

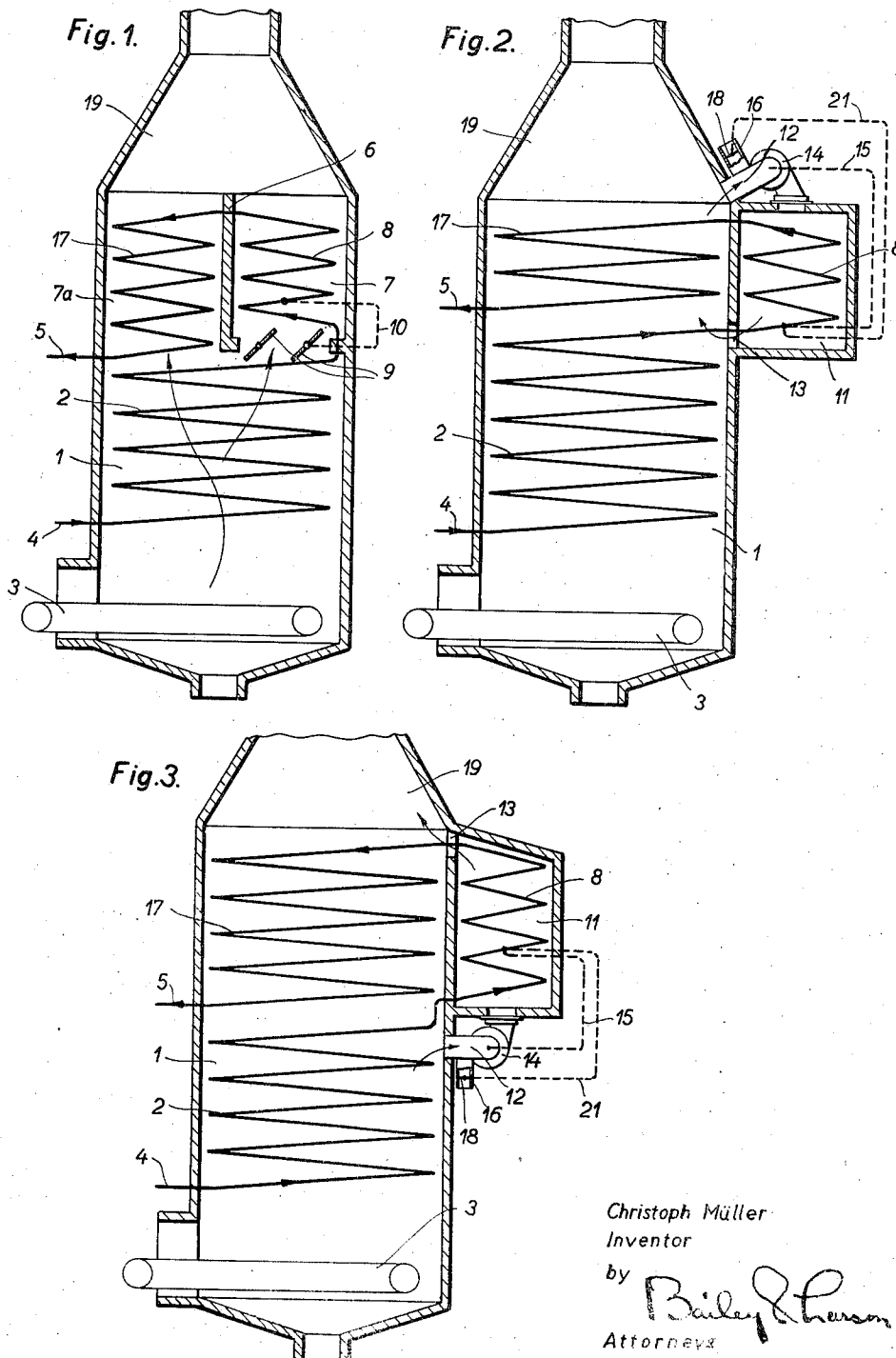
March 16, 1937.

C. MÜLLER

2,074,235

TUBULAR CONTINUOUS FLOW STEAM GENERATOR

Filed April 25, 1935



Christoph Müller
Inventor

by *Bailey & Larson*
Attorneys

UNITED STATES PATENT OFFICE

2,074,235

TUBULAR CONTINUOUS-FLOW STEAM GENERATOR

Christoph Müller, Kassel-Wilhelmshöhe, Germany, assignor to Schmidt'sche Heissdampf-Gesellschaft m. b. H., Kassel-Wilhelmshöhe, Germany

Application April 25, 1935, Serial No. 18,239
In Germany May 19, 1934

8 Claims. (Cl. 122-249)

In order to prevent with tubular steam generators operating with positive continuous flow of the working fluid, generally water, the burning of the heating surface of the so called transformation zone in which the liquid is transformed into steam and which is the main place for the deposition of salts separated from the hot liquid, it has already been proposed to locate this portion of the heating surface in a region in which the temperature of the heating gases is comparatively low. There exist, however, sometimes reasons of service which prevent that arrangement, and also the regulation of the heating gases is sometimes connected with difficulties.

This invention presents another means for obviating burning of the heating surface of the transformation zone, and it consists in heating the heating surface (wholly or at least partly) of the transformation zone in a regulable manner by means of a part-current of heating gases branched off from the main current thereof. In this way there is obtained the possibility to regulate in a simple manner the heating of the transformation zone. The heating surface of this zone may be housed, for instance, in a separate space which communicates with the main path of the heating gases for the steam generator, and is supplied with regulable quantities of heating gases branched off from the main heating gas current by means of a conveying device, for instance a fan or the like. The regulation of the amount of the heating gases may be effected in dependence of the state of the steam in the transformation zone, thus, for instance, in dependence of the pressure of the steam or of the temperature of the same, or of the contents of liquid or of moisture in the same, or of the mixture of steam and water respectively, there being then provided devices able to respond to the action of one or the other of said causes and to act, in turn, in an appropriate manner either upon a fan or the like that forms a member of the steam-generating plant, or upon the driving means for the fan etc., viz. upon the engine or motor connected therewith. Another advantage of the invention is that the heating of the transformation zone is to a certain extent independent of the variations of the load on the steam generator itself, as it is possible to control the heating of the transformation zone by means of regulating valves or the like without thereby substantially influencing the heating of the main heating surface. Furthermore, on modifying the heating of the main heating surface the heat-

ing of the conversion zone can, nevertheless, be maintained substantially constant.

The invention is illustrated diagrammatically and by way of example on the accompanying drawing, on which similar numerals denote similar parts. Figure 1 is a vertical section through a tubular continuous-flow steam generator designed according to this invention, and Figure 2 is a similar representation showing a modification. A further modification is illustrated in Figure 3 in a vertical section through a tubular continuous-flow steam generator.

On the drawing, 1 (Fig. 1) denotes a substantially vertical shaft enclosing in its lower portion a tubular coil 2, in which the water is heated to evaporation temperature by a heating device 3 of any suitable type. The water is introduced into the coil 2 through the branch 4, whereas the steam, that is to say, finished superheated steam, is withdrawn from the steam generator through the branch 5. The upper portion of the shaft 1 is subdivided, for instance by a vertical wall 6, into two chambers 7 and 7^a which are located side by side, and of which the one (7) encloses the heating surface 8 of the transformation zone which is, in the example shown, likewise constituted by a tubular coil 8. In this zone the hot water is transformed into steam. There may, anyhow, be housed in the chamber 7 also a part of the superheating surface for the steam produced in the coil 8. The final or complete superheating takes place in the coil 17 located in the chamber 7^a. The amount of heating gases permitted to stream through the chamber 7 can be varied or regulated, for instance by throttle flaps 9 or by equivalent members, the position of which can be made dependent upon the state of the steam in the transformation zone, for instance upon the temperature of the same, there being then provided for this purpose a thermostat (indicated by the dotted line 10) arranged at any suitable place pertaining to the transformation zone. The thermostat may, therefore, be connected up to the coil 8 also at another place than that selected in Fig. 1 merely by way of example. Instead of making the position of the flaps 9 or their equivalents dependent upon the temperature of the steam, it may be made dependent also upon the pressure of the same, or upon the contents of moisture in the same, all as already mentioned in the preceding part of this specification.

The waste heating gases escape through the top 18 of the shaft 1.

In the modification shown in Fig. 2 the heat-

ing coil 8 of the transformation zone is housed in an exterior chamber 11 provided outside the shaft 1 and communicating with the same through an upper passage 12 and a lower passage 13.

The upper passage 12 is combined with a conveying device 14, for instance a fan or the like, by means of which a part of the heating gases is withdrawn from the shaft 1 and driven into the chamber 11, through which it flows in a direction counter to the direction of the steam flowing through the coil 8. The heating gases get back into the shaft at the bottom of the chamber 11 through the passage 13. The regulation of the heating in this chamber is effected in this case by varying the number of revolutions of said fan, or of the motor or engine driving it, the variations being again made dependent upon the temperature or the pressure, etc. of the steam, as has already been described. The device affected by the one or the other of said causes is indicated in Fig. 2 by the dotted line 15. There exists, however, also the possibility to regulate the heating of the zone 8 with the aid of atmospheric air which can be supplied, for instance, through a branch 16 equipped with a regulating flap 18, the position of which may also be made dependent upon the state of the steam, as in the above mentioned cases. Such a device as affected by the state of the steam is indicated in Fig. 2 by the dotted line 21.

The heating gases withdrawn through the branch 12 (Fig. 2) may be conducted selectively to the superheating coil 17 through the passage 13 (Fig. 2) or to the top 19 of the shaft 1 as is shown in Figure 3. In this figure the tubular coil 8 of the transformation zone is located above the passage 12 through which the part-current of the heating-gases is withdrawn from the shaft 1. The passage 13 through which the part-current of the heating-gases escapes into the top 19 of the shaft 1 is arranged in the upper part of the chamber 11. The branched-off gases are flowing in this case in the same direction as the steam flowing through the coil 8. The gases are withdrawn from the shaft as far as possible at a place where their temperature is comparatively low.

I claim:

1. A continuous flow steam generator, comprising a steam generated heating surface, walls defining a main chamber through which the main current of heating gases flows and a second chamber separated from the main chamber, said second chamber enclosing that zone of the heating surface in which the liquid is transformed into steam, means for conducting a portion of the main current of heating gases to said second chamber and leading off the gases therefrom, regulating means responsive to one of the physical properties of the steam for controlling the flow of gases through said conducting means, and means for introducing atmospheric air into said second chamber.

2. A continuous flow steam generator, comprising a steam generating heating surface, walls defining a main chamber through which the main current of heating gases flows and a second chamber separate from the main chamber, means connecting said chambers, said second chamber enclosing that zone of the heating surface in which the liquid is transformed into steam, adjustable regulating means in said connecting means for controlling the flow of a portion of the main stream of heating gases to said

second chamber, said connecting means also including means to return said portion of the heating gases to the main chamber, and means for introducing atmospheric air into said second chamber.

3. A continuous flow steam generator, comprising a steam generating heating surface, walls defining a main chamber through which the main current of heating gases flows and a second chamber separated from the main chamber, said second chamber enclosing that zone of the heating surface in which the liquid is transformed into steam, means for conducting a portion of the main current of heating gases to said second chamber and leading off the gases therefrom, regulating means responsive to one of the physical properties of the steam for controlling the flow of gases through said conducting means, means for introducing atmospheric air into said second chamber, and means responsive to some physical property of the steam to control the flow of said atmospheric air.

4. A continuous flow steam generator, comprising walls defining a passage for the main part of the heating gases, a steam generating heating surface, said passage enclosing the major part of said heating surface, walls defining a second passage, said second passage enclosing that zone of the heating surface in which the liquid is transformed into steam, said second zone being arranged in series with said major part of the heating surface, means for conducting a portion of the main current of heating gases to said second passage and leading off the gases therefrom, and means to regulate the amount of gases passing through said conducting means.

5. A continuous flow steam generator, comprising walls forming a main passage and a second passage, a continuous tube forming a passage for water to be vaporized, said first passage enclosing a portion of the tube and the second passage enclosing that portion in which vaporization takes place, means to conduct a portion of the heating gases from said first passage to said second passage, and means to regulate the flow of gases to said conducting means.

6. A continuous-flow steam generator, comprising a steam generating heating surface, walls defining a main chamber through which the main current of heating gases flows and a second chamber separate from the main chamber, said first chamber enclosing the major part of said heating surface, said second chamber enclosing that zone of the heating surface in which the liquid is transformed into steam, said second zone being arranged in series with said major part of the heating surface, means for conducting a portion of the main current of heating gases to said second chamber and leading off the gases therefrom, and regulating means responsive to one of the physical properties of the steam for controlling the flow of gases through said conducting means.

7. A continuous-flow steam generator, comprising a steam generating heating surface, walls defining a main chamber through which the main current of heating gases flows and a second chamber separate from the main chamber, said first chamber enclosing the major part of said heating surface, said second chamber enclosing that zone of the heating surface in which the liquid is transformed into steam, said second zone being arranged in series with said major part of the heating surface, means for conducting a portion of the main current of heating

gases to said second chamber and leading off the gases therefrom, and adjustable regulating means in said conducting means for controlling the flow of a portion of the main stream of heating gases to said second chamber, said conducting means also including means to return said portion of the heating gases to the main chamber.

8. A continuous-flow steam generator, comprising a steam generating heating surface, walls defining a main chamber through which the main current of heating gases flows and a second chamber separate from the main chamber, said

first chamber enclosing the major part of said heating surface, said second chamber enclosing that zone of the heating surface in which the liquid is transformed into steam, said second zone being arranged in series with said major part of the heating surface, means for conducting a portion of the main current of heating gases to said second chamber and leading off the gases therefrom, and adjustable regulating means in said conducting means controlled by some physical property of the steam.

CHRISTOPH MÜLLER.