No. 641,534. Patented Jan. 16, 1900.

J. H. McDONALD.

WATER STERILIZING AND CONDENSING APPARATUS.

(Application filed Feb. 8, 1897.)

(No Model.) 3 Sheets—Sheet 1.

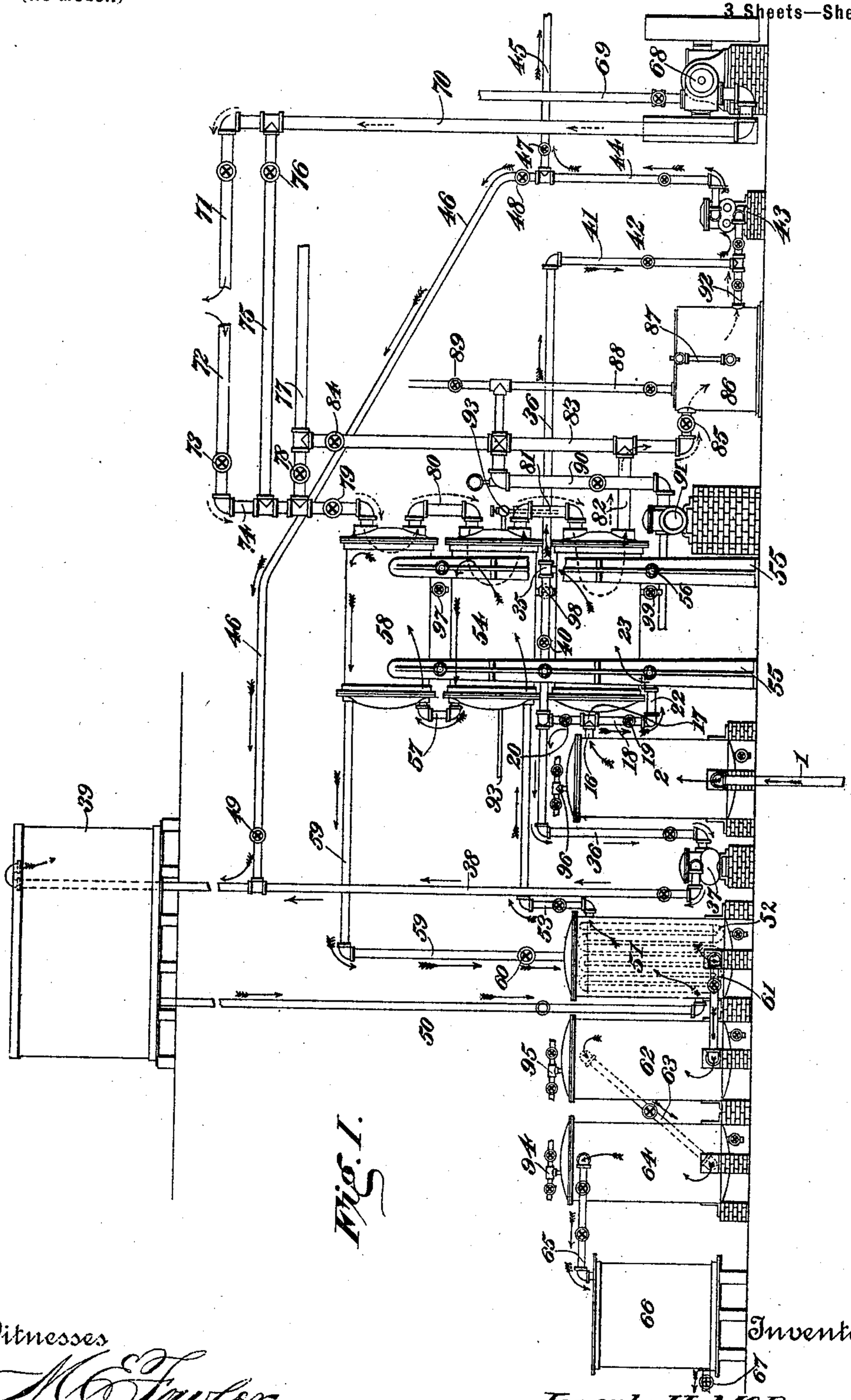

Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

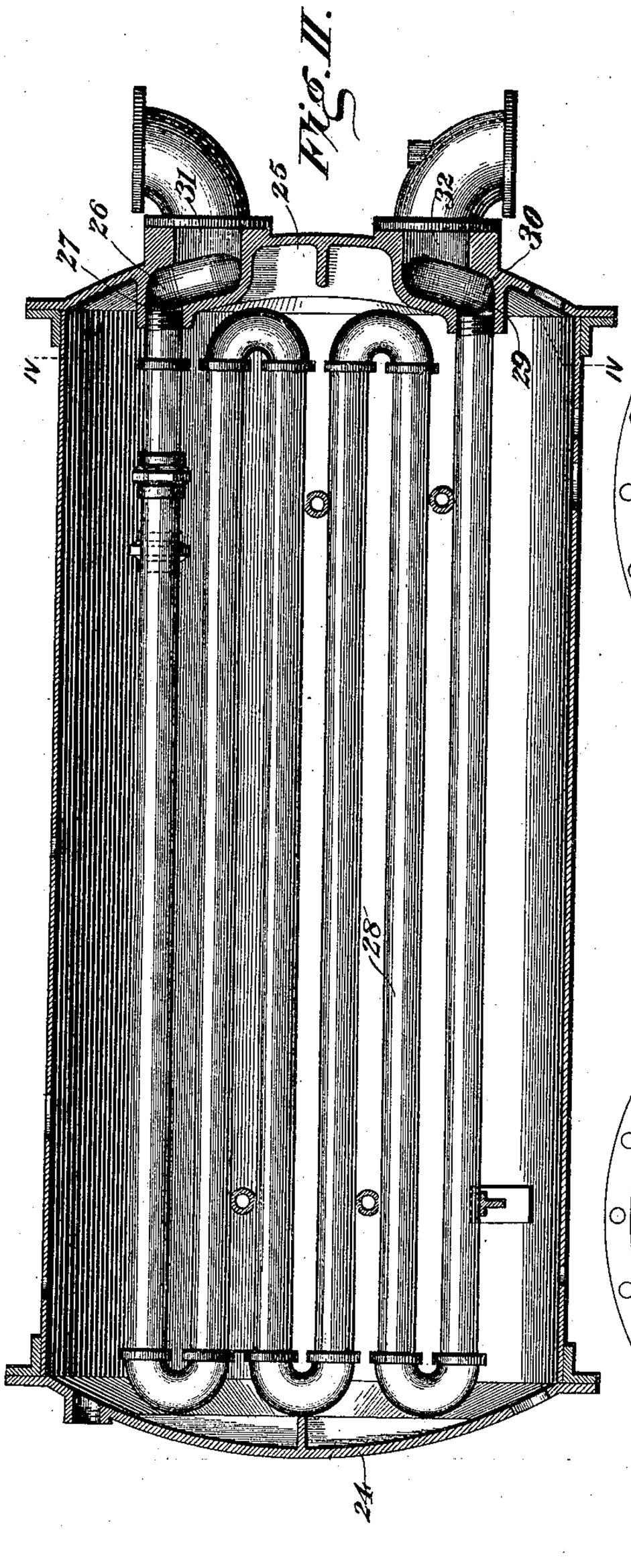

Fig. II.

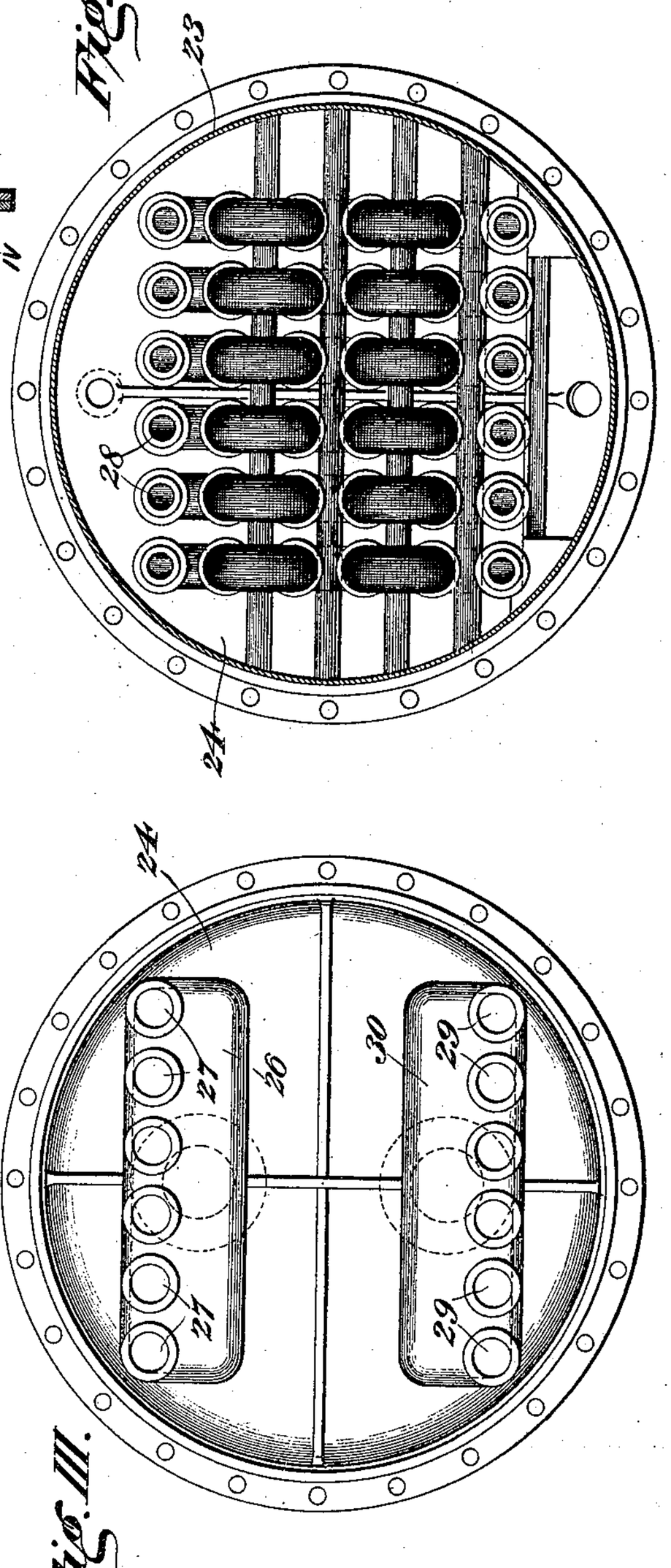

Fig. IV.

Fig. III.

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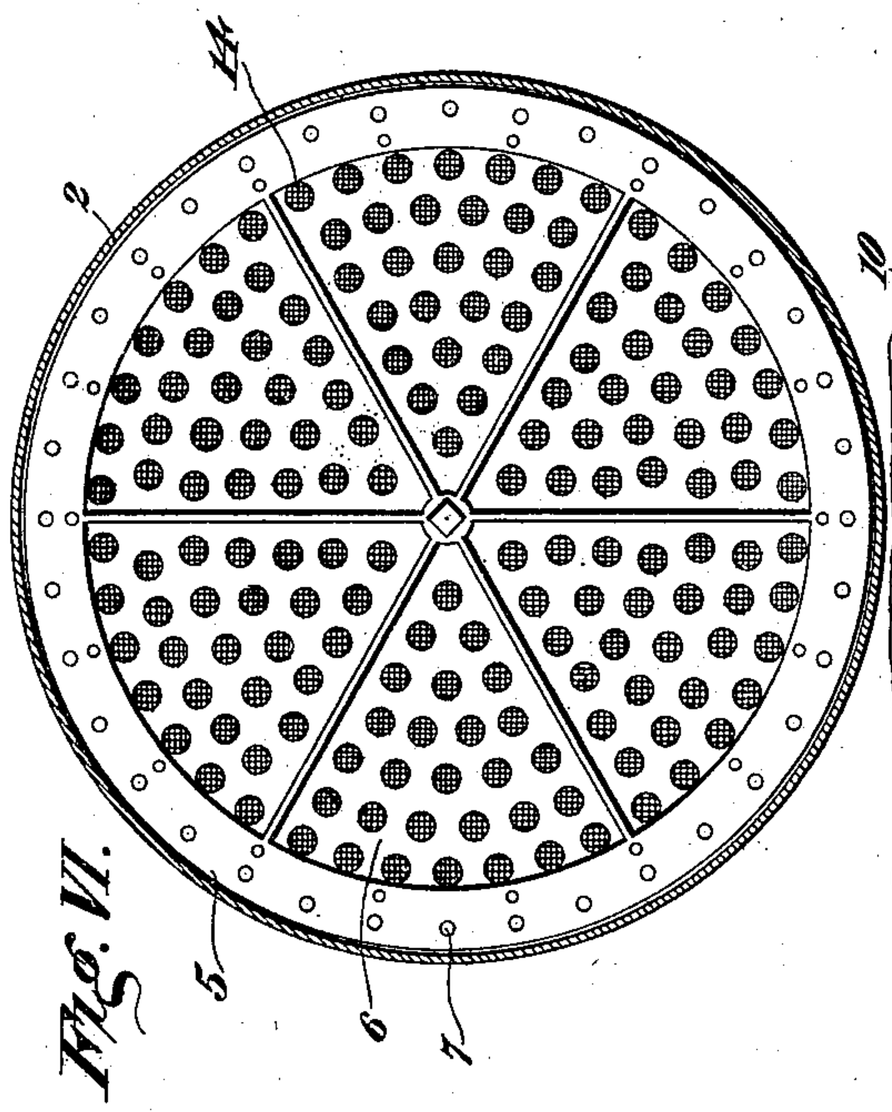

FIG. VI.

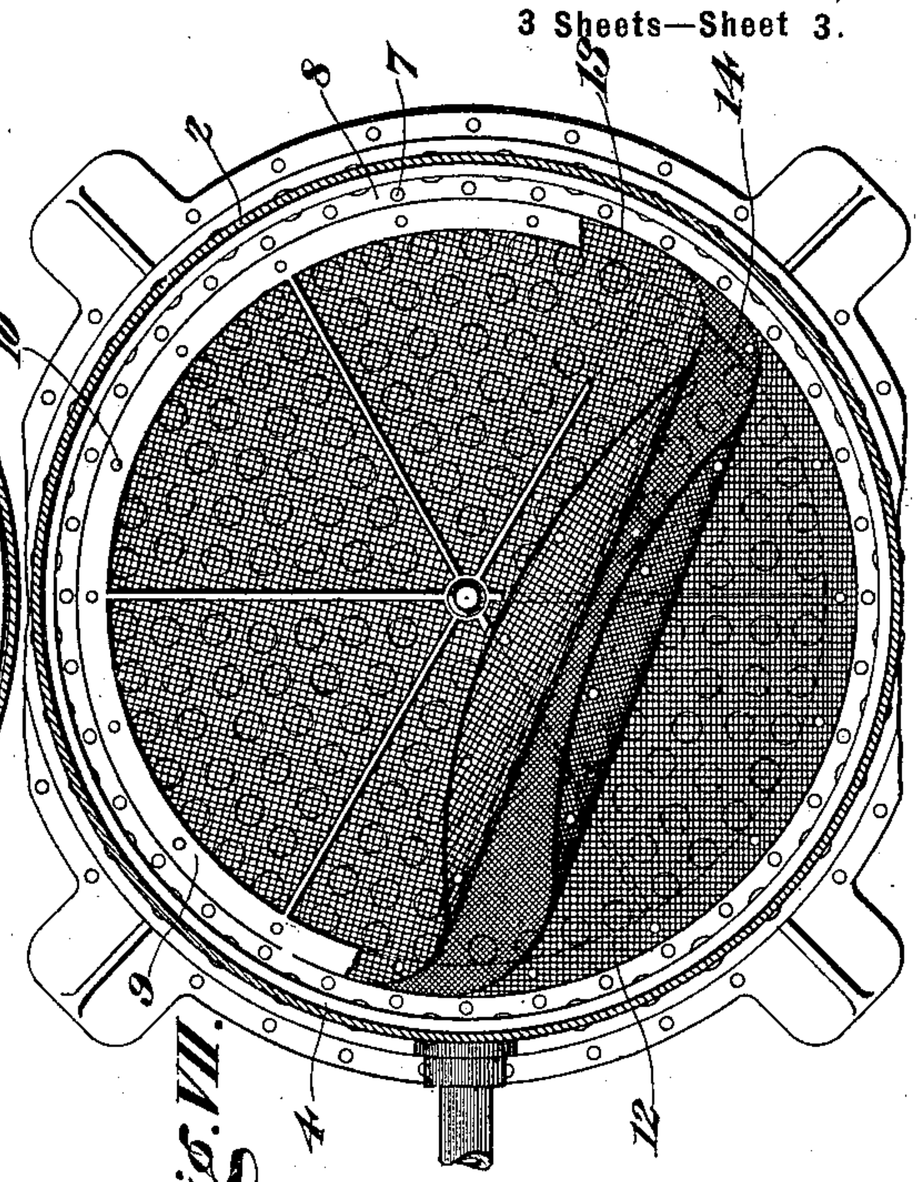

FIG. VII.

FIG. V.

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UNITED STATES PATENT OFFICE.

JOSEPH H. McDONALD, OF NEW YORK, N. Y.

WATER STERILIZING AND CONDENSING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 641,534, dated January 16, 1900.

Application filed February 8, 1897. Serial No. 622,421. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH H. McDONALD, of New York, in the county of New York, State of New York, have invented certain new and useful Improvements in Water Sterilizing and Condensing Apparatus, of which the following is a complete specification, reference being had to the accompanying drawings.

It is a recognized scientific fact that the presence of microbes even in filtered water may pollute it and render it unhealthy for drinking purposes, for the manufacture of ice, or for any similar purpose. It is also recognized, filtration alone being insufficient to purify water, that the only absolutely sure means of destroying the microbic life is in subjecting the water to a temperature of 212° Fahrenheit. This process is known as "sterilization."

The processes of sterilization of water for drinking purposes now in use are comparatively slow and expensive and unattainable to the use of the masses.

My invention is designed to produce an automatic filtering and sterilizing condenser which is completely automatic and continuous in its operation and is adapted to produce a pure, wholesome, and palatable water in large quantities.

My invention is adapted to be used, for example, in hotels, public institutions, breweries, and manufactories of starch, glucose, mineral water, and hygienic ice.

In the general objects proposed to be accomplished my present invention is closely related to the subject-matter of my Patent No. 517,552, issued April 3, 1894.

A distinctive feature of my present apparatus consists in the preferred arrangements and relations of the several elements composing my apparatus and in its economical feature of being incorporated within the steam-heating system of a building, for example, or in any other system in which exhaust-steam may be employed as the heating or sterilizing medium.

In the accompanying drawings, Figure I is a side elevation of my apparatus complete, but with the radiators of the heating system omitted. Fig. II is a longitudinal section of the lower sterilizer detached. Fig. III is a side elevation of the inside of the sterilizer-head detached. Fig. IV is a section on the line 4 4 of Fig. II. Fig. V is a longitudinal section of one of the filters. Fig. VI is a section on the line VI VI thereof. Fig. VII is a section on the line VII VII thereof.

Referring to the figures on the drawings, 1 indicates a water-main which communicates directly with a filter 2 of sufficient dimensions and construction. The filter is divided into three compartments 3, 4, and 5, (see Fig. V,) separated by similar partitions composed of a perforated diaphragm 6, secured, as by bolts 7, to an annular flange 8, surrounding the interior of the filter. Upon its flat side the diaphragm 6 is provided with three plies or layers of copper or brass wire-gauze, the layers being held in place by a spider 9, (see Figs. VI and VII,) secured in place as by a crown of bolts 10 and a central bolt 11. The wire-gauze preferably consists of outer layers 12 and 13 of corresponding mesh—for example, one-sixteenth of an inch—and an intermediate layer 14 of finer mesh, say one-thirty-second-inch mesh. (See Fig. VII.) The spiders 9 and the two partitions are preferably opposed to each other, as clearly illustrated in Fig. V, the compartment 4 being filled with any suitable filtering material. From the filter 2 a pipe 16 communicates through a T-fitting 17 with a vertical pipe 18, provided with cocks 19 and 20, located, respectively, above and below the fitting 17. Below the cock 19 the pipe 18 communicates through a pipe 22 with the condenser 23.

The condenser is preferably cylindrical in form and is provided at one end, as shown in Fig. II, with a head 24 and at the other end with a coil-collecting head 25, in which (see Fig. II) a chamber 26 is provided with a series of openings 27, that are adapted to communicate, respectively, with the coils 28 and through them with the openings 29 of a second chamber 30. The chambers 26 and 30 are preferably cast integral with the head 25 and are provided, respectively, with inlet and outlet openings 31 and 32. By this arrangement the numerous coils enumerated in Fig. IV are collected into one inlet and one discharge pipe.

The condenser is of substantially the same construction as the sterilizer, and a description of its details is the same as that of the

sterilizer. Figs. II, III, and IV, however, are taken directly from the lower sterilizer.

The interior of the condenser 23 communicates through a T-fitting 35 with a pipe 36, which communicates at one end with the pipe 18 above the cock 20 and beyond it with a general-supply pump 37, which through a pipe 38 communicates with the general-supply tank 39. A cock 40, located between the juncture of the pipe 36 with the pipe 18 and the fitting 35, divides the pipe 36 into the section previously described and into another section, which through the vertical pipe 41, controlled as by a valve 42, communicates with the feed-pump 43. The feed-pump supplies water through a valve-controlled pipe 44 to pipes 45 and 46, controlled, respectively, by valves 47 and 48. The pipe 45 communicates with a steam-boiler, (not illustrated,) while the pipe 46 communicates with the pipe 38, above referred to, and through it with the tank 39. A cock 49 within the pipe 46 in proximity to the pipe 38 is preferably employed for use when the pipe 38 is in active communication with the pump 37.

In Fig. I of the drawings the course of the water through the condenser to the tank 39 is indicated by feathered arrows. The course of the water through the cock 20 and pump 37—that is, outside of the condenser—is indicated by tailless arrows.

It may be mentioned here in order to avoid confusion that the course of steam, to be hereinafter described, is indicated in the same drawings by dotted arrows. Pursuing the course indicated by the feathered arrows from the tank 39, the pipe 50 descends and communicates with the interior of a cooling-chamber 51, which contains coils 52. Through a valve-controlled pipe 53, communicating with it, preferably through its upper part, the interior of the cooling-chamber 51 communicates with the lower or lowest sterilizer 54 of a series of sterilizers arranged, preferably, in vertical alinement with the condenser 23.

The condenser and series of sterilizers are preferably supported upon uprights 55, which—by the aid of cross-bolts 56, for example—constitute a supporting-frame. The sterilizer 54 communicates through a pipe 57 with the next sterilizer 58 of the series, and so on throughout the series. Two sterilizers are shown in the drawings as constituting a series; but more may be employed, if the size of the plant should require.

From the last of the series of sterilizers a pipe 59, provided with a cock 60, communicates with the coils 52 of the cooling-chamber, or, as they may be denominated, "cooling-coils."

A valve-controlled pipe 61 unites the cooling-coils with a second filter 62, constructed substantially after the manner of the filter 2, and that in turn, as by a pipe 63, communicates with the decolorizer 64. The construction of the decolorizer may correspond to that of the filter 2, the only difference being that the receptacle between the diaphragms is filled with a suitable decolorizing material. The decolorizer communicates through a valve-controlled pipe 65 with a storage-tank 66, from which perfectly filtered, sterilized, and decolorized water may be drawn away for use, as required, 67 being illustrated as a discharge-pipe for that purpose.

In the previous description I have described the course pursued by the water from the main and its final arrival within the storage-tank 66. I shall now proceed to describe the manner in which the sterilizers and condenser are operated through the employment of steam as a heating medium.

As above stated, I prefer for the sake of economy to utilize the otherwise useless or exhaust steam. As an example of such utilization, I illustrate a steam-engine 68, which takes live steam through a pipe 69 from a source of steam—as, for example, a boiler. (Not illustrated.)

70 indicates an exhaust-steam pipe connected at its lower end with the exhaust of the engine 68 and at its upper end with a valve-controlled pipe 71, that may supply a radiating system of a steam-heating-system apparatus. (Not illustrated.)

72 indicates a pipe that communicates with the pipe 71 through the radiating system. (Not illustrated.) A cock 73 is preferably inserted within the pipe 72, as illustrated.

74 indicates a pipe uniting the pipe 72 with the coils of the upper sterilizer 58.

75 indicates a pipe controlled by a cock 76, that unites the pipes 70 and 74, whereby when required, the pipes 71 and 72 having been shut out, the exhaust-steam may still find access to the pipe 74.

77 indicates an atmospheric exhaust-pipe provided with a valve 78, through which when the valve 79 of the pipe 74 is closed the steam may exhaust to the atmosphere instead of through the sterilizer-coils.

A pipe 80 unites the coils of the upper sterilizer 58 and the coils of the lower sterilizer 54, while a pipe 81 unites the coils of the lower sterilizer to the condenser-coils 23.

The coils of the sterilizers and condenser, as has been already explained, being substantially the same as those illustrated in detail in Figs. II, III, and IV, are not in this general description identified by letter and are not illustrated in the elevation of the apparatus shown in Fig. I.

The coils of the condenser communicate through a pipe 82 with an upright pipe 83, controlled as by a valve 84 and communicating at its upper end with the pipe 77 and at its lower end through a cock 85 with a receiver 86. The receiver is preferably provided with a water-gage 87 and with a valve-controlled pressure-relief pipe 88, which, communicating with the atmosphere, may be employed, if required. Through the pipe 83 the air from the receiver or from the condenser-coils may pass out through the atmospheric

exhaust-pipe 77, or, if preferred, it may be drawn off by aid of a vacuum, a valve-controlled pipe 90, communicating with an air-pump 91, being shown for that purpose, if preferred.

92 indicates a valve-controlled pipe which establishes communication between the receiver 86 and the section 41 of the pipe 36, thereby supplying to the pump 43 the filtered and sterilized water of condensation, as well as the filtered water that is supplied through the pipe 36 from the filter 2. The commingled water of condensation and of direct supply is in the manner above described conducted through the pipe 44 from the pump 43.

Within the pipe 81 I illustrate in Fig. I a valve-controlled spray-pipe 93, that is adapted to discharge a cold spray directly into the body of steam contained within the condenser-coils, if required. Inasmuch as the water thus supplied must receive complete treatment by my apparatus before it can reach the storage-tank 66, it is immaterial from what source the water supplied through the pipe 93 is drawn and may be taken directly from the main 1.

If desired, as a means of cleansing the several operative elements I show a valve-controlled steam and water connection 94, 95, and 96 on the filters 64, 62, and 2, respectively. I show also valve-controlled washouts 97, 98, and 99, respectively, communicating with the interior of the two sterilizers and the condenser.

The operation of my device is as follows: Water from any source of supply (not illustrated) enters the filter 2 through the main 1 and from it passes into the pipe 18, whence, if the cocks 19 and 40 be closed and the cock 20 be opened, it pursues a direct course, following the line of the tailless arrows to the tank 39. This course would be a cut-off from the pump 43 and would be employed temporarily—as, for example, for the purpose of repairing the pump or other mechanism of the apparatus. Normally the operative positions of the cocks 19 and 40 would be open, the cock 20 being closed. Water from the filter 2 under such conditions enters the condenser 23 through the pipe 22, and, passing thence through the pipes 36 and 41, is supplied to the pump 43, whence through the pipes 44 and 46 it is elevated to the tank 39. A portion of the water supplied from the pipe 44 may be conducted to the boiler from the pipe 45. The water, cold from the main, in passing through the system of pipes last described envelops the condenser-coils and serves to cool them. Descending from the tank 39 through the pipe 50, along the course indicated by the feathered arrows, the water enters the interior of the cooling-chamber 51, enveloping the cooling-coils within it. Thence, through the pipe 53, it passes to the lower sterilizer 54 and is there subjected to the initial heating through direct contact with the steam-coils therein. Thence, rising through the pipe 57, it enters the next sterilizer and being there subjected to a high degree of heat is raised to the boiling-point or to a temperature not less than 212° Fahrenheit. Let it be observed in this connection that the temperature of the cold water is raised by degrees in passing from one sterilizer to another, so that by the time it reaches the last sterilizer of the series it has reached approximately the desired temperature. By this arrangement the heat of the exhaust-steam is utilized to the greatest advantage and gives up its heating qualities step by step. If the cold water were brought at once into contact with coils containing the exhaust-steam, it would, if supplied in considerable quantities, come into contact with the coils without being sterilized; but by the successive arrangement of bringing the cool water into contact with the less-heated coils, and so on to the hottest, its perfect sterilization is insured. It is for this reason that the number of sterilizers employed in the series, as previously suggested, may be increased or diminished in proportion to the capacity of the apparatus. The water having been sterilized by passage through the last of the series of sterilizers is conducted through the pipe 59 to the coils of the cooler 51, whence, its temperature being reduced in its passage through the same, it is passed through the filters 62 and 63 successively, and finally conducted to the storage-tank 66.

In order to follow without confusion the course of the water from the main to the storage-tank 66, it was assumed that the condenser and the sterilizer-coils contain steam. It now remains to describe the means of supplying steam to those several coils. Steam, preferably exhaust-steam—derived as from the exhaust of the engine 68, for example—is conducted through the pipe 70 to the pipe 74. The connection between those pipes may be made either through the pipes 71 and 72 and the radiating system, of which they form initial and ultimate elements, or, their valves being closed and the valves 76 being open, communication may be made directly through the pipe 75. Communication directly through the pipe 75 would be employed, for example, during the summer season, when the heating system would not be in use. From the pipe 74 the exhaust-steam at its highest temperature passes into the coils of the sterilizer 58 and there, as previously specified, serves to raise the water surrounding the coil to a temperature sufficiently high to sterilize it. Passing from the coils of the sterilizer 58 the steam, having given up a portion of its heat, enters from the pipe 80 the coils of the sterilizer 54 or the next one in the series of sterilizers. There it serves to impart a degree of heat to the water surrounding the coil within the sterilizer and gives up in turn additional heat. Consequently when the steam has passed through the series of sterilizers it has been partially condensed, the series of sterilizers serving the dual purpose of heating the

water surrounding the coils and of cooling the steam that passes through them. Issuing from the coils of the sterilizer 54 or, as illustrated, the last of the series the partially-condensed steam enters through the pipe 81 the coils of the condenser 23, wherein, being cooled by direct contact of the cold water from the main, it is entirely condensed or liquefied and is discharged through the pipes 82 and 83 into the receiver 86.

To insure the perfect operation of the condenser, a spray of cold water may be introduced directly into the interior of the condenser-coils through the pipe 93, if required. Any air contained within the receiver 86 may issue through the atmospheric discharge-pipe 77 by way of the pipe 83, or, the cock 84 being closed and the valve of the pipe 90 being open, it may be drawn off by the air-pump 91.

In order to render my apparatus complete and to anticipate all conditions, I provide in the atmospheric discharge-pipe 77 a cock 78 and below the pipe 77 in the pipe 74 a cock 79. By this arrangement it is possible at any time by opening the cock 78 and closing the cock 79 to produce a discharge to the atmosphere of the exhaust-steam from the pipe 70. The condenser can also be used without the vacuum-pump 91 by closing the cock between pipe 83 and pipe 88 and closing the cock on pipe 90; also, opening cock 84 and cock 90, thus exhausting through the condenser to the atmosphere.

What I claim is—

1. The combination with a sterilizer and a source of water-supply, of means for diverting a portion of such water to be heated, and another portion to the sterilizer to be sterilized, means for directing the heated water to the sterilizer whereby it operates as the sterilizing agent, and means for commingling the two portions of water, substantially as set forth.

2. The combination with a source of water-supply, and a sterilizer, of a divided water-course leading from the source of supply, one part leading to a heater where water may be converted into steam, and the other part to the sterilizer, a steam-conduit which in its course passes through the sterilizer, a condensing apparatus for the steam, and a conduit for the condensed water leading back to the conduit from the source of supply, substantially as set forth.

3. The combination with a source of water-supply and source of steam-supply, of a condenser for the steam, means whereby the water of condensation, and of the direct supply may be commingled, sterilizing and filtering elements arranged in successive order, and means for supplying the commingled water of condensation and of the direct supply through the same, substantially as set forth.

In testimony of all which I have hereunto subscribed my name.

JOSEPH H. McDONALD.

Witnesses:
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CHAS. A. WEBB.