April 5, 1932. O. ENGLER 1,852,293

HIGH PRESSURE BOILER

Filed Jan. 5, 1931 2 Sheets-Sheet 1

Fig. 1.

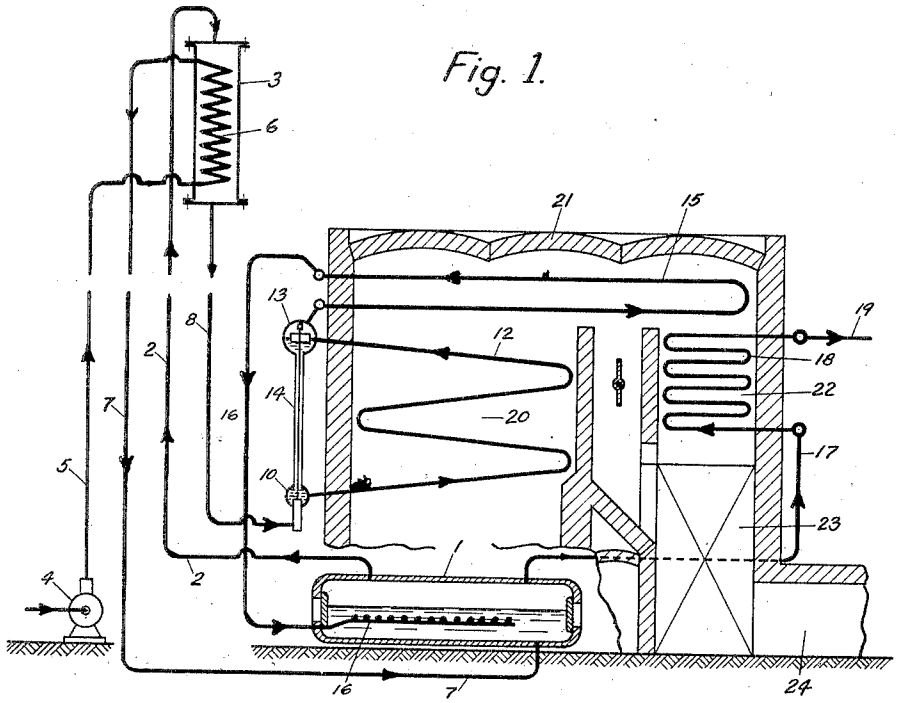
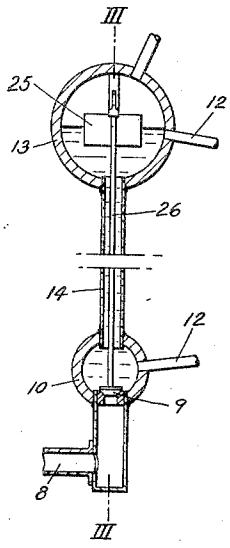


Fig. 2.



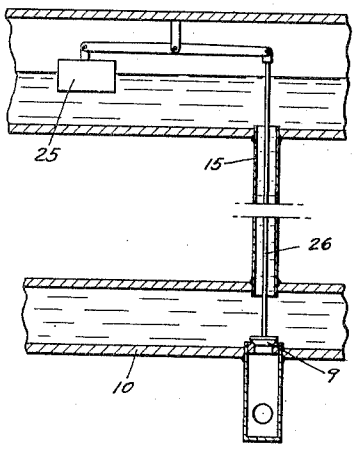


Fig. 3.

Otto Engler
INVENTOR

BY O. V. Thiele
ATTORNEY

April 5, 1932. O. ENGLER 1,852,293

HIGH PRESSURE BOILER

Filed Jan. 5, 1931 2 Sheets-Sheet 2

Fig. 4.

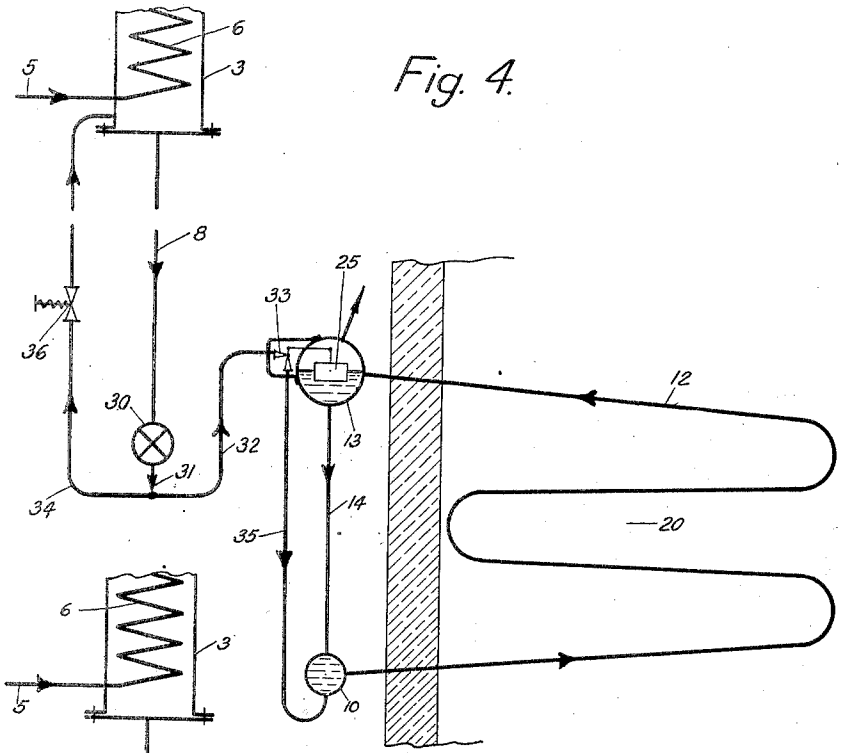
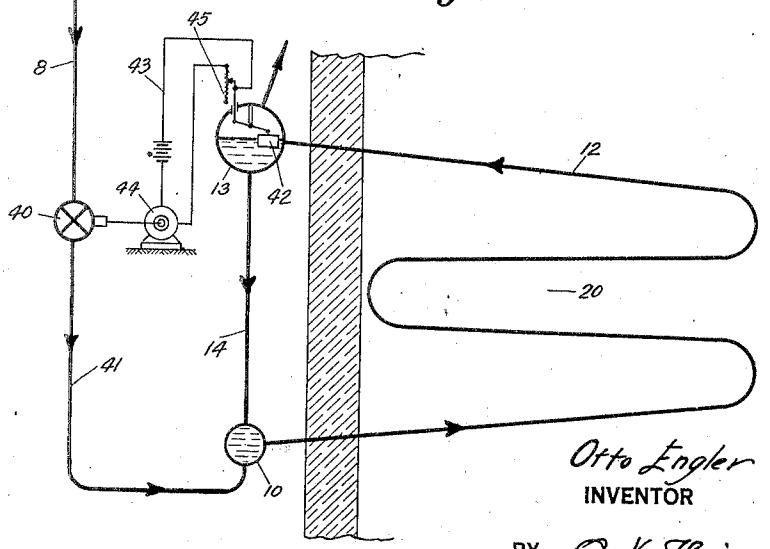


Fig. 5.



Otto Engler
INVENTOR

BY O. V. Thiele

ATTORNEY

Patented Apr. 5, 1932

1,852,293

UNITED STATES PATENT OFFICE

OTTO ENGLER, OF CASSEL-WILHELMSHOHE, GERMANY, ASSIGNOR TO SCHMIDT'SCHE HEISSDAMPF-GESELLSCHAFT M. B. H., OF CASSEL-WILHELMSHOHE, GERMANY

HIGH PRESSURE BOILER

Application filed January 5, 1931, Serial No. 506,709, and in Germany February 22, 1930.

The invention relates to the generation of high pressure steam by means of the injection into the water content of the high pressure drum of superheated steam taken from the high pressure drum in a saturated state. In contrast to a known process of this kind in which the heating steam is taken from the high pressure drum and forced by means of a pump through a superheater back into the drum, the present new process consists in condensing in a heat interchanger the heating steam which has been taken from the high pressure drum and thereafter to reconvert it into steam in an externally heated evaporator to which the condensate is led in controlled quantity, the steam passing through a superheater back into the water space of the high pressure drum. The essential advantage of the new process resides in the fact that the pump for handling the steam is omitted. If the heat interchanger in which the heating steam is, according to the new process, first condensed is located high enough above the evaporator, then the circulation of the heating steam can be accomplished by gravity. If the necessary height is not available, then the condensate can be forced to the evaporator through a pump. This pump in that case has to overcome merely the friction losses of the condensate. Only a small amount of power is therefore required for it and no structural difficulties are present.

The regulation of the amount of condensate carried to the evaporator is accomplished by means of a feed-water regulator actuated by a float located in a water separator between the evaporator and the superheater. The heat interchanger used for condensing the saturated steam taken from the high pressure drum is preferably given the form of a feed-water heater heated by this steam. If this is done, the heating steam circulation will automatically follow the load fluctuations of the boiler plant. When the boiler is working at high rating and the feed-water consumption is high, the amount of steam condensed in the feed-water heater will increase on account of the increased cooling effect, whereas with lower boiler loads and decreased feed-water amounts this condensation will correspondingly decrease. This action is due to the fact that when less condensate is fed into the evaporator the level of the condensate in the heat interchanger rises and the effective cooling surface is thereby diminished.

On the drawings, Fig. 1 shows in diagrammatic form an illustrative example of a boiler installation adapted for using the new process; Fig. 2 shows on an enlarged scale a vertical section of an arrangement of the feed-water regulator in the evaporator; Fig. 3 is a section on line 3—3 of Fig. 2; Figs. 4 and 5 show portions of a boiler installation illustrating variations of the invention.

In Fig. 1 the reference numeral 1 designates the high pressure drum from whose steam space a line 2 leads to the feed-water heater 3. Feed-water is forced by means of a pump 4 through the pipe 5, the coil 6 located in the feed-water heater 3 and a pipe 7 leading from the feed-water heater to the high pressure drum 1. The heating steam flows in counter-flow to the feed-water in the feed-water heater 3. The condensate flows through a pipe 8 through a valve 9 into the lower drum 10 of the evaporator. The coils 12 of the evaporator are arranged between the lower drum 10 and an upper drum 13 which serves as a steam separator. The steam separator 13 is also connected with the lower drum 10 by the vertical return tubes 14. The steam after it has had its water separated out in the drum 13 flows to the superheater 15 from which a pipe 16 leads to the high pressure drum 1 where the superheated steam is injected into the water under the surface. The high pressure drum is not heated from the outside. The high pressure steam generated in it solely through the heating by the superheated heating steam goes through a pipe 17 to the gas heated superheater 18 and from this through the pipe 19 to the point of consumption. The heating gases of the furnace (not shown) flow in the first place through the pass 20 in which the evaporator 12 is arranged, next heat the superheater 15 arranged under the roof 21, and then enter the pass 22 in which the superheater 18 for the working steam and an air preheater 23 are arranged in sequence. The lower end of the

pass 22 is connected by the passage 24 with the stack. The feeding of the evaporator with heating steam condensate is regulated in such a manner that the water level in the drum 13 remains constant. For this purpose a float 25 is placed in the drum 13 which acts on the feed valve 9 by means of a rod 26 extending through a downcomer 14.

An essential advantage of the installation described resides in the fact that the evaporator coils 12 which are heated by hot gases are well cooled by means of a clean condensate. Moreover, there will be no appreciable deposits formed in the coils of the feed-water heater because these coils are traversed by the feed-water at high velocity. The precipitates are therefore carried along to the high pressure drum where their being deposited is not injurious.

The forms of the invention illustrated in Figs. 4 and 5 differ from the installation first described only in the means for carrying the condensate of the feed-water heater 3 to the lower drum 10 of the evaporator. In both forms it is assumed that the condensate pipe 8 leading from the feed-water heater has in it a pump. The pressure line 31 of the pump 30 is, according to Fig. 4, connected through the pipe 32 with the feed valve 33 and likewise by the recirculating line 34 with the feed-heater 3. The feed valve 33 from which a feed line 35 leads to the lower drum 10 is actuated by the float 25 in the drum 13. In the circulating line 34 there is a spring loaded valve 36 whose loading is so chosen that it will begin to open when the feed valve 33 is closed by the float 25.

In the form of the invention shown in Fig. 5, it is assumed that the pump 40 in the condensate line 8 from which the feed line 41 extends to the lower drum 10 of the evaporator is electrically driven. The float 42 in the drum 13 regulates a resistance 45 in the circuit 43 of the motor 44 of the pump 40 so that feeding of the evaporator is regulated by changing the number of revolutions of the pump.

I claim:

1. Process for the generation of high-pressure steam by the introduction into the water in the high-pressure drum of superheated steam taken from the drum in a saturated state, characterized by first condensing the steam taken from the high-pressure drum in a heat-interchanger and thereupon re-evaporating the condensate in an externally heated evaporator to which the condensate is admitted in regulated quantity, and letting the steam so formed go through a superheater into the water in the high-pressure drum.

2. The process in accordance with claim 1 and including the further step of preheating the feed-water for the high-pressure drum in said heat-interchanger out of contact with the steam.

3. The process in accordance with claim 1, the regulation of the flow of condensate to the evaporator being in response to changes in the water level in the steam-and-water drum of said evaporator.

4. In apparatus of the class described, the combination of a high-pressure drum, a heat-interchanger of the type wherein the heat-interchanging media are not in contact with each other, an evaporator, a superheater, a pipe connecting the upper part of the drum to the heat-interchanger to lead steam from the former to the latter, a pipe connecting the heat interchanger to the evaporator to lead condensate from the former to the latter, a pipe connecting the evaporator to the superheater to lead steam from the former to the latter, and a pipe connecting the outlet of the superheater to the drum and arranged to lead steam from the former to the latter and to discharge it below the water level.

5. Apparatus in accordance with claim 4 and further comprising means to force feed-water through the heat-interchanger into the drum, and a float-controlled valve to regulate the admission of the condensate from the heat-interchanger into the evaporator in response to variations in the water lever in the evaporator.

OTTO ENGLER.