No. 661,932. Patented Nov. 13, 1900.

A. G. HOHENSTEIN.

FEED WATER HEATER.

(Application filed Apr. 3, 1900.)

(No Model.) 4 Sheets—Sheet 1.

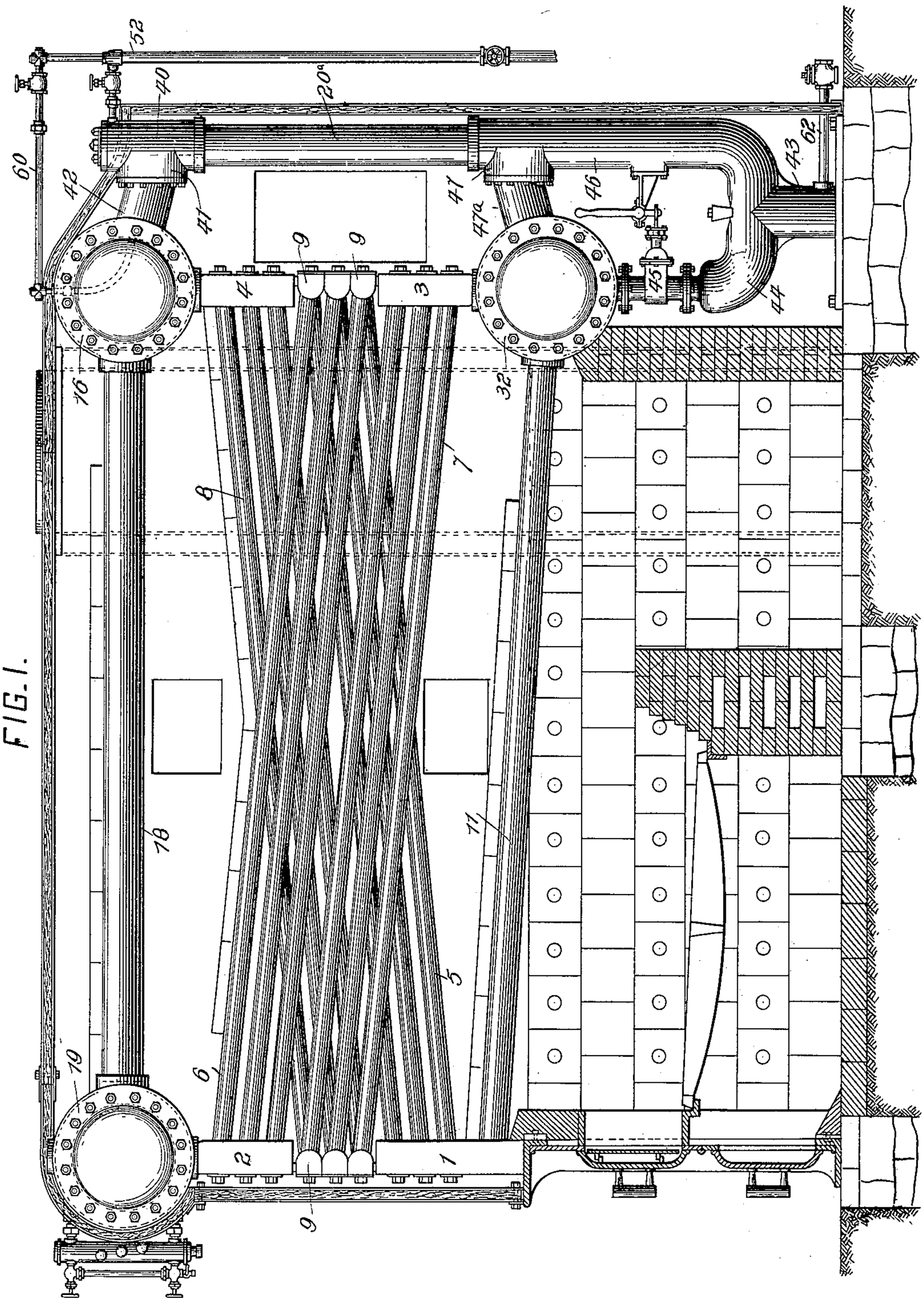

FIG. 1.

WITNESSES:
Herbert Bradley.
F. E. Gaither

INVENTOR
Archie G. Hohenstein
by Dennis B. Wolcott Att'y.

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4 Sheets—Sheet 2.

FIG. 2.

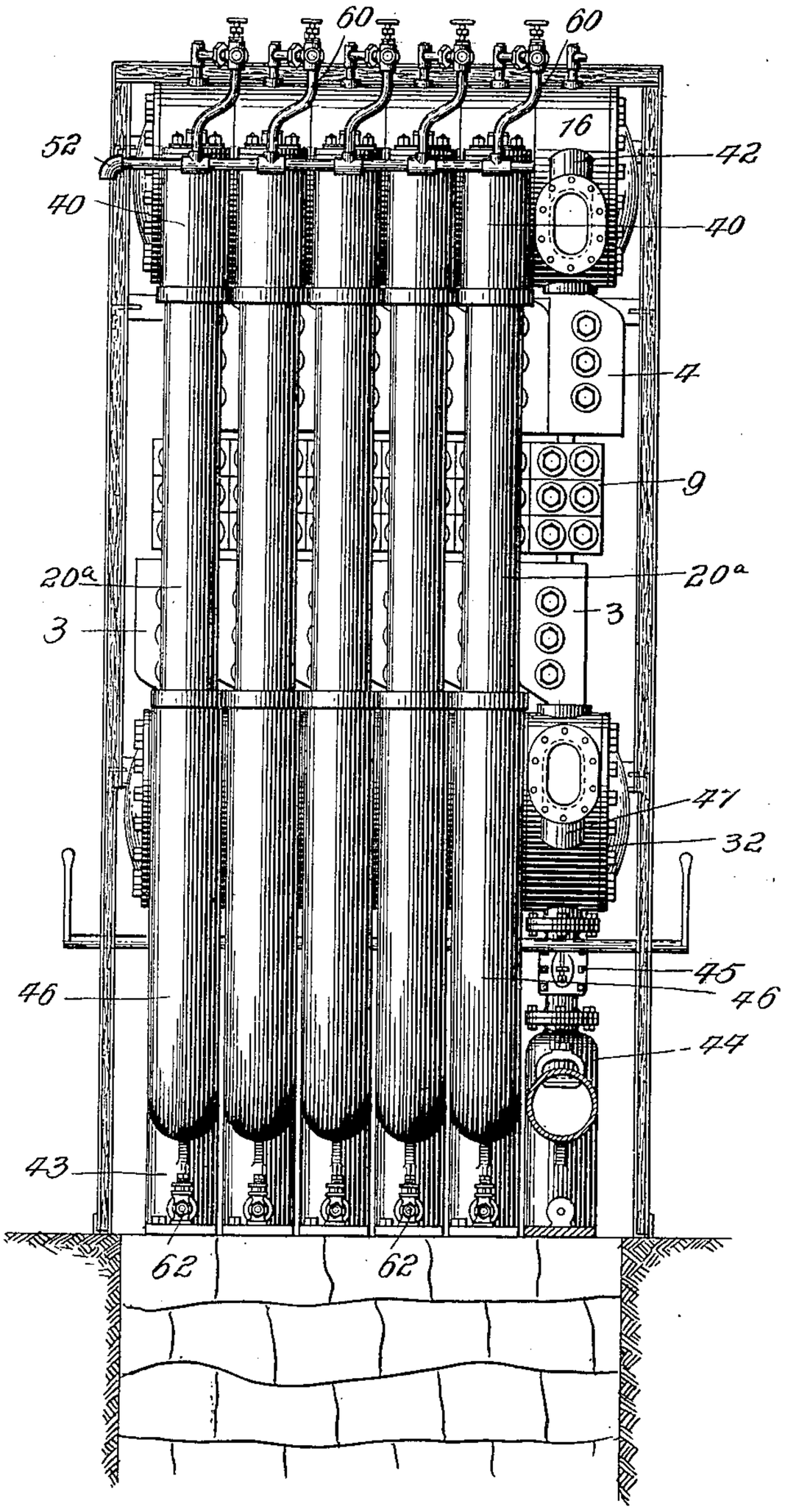

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FIG. 3.

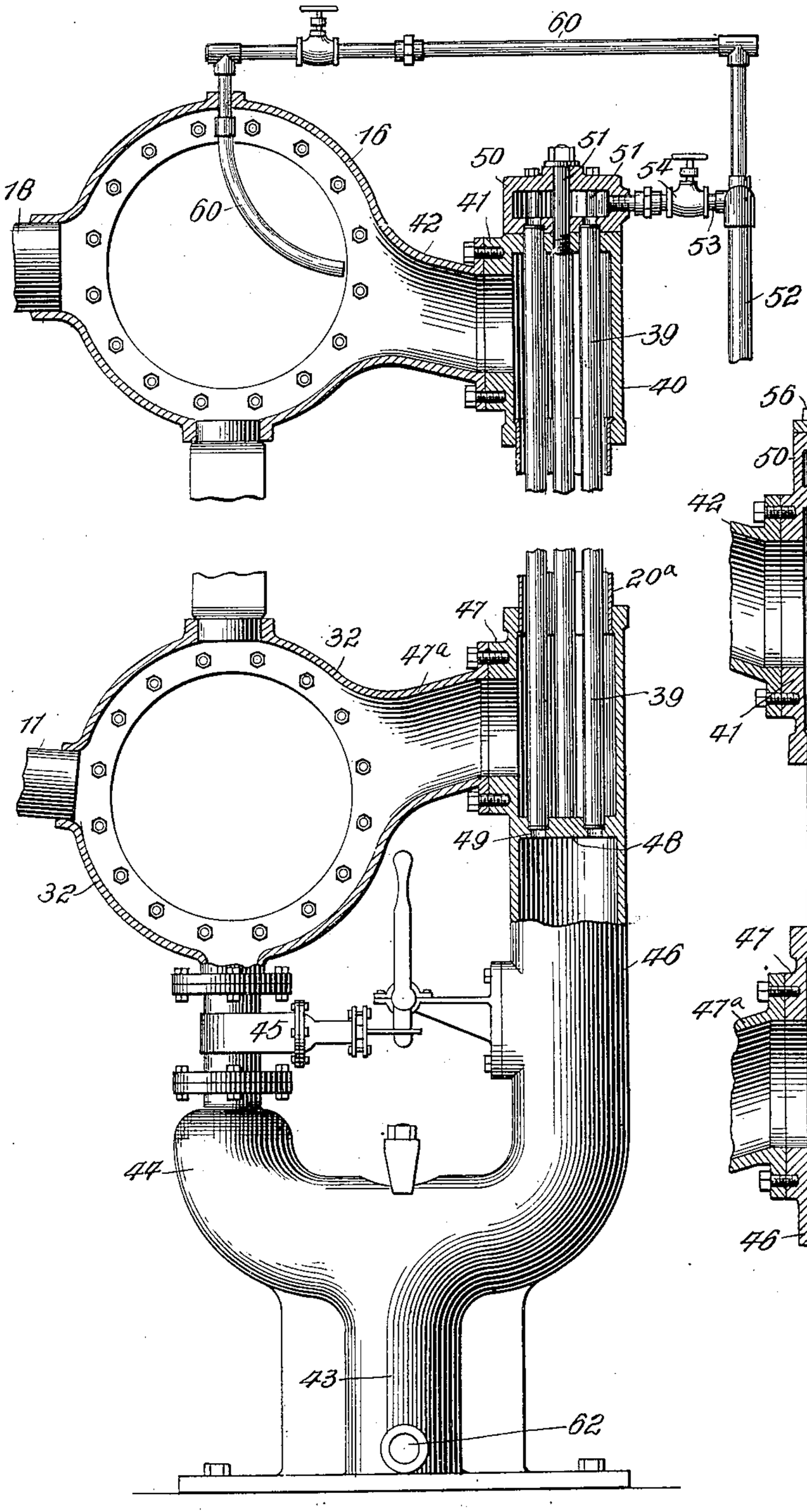
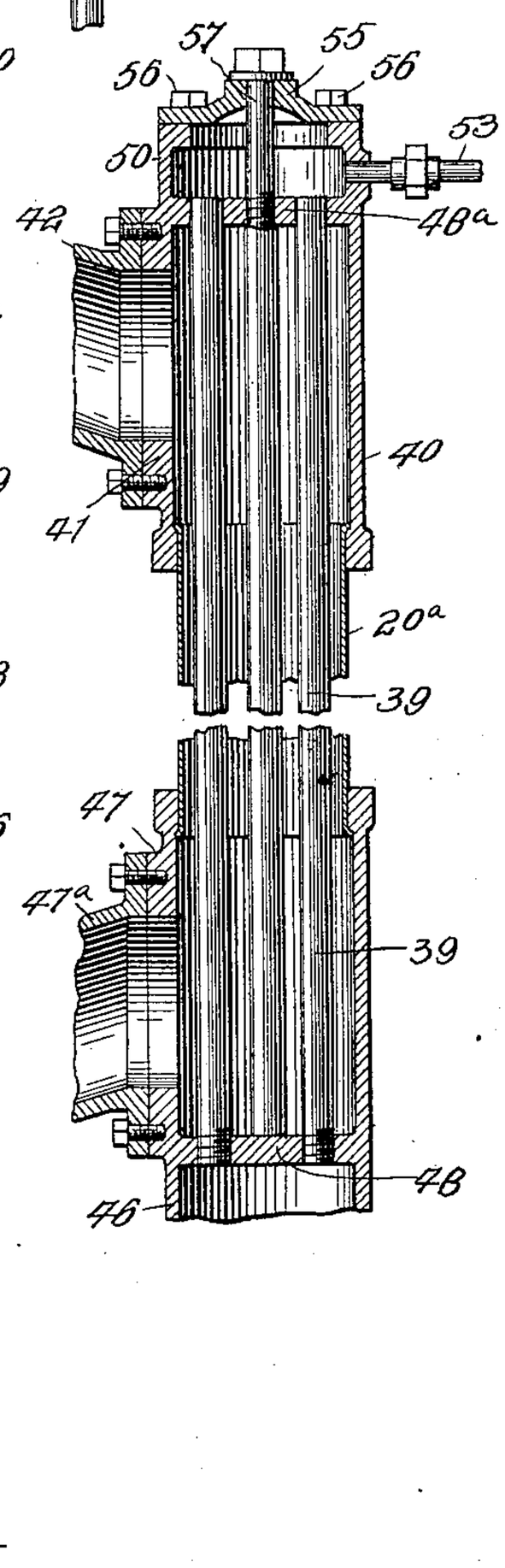


FIG. 4.



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4 Sheets—Sheet 4.

FIG. 6.

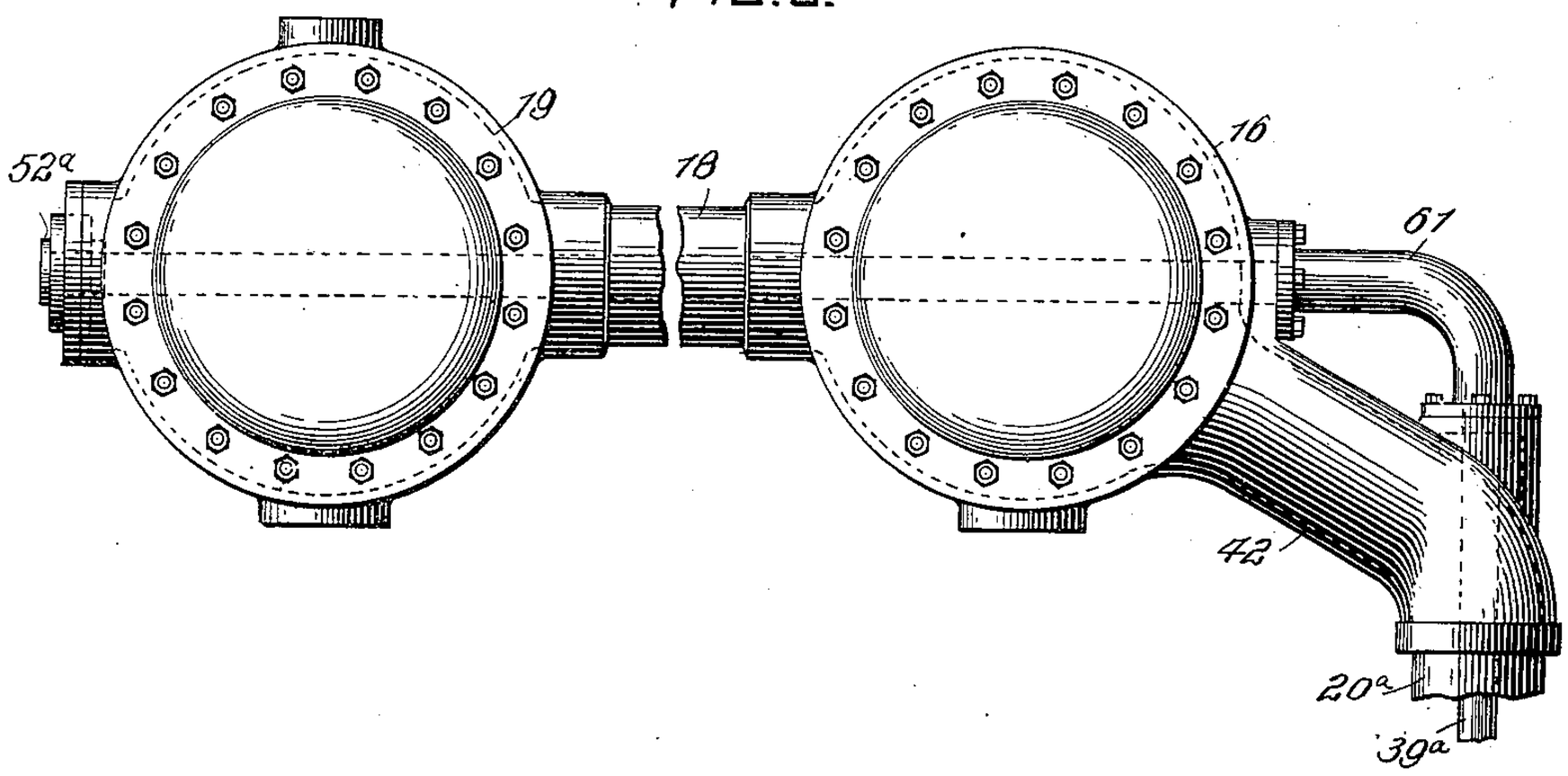
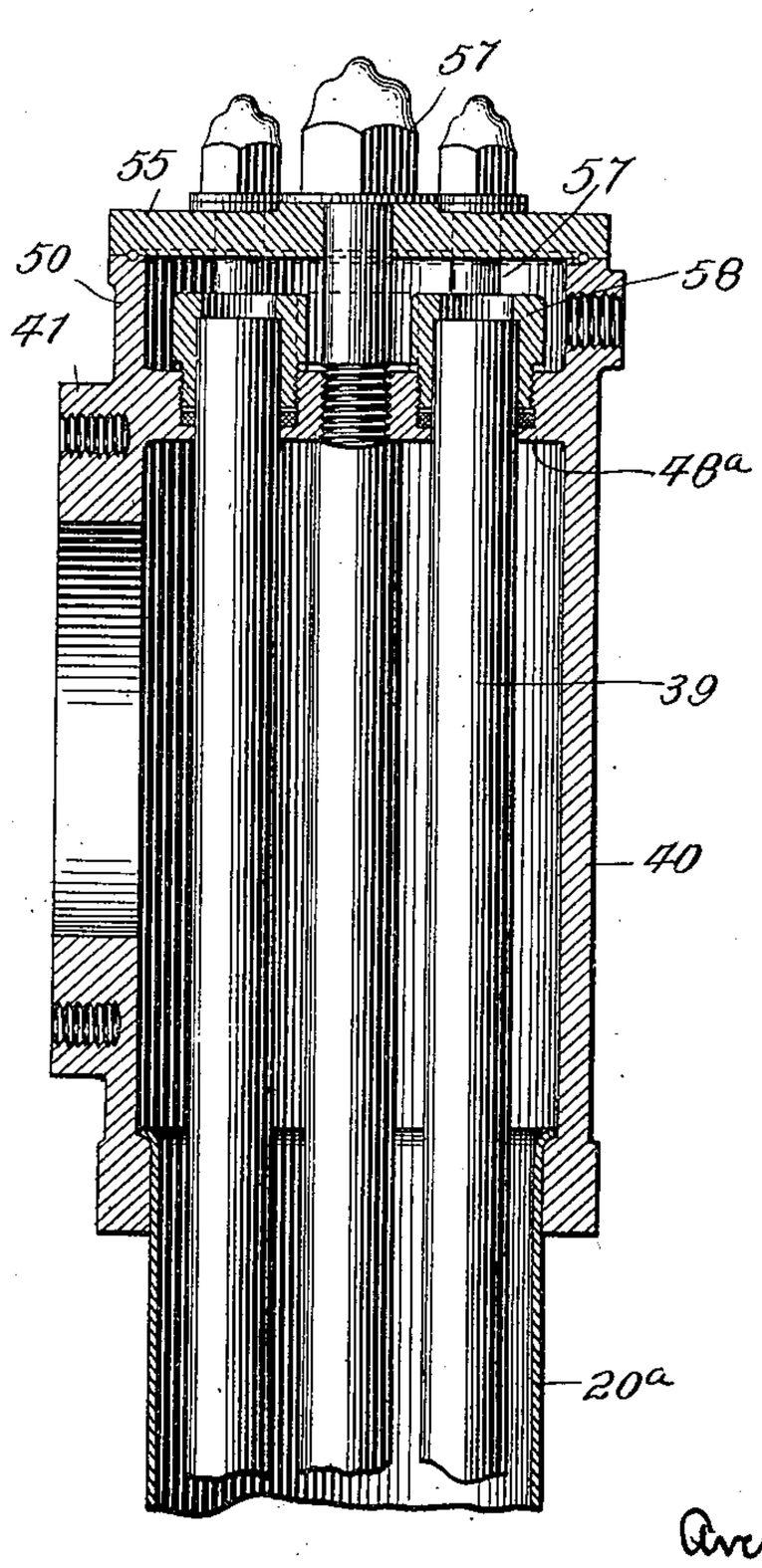


FIG 5



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Herbert Bradley
F. E. Gaither

INVENTOR
Archie G. Hohenstein
by Dainis S. Wolcott Att'y.

UNITED STATES PATENT OFFICE.

ARCHIE G. HOHENSTEIN, OF NEW HAVEN, CONNECTICUT.

FEED-WATER HEATER.

SPECIFICATION forming part of Letters Patent No. 661,932, dated November 13, 1900.

Application filed April 3, 1900. Serial No. 11,379. (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 Feed-Water Heaters, of which improvements the following is a specification.

The invention described herein relates to certain improvements in means for purifying feed-water for boilers before the water passes into the circulation of the boiler.

To effect the separation of the solids—such as carbonates or sulfates of lime, magnesia, &c.—it is necessary to heat the feed-water to the temperature of the water in the boiler. Various means have been devised for this purpose, such as heating the feed-water prior to its being fed to the boiler by exhaust-steam; but as the heat obtained from the exhaust-steam is not sufficient at all times to effect a complete separation of the solids resort has been had to live steam taken direct from the boiler to reinforce the exhaust-steam or to operate alone in purifying the water. While the solids can be effectively separated from the water by the use of live steam drawn from the boiler, such method involves the loss of considerable power.

The object of the present invention is to provide for the introduction of the feed-water into the circulating system, but insulated during a portion of its traverse from the water in the boiler, and after being heated to the temperature of the water in the boiler to cause the feed-water to pass through a separating-chamber which is connected to, but out of the direct path of, the circulation, thereby affording opportunity for a complete separation of the solids from the feed-water.

The invention is hereinafter more fully described and claimed.

In the accompanying drawings, forming a part of this specification, Figure 1 is a view, partly in section and partly in elevation, of a water-tube boiler having my improvements applied thereto. Fig. 2 is a rear elevation of the boiler, one of the downtakes being removed. Fig. 3 is a view, partly in section and partly in elevation, of the rear portion of the boiler on an enlarged scale. Fig. 4 is a sectional view of one of the downtakes, illustrating a modification in the manner of securing the feed-water tubes in position. Fig. 5 is a sectional view of the upper portion of one of the downtakes, illustrating another modification in the manner of securing the upper ends of the downtakes; and Fig. 6 illustrates an alternative manner of introducing the feed-water into the boiler.

Although my improvements are shown and will be hereinafter described in connection with the form or construction of boiler forming the subjects-matter of applications for Letters Patent Serial Nos. 5,439 and 5,440, (1900,) filed by me February 26, 1900, it will be understood that the improvements can be applied to other forms or constructions of boilers by slight changes in construction and arrangement, which will readily suggest themselves to those skilled in the art.

In the practice of my invention as illustrated in the accompanying drawings the feed-water is introduced into a suitable chamber at the upper end of the downtake-pipes and passes thence by tubes 39 into what is termed a "reservoir" or "settling-chamber," which should be located in part, at least, below the lowest point of the circulating system of the boiler—as, for example, below the drum 32, which is connected with the lower ends of the downtake pipes or tubes. The inlet-chamber for the feed-water and the settling-chamber are connected by suitable tubes passing through the downtake-pipes through which the boiler circulation passes, said tubes passing through suitable diaphragms or tube-sheets, so that the feed-water does not enter into the circulation of the boiler until after it has passed through the settling or separating chamber into the drum 32, with which such chamber is connected, as clearly shown in Figs. 1 and 3. If desired, the feed-water may be given a further traverse through the circulating system by a tube through the upper steam separating-drums 19 and 16 and the connecting-tube 18 prior to its passage through the downtake-pipes to the settling-chamber, as shown in Fig. 6. As the pipes or tubes through which the feed-water passes are comparatively small and are arranged so as to be continuously in contact with water circulating through the downtakes, the water flowing

therethrough will be readily raised to the temperature of the water contained in the boiler before it passes into and through the settling-chamber, in which the solids precipitated by heat will collect and can be removed through suitable blow-off pipes.

A desirable construction is shown in Figs. 1 and 3, in which the downtake-pipes have their upper ends formed by a shell 40, provided with a nozzle or flange seat 41, to which is bolted the neck or nozzle 42, extending from the drum 16. This shell is preferably connected by a tube 20ª to the upper end of the hollow casting forming the settling-chamber. This casting is preferably made in the form of a Y, the tail 43 thereof resting on a suitable foundation. One arm 44 of the Y-shaped stand serves as a support for the drum 32, to which it is connected, such connection being preferably provided with a valve 45. The arm 46 of the stand forms the lower portion of the downtake and is provided with a flange-seat 47, to which is secured the nozzle 47ª, extending from the drum 32. The stem or tail 43 forms the receptacle for the solid matters. Below the flange-seat 47 a diaphragm or tube-sheet 48 is formed across the arm 46, and through said diaphragm or tube-sheet are formed openings for the passage of the feed-water. The tubes 39 for the feed-water have their lower ends seated in sockets formed in the diaphragm 48, a tight joint being formed either by means of packing-rings 49, interposed between the lower ends of the tubes and the bottom of the sockets, as shown in Fig. 3, or by screwing the lower ends of the tubes 39 into the diaphragm 48, as shown in Fig. 4. The upper ends of the tubes 39 pass through suitable holes in the top of the boxes or shells 40, as shown in Fig. 3. On the upper ends of these boxes or shells are secured hollow heads 50, having openings formed through their under sides, said openings having sockets formed around them for the reception of the upper ends of the tubes 39. These heads 50 are drawn down against the end of the box or shell 40 by suitable bolts 51, which also serve as transverse braces for the head. By suitably proportioning the lengths of the tubes 39 the seats in the heads 50 will be caused to bear against the ends of the tubes, and as suitable packing is interposed between the said seats and tube ends the drawing of the head to position by the bolts 51 will form a tight joint at the lower and upper ends of the feed-water tubes 39. As shown in Figs. 1, 2, and 3, the feed-water pipe 52 is connected by branches 53, provided with valves 54, to each of the heads 50 on the downtake-pipes.

As shown in Fig. 4, the heads 50 may be formed integral with the boxes or shells 40, in which case the head is provided with removable caps or plates 55. These caps or plates are secured to the heads 50 by bolts 56 and are centrally braced by means of a bolt 57, if necessary. When using the construction shown in Fig. 4, it is preferred that the lower ends of the tubes 39 should be threaded into the diaphragm or tube-sheet 48 and that the upper ends of the tubes 39 should be expanded into the openings through the diaphragm 48ª, separating the boxes or shells 40 from the heads 50.

As shown in Fig. 5, the upper ends of the tubes 39 pass through the diaphragm 48ª into the heads 50, and the upper portions of the holes or openings through which the tubes pass are enlarged and internally threaded for the reception of the stuffing-box nuts 58. These nuts are provided at their upper ends with inwardly-projecting rims adapted to bear upon the ends of the tubes 39 when screwed into the threaded sockets. In order to form tight joints between the tubes and the diaphragms 48ª, suitable packing, as asbestos, is placed around the tubes within these threaded sockets, so that when the nuts 58 are screwed down the packing will be compressed and form a tight joint around the tubes.

In order to facilitate the cleaning of the tubes 39 and the settling-reservoir, valves 45 are placed in the connections between such reservoir and the lower rear drum, as shown in Fig. 3. By closing one of these valves and removing in the one case the head 50 and in the other forms the caps or plates 55 access can be had to the tubes 39 in the downtake connected to the settling-chamber isolated by the closure of the valve 59 without interfering with the operation of the boiler, as the closure of the valve 45 will remove any pressure from the feed-water in the settling-chamber and tubes 39. It is characteristic of my improved constructions as shown in Figs. 3, 4, and 5 that any of the tubes can be easily removed and others inserted by simply removing heads 50 or the cap-plates 55 without disturbing any other part of the boiler.

In order to maintain the supply of feed-water to the boiler when the feed-tubes 39 are out of service for any purpose, provision is made by the valved by-pass 60, extending from the feed-pipe 52 to the upper rear drum 16 to maintain a feed-water supply. The discharge portion of such by-pass is arranged in line with the nozzles 42, so that the feed-water when thus introduced will first pass through the downtakes in the lower rear drum 32, in which a settling of the solid matter will occur.

If desired, a feed-water tube 52ª may be arranged to pass through the front upper drum, the tube 18, and the rear upper drum and be connected by an elbow 61 to a tube 39ª, as shown in Fig. 6, said tube extending down through the downtake to the lower rear drum. By the removal of the elbow 61, which is attached to flange-seats on the drum 16 and the downtake 20, access may be had to the tubes 52ª and 39ª without disturbing other connections of the boiler.

It is characteristic of my improvement that

the feed-water is heated by the water circulating through the boiler preliminary to the discharge of the feed-water into the settling-tank which is connected to one member—*e. g.*, the rear lower drum of the circulating system—and that during the settling operation the feed-water is entirely outside of the circulating system in the boiler and is therefore undisturbed, permitting of the free setting of solid matter.

The sediment may be removed from the portions 43 of the settling-chambers by blow-off pipes 62, or the portions 43 of these chambers may be connected in series, so as to be blown off simultaneously. As described and shown in the applications referred to, the rear lower drum is connected directly to the lower rear headers 3 and by a series of tubes 11 to the lower front headers. These lower headers are connected, respectively, to upper headers 2 and 4 by banks of tubes 7 and 8 and 5 and 6, extending across the combustion-chamber. The banks of tubes 5 and 7 are connected to the tubes in banks 6 and 8 by boxes 9. The upper headers are connected to the steam separating-drums, which in turn are connected together by a series of tubes 18. The drums 16, 19, and 32 may be formed of a series of sections, as described in application Serial No. 5,440, forming what is termed in said application a "unit-boiler," or the drums may be made continuous, as shown and described in the other application referred to.

The leading characteristics of my improvements consist, generally stated, in the provision of means whereby the feed-water is conducted through at least a portion of the circulating system of the boiler to a point outside of and preferably below the general range or path of the boiler circulation, where a settling of the solids precipitated by the heat can be effected.

It is characteristic of my improvements that the feed-water pipes while within the circulating system of the boiler are protected from direct contact with the flame, thereby avoiding any baking of the precipitated solids on any of the surfaces.

I claim herein as my invention—

1. A boiler provided with downtakes and having a heat-generated circulation in combination with a settling chamber or receptacle connected to the boiler, and feed-water tubes passing through the downtakes and connected to said chamber or receptacle whereby the feed-water is caused to pass through without commingling with the water in the boiler, substantially as set forth.

2. In a boiler having a heat-generated circulation, the combination of upper and lower rear drums, downtakes connected to said drums, a settling chamber or receptacle connected to the lower drum, and feed-water tubes passing through the downtakes and connected to said chamber or receptacle, whereby the feed-water passes through the water circulating in the boiler, but without commingling therewith, substantially as set forth.

3. In a boiler, the combination of downtakes connected at or near their upper and lower ends to other portions of the boiler, diaphragms arranged in the downtakes above and below the points of connection of the downtakes with the other portions of the boiler, feed-water tubes arranged within the downtakes and projecting through the diaphragms and a chamber or receptacle connected to the boiler and the feed-water tubes, substantially as set forth.

4. In a boiler, the combination of upper and lower rear drums, downtakes connected to said drums, a chamber or receptacle connected to the lower drum, feed-water tubes passing through the downtakes and connected to said chamber or receptacle whereby the feed-water is heated by water circulating in the downtakes, prior to the admission of the feed-water into the boiler circulation and a by-pass connecting the feed-water pipe to the upper drum, substantially as set forth.

5. In a boiler, the combination of a downtake adapted to be connected at or near its ends with other portions of a boiler and provided with tube-sheets or diaphragms above and below its points of connections with the boiler, tubes extending through the downtakes and having their ends connected to the chambers formed outside of the diaphragms, substantially as set forth.

6. A boiler provided with a downtake having chambers above and below its point of connection with other portions of the boiler, in combination with tubes arranged within the downtake and having their ends connected to said chambers whereby the feed-water is heated by water circulating in the downtake prior to its admission into the boiler circulation, and a removable cap on the upper chamber, substantially as set forth.

7. In a boiler, the combination of a drum forming a portion of the circulating system of the boiler, a hollow stand connected to said drum and serving as a support for said drum, a downtake-pipe connected to the drum and to another portion of the circulating system of the boiler and a feed-water tube extending through the downtake and connected to the stand, substantially as set forth.

8. In a boiler, the combination of upper and lower drums, a hollow Y-shaped stand having its arms connected to the lower drum, a diaphragm or tube arranged in one of the arms below its point of connection with the drum, a downtake-tube connecting the upper drum with said arm and a feed-water tube arranged in the downtake and extending through the diaphragm, substantially as set forth.

In testimony whereof I have hereunto set my hand.

ARCHIE G. HOHENSTEIN.

Witnesses:

DARWIN S. WOLCOTT,

F. E. GAITHER.