

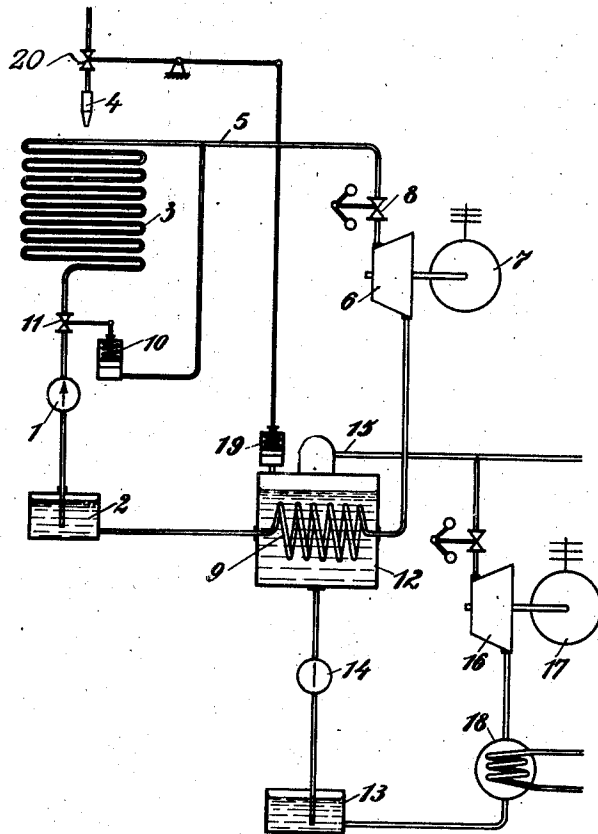
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W. ABENDROTH

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ARRANGEMENT OR SYSTEM FOR THE GENERATION OF STEAM

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Inventor
Wilhelm Abendroth
by Knight & Co. attorneys

UNITED STATES PATENT OFFICE.

WILHELM ABENDROTH, OF BERLIN-CHARLOTTENBURG, GERMANY, ASSIGNOR TO SIEMENS-SCHUCKERTWERKE GESELLSCHAFT MIT BESCHRANKTER HAFTUNG, OF BERLIN-SIEMENSSTADT, GERMANY, A CORPORATION OF GERMANY.

ARRANGEMENT OR SYSTEM FOR THE GENERATION OF STEAM.

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My invention relates to an arrangement or system for the generation of steam.

It is already known to generate steam by raising a liquid working medium to its critical pressure, by a pump or other suitable pressure producing means, and heating it at this critical pressure at least up to its critical temperature. If steam is generated in this manner the working medium passes steadily from the liquid into the vaporous state without taking up evaporation heat. The advantage of this process resides in the fact that a separation of steam and liquid of equal temperatures but of different physical properties cannot take place at any point of the process. In this way the dangers are eliminated which are caused in ordinary steam generators by the well-known ebullition or boiling phenomena. This process may be carried out in such a manner that a plurality of working media with different critical temperatures are converted into steam in series relation. The waste heat of one working medium hereby serves to heat the second working medium, which also stands under critical pressure, up to the critical temperature and thus convert it into steam.

My invention consists in coupling two vapor generating processes in such manner, that the first working medium is at the critical pressure and the critical temperature converted into vapor, while the second working medium takes up the heat at a temperature below its critical value, the pressure of the second working medium being so regulated that it vaporizes at this temperature. The coupling of a steam generating process carried out at the critical values with a steam generating process carried out below the critical values presents the advantage that no special source of heat is required for the evaporation of the second working medium and that furthermore a considerably greater adaptability of the plant is attained. The process of generating steam at the critical values of the working medium presumes a very sensitive regulation of the plant as otherwise load disturbances cannot be avoided. Already a comparatively minute lowering of the pressure below the critical pressure may cause a considerable wetness

of the vapor whereby the risks which this special manner of generating steam is just intended to avoid, arise in a higher degree. In the described coupling of the two steam generation processes it is on the other hand possible to regulate the pressure of the second working medium within wide limits and to bring it also in dependence from the output of the power engine driven by the first working medium, since the temperature, at which the first working medium escapes from the power engine, rises, as a rule, with the falling output of the engine. The second working medium may hereby be utilized directly for the storage of energy which is not so easily possible when the steam is generated above the critical values. The entire plant thus becomes more elastic.

In connection with my improved arrangement or system an automatic regulation may be provided which in dependence from the allowed limit pressures of the secondary steam generator controls the furnace of the primary boiler by means known per se.

In the drawing affixed hereto an embodiment of my invention is diagrammatically illustrated by way of example. In the system or arrangement shown a process for the generation of vapor at critical values is coupled with a process for the generation of vapor below the critical values. The first working medium is drawn up in liquid state by a pump 1 from the supply tank 2 and is forced at least at the critical pressure through a system of pipes 3 which by means of the burner 4 is heated at least up to the critical temperature. The vapor produced in this system of pipes is conducted through a feed pipe 5 to an engine 6 which drives a dynamo 7. 8 is the regulating valve of the engine 6. After the working medium has performed work in the engine 6 it is passed through the pipe coil 9 in which it is condensed and from which it flows back into the supply tank 2. In order to keep the pressure of the working medium at least at the critical pressure, a pressure control device 10 is provided which in dependence of the pressure of the live vapor adjusts a throttle valve 11 in the pipe leading from the pump 1 to the generator 3 in such a manner that when the pressure falls in the

pipe 5 the valve 11 is opened wider and more liquid working medium supplied while when the pressure in the pipe 5 rises the regulation procedure is reversed.

5 The secondary vapor generation process takes place in a boiler 12 into which the liquid working medium is fed from a supply tank 13 by a pump 14. The boiler 12 is heated through a pipe coil 9 by which the
10 primary medium transmits its waste heat to the secondary working medium. Pressure and temperature of the secondary vapor generation process is assumed to be below the critical values of the secondary working
15 medium. The vapor generated in the boiler 12 is led to the consumers through the pipe 15. In the present case, as an example, a turbine 16 and an electric generator 17 are shown as consumers, and the exhaust of the
20 turbine is condensed in a condenser 18 the condensate of which is returned into storage tank 13. The boiler 12 is preferably designed with a large liquid space so that it acts at the same time as storage vessel, reservoir
25 or accumulator. The prime mover 6 may then continuously run under normal load while the prime mover 16 is primarily intended to cover the peak loads. It is capable of doing this inasmuch as the boiler 12
30 acting as storage vessel is at all times in a position to supply the volumes of vapor required for covering the peak loads and the regulation of the primary vapor generator need therefore rarely come into action.

35 In the illustration there is, furthermore, shown a regulation of the primary vapor generation in dependence of the secondary vapor generation, which operates in such a manner that a pressure control device 19
40 adjusts the fuel valve 20 so that when the pressure in the boiler 12 rises the fuel supply to the heater 3 is reduced and conversely that the fuel supply is increased when the boiler pressure falls.

45 Various modifications and changes may be made without departing from the spirit and the scope of the invention, and I desire, therefore, that only such limitations shall be
50 art.

I claim as my invention:—

1. In a vapor generating plant in combination a supply well, a pipe system constituting a primary vapor generator, a pump for forcing operating liquid from said well
55 into said generator, means for heating the liquid in said primary generator to a suitable temperature to generate vapor at critical values, a prime mover connected to said generator, a condenser system connected to
60 the exhaust side of said prime mover, a secondary vapor generator containing said condenser system as its source of heat supply, means for feeding operating liquid into said secondary generator, a second prime mover
65 connected to said secondary generator, and means connected with said secondary generator and responding to varying load conditions therein caused by the varying load of the second prime mover, said means being
70 connected with said primary vapor generator to control its vapor output in accordance with the load variations of the secondary prime mover.

2. In a vapor generating plant in combination a supply well, a pipe system constituting a primary vapor generator, a pump for forcing operating liquid from said well
75 into said generator, means for heating the liquid in said primary generator to a suitable temperature to generate vapor at critical values, a prime mover connected to said generator, a condenser system connected to
80 the exhaust side of said prime mover, a secondary vapor generator containing said condenser system as its source of heat supply, means for feeding operating liquid into said secondary generator, a second prime mover
85 connected to said secondary generator, and a pressure responsive means connected with said secondary generator and responding to the pressure variations therein caused by the varying load of the second prime mover, said
90 means being connected with said primary vapor generator to control its vapor output in accordance with the load variations of the
95 secondary prime mover.

In testimony whereof I affix my signature.

WILHELM ABENDROTH.