

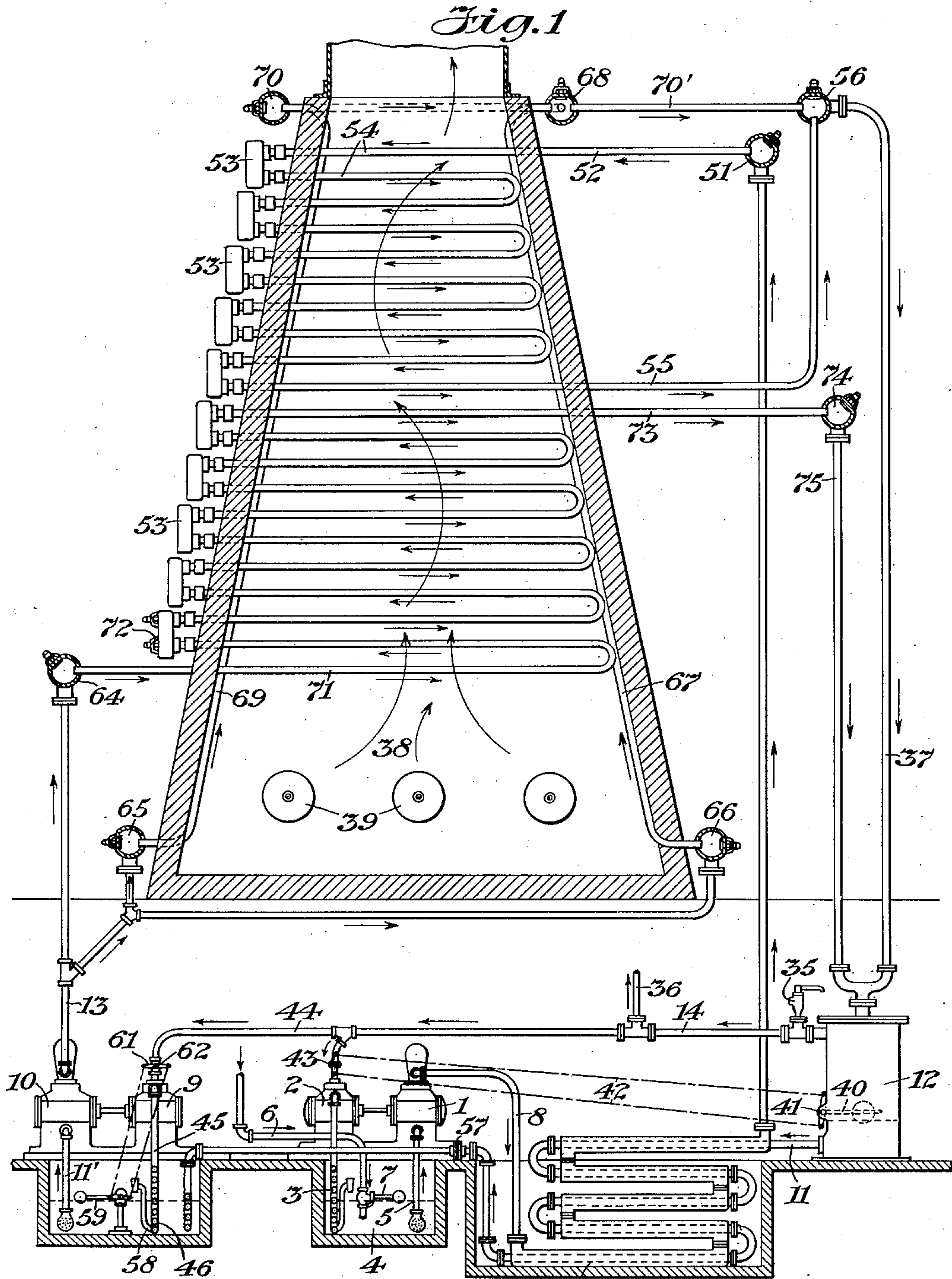
May 9, 1933.

C. E. LUCKE

1,908,265

BOILER

Original Filed Jan. 3, 1927 2 Sheets-Sheet 1



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Fig. 2

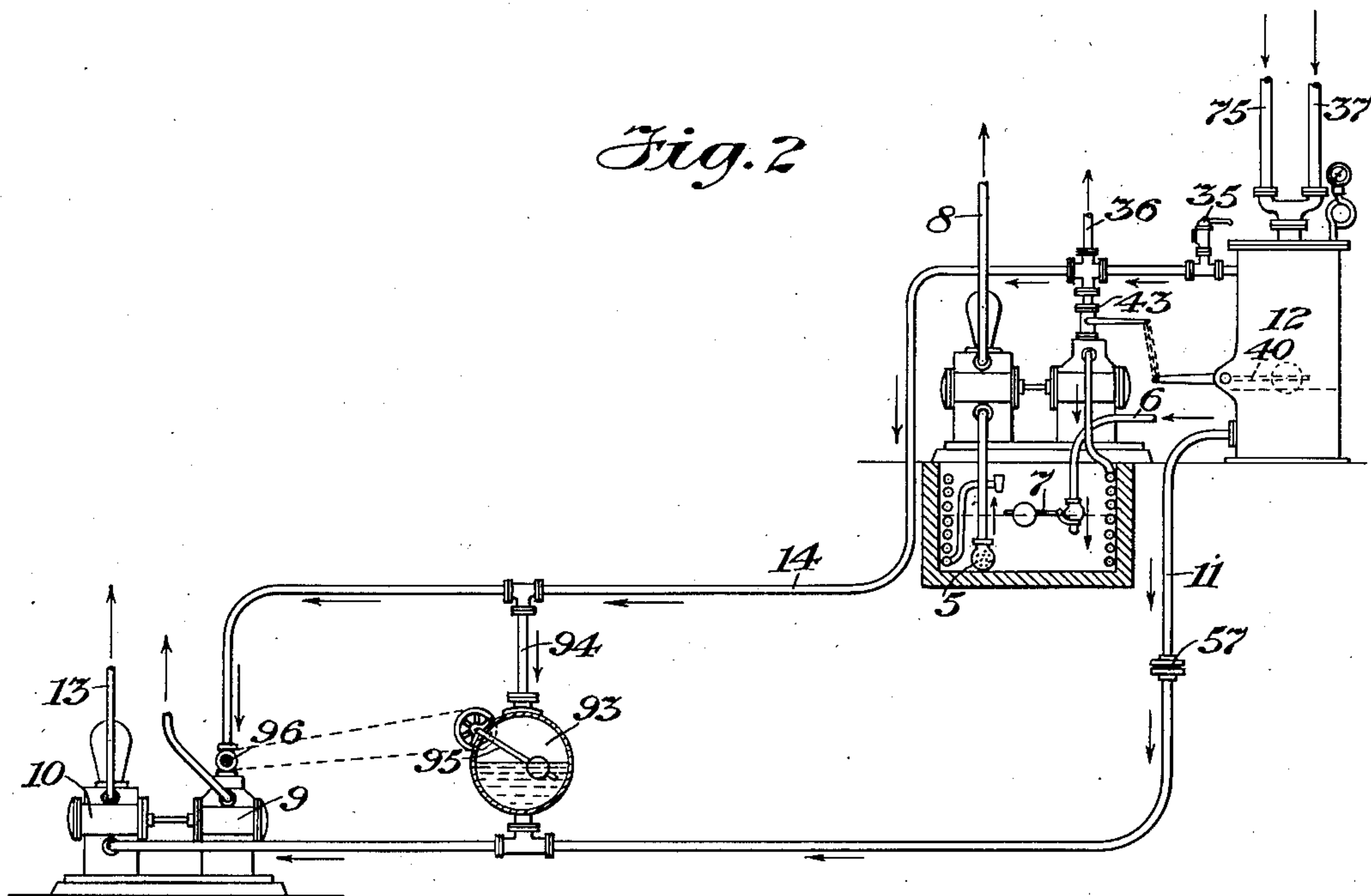
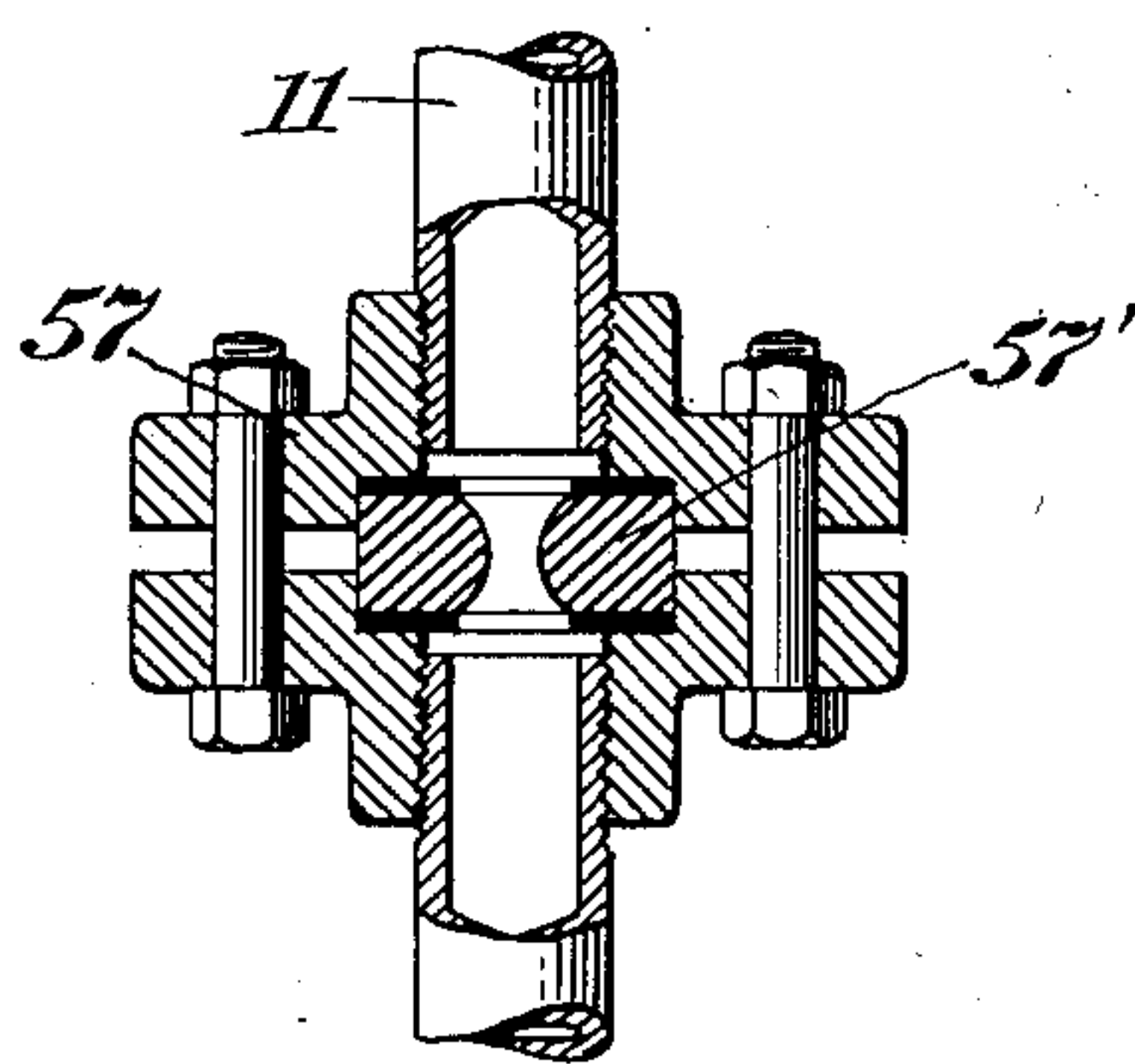


Fig. 3



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BOILER

Original application filed January 3, 1927, Serial No. 158,469. Divided and this application filed August 11, 1930. Serial No. 474,672.

This invention relates to steam boilers and more particularly to steam boilers of the forced circulation type in which a pumping mechanism is employed for obtaining the desired circulation through the boiler tubes, and this application is a division of my application Serial No. 158,469, filed January 3, 1927.

An object of this invention is to provide a boiler of the type set forth having an improved arrangement of pumping mechanism and steam generating tubes. This and other objects which will be apparent to those skilled in this particular art are obtained by the invention illustrated by the accompanying drawings in which

Fig. 1 is a transverse sectional view diagrammatically illustrating one embodiment of this invention;

Fig. 2 is a diagrammatic view showing a modified arrangement of the pump, and

Fig. 3 is a sectional view of a detail of construction.

The present invention relates to a forced circulation boiler in which the circulation is maintained by a circulating pump wholly independent of the feed pump. Multiple circuits are provided through which the water is forced by the circulating pump. A feed pump is provided for forcing water through an economizer which is entirely independent, as far as flow conditions are concerned, of the other tube sections of the boiler and of the circulating pump. In the present arrangement a steam and water separating chamber is provided into which the various tube sections including the economizer section discharge.

The particular embodiment of this invention which has been chosen for the purpose of illustration includes a steam pump for feed water for the water cylinder 1 and steam cylinder 2. The exhaust from the steam cylinder goes through a coil 3 in the feed water tank 4 into which the condensate from the steam is collected. A suction pipe 5 leads from the tank 4 to the water cylinder 1 of the pump and the water tank is provided with a pipe 6 for delivering water thereto from any convenient source of supply, a flood valve

7 being provided for controlling the level of water in the water tank. A feed water pipe 8 leads from the pump cylinder 1 to the boiler.

A separate and independent circulating pump for maintaining the circulation of the unvaporized water that has passed through the boiler is provided. This circulating pump has steam cylinder 9 and water cylinder 10, the water cylinder receiving water through the pipe 11 from the separating chamber 12. The pipe 13 leads from the cylinder 10 to tubes in the boiler through which the water is to be circulated and a steam pipe is provided for removing the steam from the separating chamber 12.

As illustrated in Fig. 1 the feed water pipe 8 of the water cylinder of the feed water pump passes through a jacket 50 through which the pipe 11 from the separator 12 also passes, so that the feed water is heated to some extent before it enters the connected header 51. The feed water passes from the header 51 through rows of tubes 52 across a hot gas passage in the upper portion of the furnace 38, which may be fired by means of fuel burners 39. The gas passage is illustrated as of a gradually contracting cross-sectional area. The feed water flows through rows of tubes 52 into the tube connectors 53, thence into the U-tubes 54 leading from the tube connectors 53 to the next lower set of tube connectors, and so on to the lowest set of connectors 53 of the series, thence through a row of tubes 55 to the collector 56 from which the pipe 37 leads to the steam and water cylinder 12.

The unvaporized water collected in the separating chamber 12 is returned to the furnace and caused to circulate through a separate group of tubes. The water passes from the separator 12 through the pipe 11 and is cooled by the feed water in the jacket 50 to such a point that it can pass through a metering orifice located in the line 11 without forming steam when the pressure is relieved thereby. After the reduction of the pressure, the water is delivered to the suction tank 58 of the circulating pump. A float mechanism 59 is provided in this tank and connected by cords to a lever 61 on the stem of the valve

62 in the line 44 delivering operating steam to the steam cylinder of the circulating pump.

The water circulated by the circulating pump is forced through separate groups of tubes located in the furnace proper. From the pipe 13 the water flows through branch lines of headers 64, 65 and 66, respectively. The header 66 supplies water to a row of furnace wall tubes 67 connected at their upper ends to a header 68. From the header 65 water is delivered to a separate group of furnace wall tubes 69 connected at their upper ends to a header 70. A pipe or pipes 70' convey steam and water from the headers 68 and 70 to the header 56 into which the group of tubes 54 which receive the water from the feed pump also deliver. A header 64 communicates with still another group of tubes 71 of U-shape and extending across the path of the furnace gases. Tubes and connectors 72 connect successive tubes 71 through which water or steam and water flow to a row of tubes 73 leading to a steam and water header 74 from which the pipe 75 leads to the separating chamber 12. A safety valve 35 is connected to the steam delivering pipe 14 adjacent separator 12 and communicating pipe 36 connecting steam pipe 14 with any desired point of consumption.

With this arrangement, the rate of operation of the circulating pump or the rate of recirculation of the unvaporized water is controlled by the rate of bleeding of the water through the orifice 57 in the unvaporized water return line 11. The orifice 57 is of fixed size and the speed of operation of the circulating pump is adjusted automatically by the float operated steam valve so as to maintain a substantially constant level in the suction tank 58 of the circulatory pump. It will, of course, be understood that the orifice size can be varied or adjusted in any desired manner and by any desired means, but for any given opening the rate of circulation of the water will remain substantially constant and wholly independent of the rate of feed or of the rate of steam generation.

In the arrangement of the invention illustrated in Fig. 2, the unvaporized water passes from the separating chamber 12 through a pipe 11 and orifice 57 to a closed suction tank 93 of the circulating pump. The tank 93 is connected by the pipe 94 to the steam line 14 so as to equalize pressure and permit a free flow of liquid.

A constant level is maintained in the suction tank 93 by the flow control mechanism 95 for operating steam valve 96 of the circulating pump. With this arrangement, the head of water in the orifice which determines the rate of circulation independent of the rate of feed of the boiler is the difference in level between the water in the separating

chamber 12 and that in the suction tank 93. This makes it practical to eliminate heat exchanger 50 illustrated in Fig. 1 as little or no steam is formed by the passage of water through the orifice 57 and what is formed does not leave the system. Furthermore, a larger orifice may be used and less power is required for the water circulating pump because the full steam pressure goes into the suction thereof.

In Fig. 3, a metering device or orifice is shown in which different discs 57' having orifices of different sizes may be used to suit different conditions.

What I claim as new, and desire to secure by Letters Patent, is:

1. A steam generator including groups of water tubes, a steam and water separator receiving the discharge from all of said groups, a water circuit including a circulating pump receiving water from said separator and delivering to at least one group of tubes, a reservoir below the water level in the separator and between the pump section and separator and vented to the steam space of the system, and a regulating orifice between the separator and reservoir.

2. A steam generator including groups of water tubes, a steam and water separator receiving the discharge from all of said groups, a water circuit including a circulating pump receiving water from said separator and delivering to at least one group of tubes, a reservoir below the water level in the separator and between the pump section and separator and vented to the steam space of the system, a regulating orifice between the separator and reservoir, and a pump speed regulator actuated by the water level in the reservoir.

3. A steam generating system utilizing groups of water tubes, a steam and water separator receiving the discharge from all of said groups, a water circuit including a pressure reducing orifice, a reservoir and a circulating pump in the order named receiving water from the separator, the reservoir being below the water level of the separator and vented to the steam space of the system, and control means for the circulating pump actuated by the water level in the reservoir.

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