage of feed-water arranged in said chamber so as to be subjected to full boiler temperature, a chamber for the collection of precipitates at the discharge end of the tube or tubes and a rising tube or gas-

separating chamber connected to the collecting-chamber and to the boiler at a point below the normal water-level, substantially as set forth.

2. A feed-water heater having in combination one or more tubes for the passage of feed-water, a chamber for the collection of precipitates at the discharge end of the tube or tubes and a rising tube or gas-separating chamber connected to the collecting-chamber and the boiler at points below the normal water-level in the heater, substantially as set forth.

3. A feed-water heater having in combination a chamber at its upper end adapted to receive the feed-water, a heating-chamber below the receiving-chamber having connections to the boiler for the circulation of water or steam therethrough, a chamber for the collection of precipitates arranged below the heating-chamber, tubes connecting the receiving and collecting chambers and passing through the heating-chamber and a rising tube or gas-separating chamber connected to the collecting-chamber and to the boiler at points below the normal water-level in the heater, substantially as set forth.

4. In a boiler, the combination of downtakes, feed-water tubes passing through the downtakes, a settling-chamber connected to said tubes, and rising tubes connected to the settling-chamber and to the boiler, substantially as set forth.

5. The combination of a boiler, feed-water tubes passing through a portion of the boiler, a settling-chamber connected to said tubes and rising tubes connected to the settling-chamber and the boiler, substantially as set forth.

6. The combination of a boiler, feed-water tubes passing through a portion of the boiler, settling-chambers connected to said tubes and rising tubes extending from the settling-chamber to a point above the normal water-level in the boiler and having a connection with the boiler below the normal water-level, substantially as set forth.

7. The combination of a boiler, feed-water tubes subjected to the heat of the water of the boiler, a settling or collecting chamber connected to said tubes, a rising tube or gas-separating chamber connected to said tubes and to the boiler and a filtering material arranged in the rising tube, substantially as set forth.

In testimony whereof I have hereunto set my hand.

ARCHIE G. HOHENSTEIN.

Witnesses:

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F. E. GAITHER.