Dec. 9, 1930. H. GLEICHMANN 1,784,426

APPARATUS FOR AND METHOD OF GENERATING STEAM

Filed June 4, 1927

Fig. 1

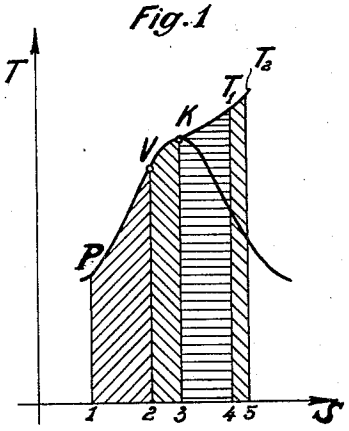


Fig. 2

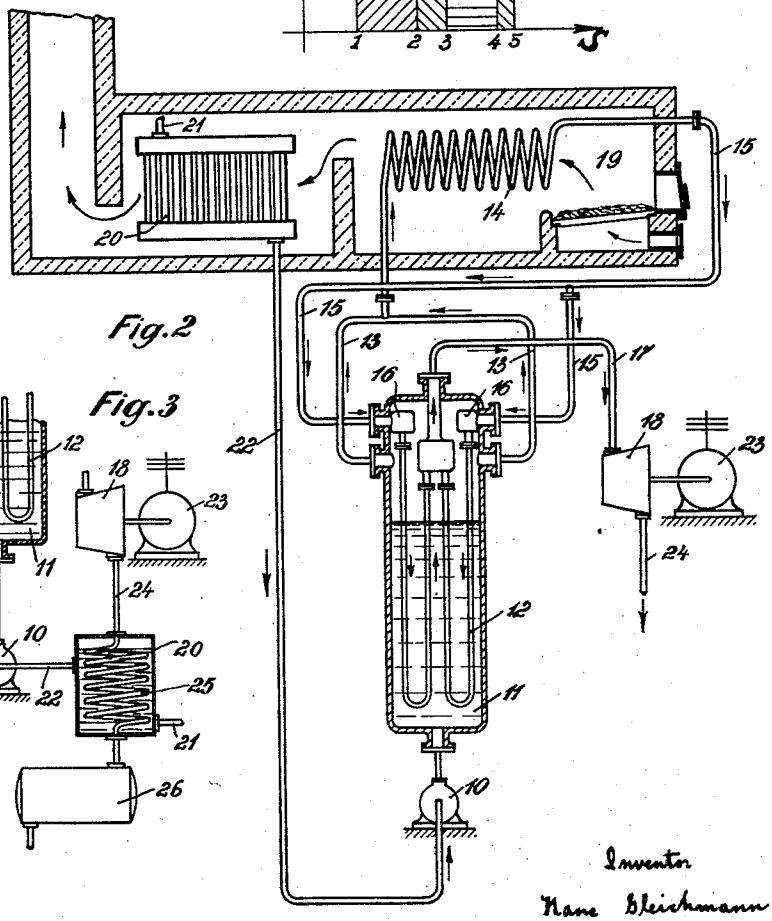


Fig. 3

Inventor
Hans Gleichmann
by Knight Bros
Attorneys

Patented Dec. 9, 1930 1,784,426

UNITED STATES PATENT OFFICE

HANS GLEICHMANN, OF BERLIN-SIEMENSSTADT, GERMANY, ASSIGNOR TO SIEMENS-SCHUCKERTWERKE GESELLSCHAFT MIT BESCHRÄNKTER HAFTUNG, OF BERLIN-SIEMENSSTADT, GERMANY, A CORPORATION OF GERMANY

APPARATUS FOR AND METHOD OF GENERATING STEAM

Application filed June 4, 1927, Serial No. 196,593, and in Germany June 9, 1926.

My invention relates to an apparatus for and a method of generating steam.

My invention consists in highly preheating the working medium by waste heat and then evaporating it by superheating heat, which is withdrawn from the working medium, itself heated beyond the working temperature.

An embodiment of my invention is illustrated by way of example in the drawing affixed hereto.

In the drawings:—

Fig. 1 represents a heat diagram explanatory of the working of my improved process.

Fig. 2 represents an apparatus partly in diagram and partly in vertical section for carrying out my improved process, and

Fig. 3 represents a modification of the apparatus shown in Fig. 2.

Referring to the heat diagram in Fig. 1 of the drawing P denotes the temperature of the water at which it is introduced into the apparatus in which the waste heat is recovered. The waste heat may either be contained in the steam withdrawn (regenerative process), or it may be flue gas heat, or the water may be preheated by steam and flue gases in combination. The preheating is carried as far as possible and reaches its highest point at V. It will now be assumed that the apparatus is already in operation, i. e. that a portion of the working medium is superheated to the point T_2 and that T_1 is the temperature at which the working medium is introduced into the power engine. Before the working medium reaches the power engine it is, according to the invention passed at the temperature T_2 into a heat exchange apparatus in which it heats the water, already preheated to the point V, up to the point K and, since the point K is the critical point, converts it steadily i. e. without ebullition, into steam. The area 2 V K 3 in the diagram should thus be equal to the area 4 T_1 T_2 5. The furnace alone consequently supplies the heat 3 K T_2 5 only.

Referring to Fig. 2 of the drawing, 10 is a pump, 11 a receptacle into which the preheated water is introduced, 12 a heat exchange device consisting of tubes. 13, 15 and 17 are the connecting tubes, 14 is the superheater located in a combustion chamber 19, 20 is a receptacle containing water and being arranged behind the superheater and swept and heated by the flue gases flowing past it, 21 is a feed water supply pipe and 22 a supply pipe to the receptacle 11. 16 are the headers for the tubes 12, 18 is a turbine and 23 an electric generator.

The manner of operation of the apparatus is as follows: the pump 10 conveys the water, highly preheated in the receptacle 20, into the receptacle 11, which is heated by the heat exchange device 12. The steam generated thereby in the receptacle 11 flows through the pipe 13 to a superheater 14 in which it reaches, for instance, the temperature T_2. The superheater 14 is heated in a combustion chamber 19 by means of any suitable fuel, such as coal, pulverized coal or gas. The pipes 15 lead the superheated steam into the headers 16 with which the heat exchange tubes 12 are in communication. In this tubular heat exchange device the temperature of the steam traversing it is lowered to the value T_1 owing to the transfer of heat to the contents of the receptacle 11 and thence the steam at reduced superheating temperature T_1 passes through the live steam pipe 17 to the consumer, for instance the turbine 18, driving the electric generator 23.

Fig. 3 of the drawings, illustrating a modification of the apparatus according to Fig. 2, shows the essential modified parts only. The water receptacle 20 is here not located within the reach of the flue gases of the combustion chamber 19 but a coil 25 traversing it is in communication with a turbine 18 by means of a pipe 24. The exhaust steam of the turbine 18 flows through this coil within the water receptacle 20 and heats the feed water. The preheated water is conveyed in exactly the same manner as in Fig. 2 into the receptacle 11 by means of the pump 10 across the connecting pipe 22.

From the coil 25 the steam may be passed into the condenser 26 and the condensed steam may in its turn be used for feeding the water receptacle 20.

In this apparatus it is possible to use in the combustion chamber superheating sur-

faces only and the further advantage is obtained that the deposits of sludge in the tubes 12 is harmless since these tubes are not exposed to the fire and may easily be cleaned and renewed.

Various changes and modifications may be made without departing from the spirit of my invention and I desire therefore, that only such limitations shall be placed thereon as are imposed by the prior art.

I claim as my invention:

1. An apparatus for generating steam comprising a superheater and means for externally supplying heat to said superheater, a steam generating receptacle located outside of said external heat supply means, and a heat exchange device contained in said receptacle, said exchange device being connected at one end to the output side of said superheater, and at the other end to a steam main, said heat exchange device supplying to the liquid contained in the receptacle all of the heat necessary to evaporate the liquid, and a steam connection between the steam space of said receptacle and the input side of said superheater.

2. The method of indirectly generating vapor used by a consumer, which consists in continually supplying and evaporating a highly preheated liquid operating medium, superheating the vapor generated by direct outside heat supply, and in bringing the superheated vapor into heat transferring contact with the preheated liquid medium before the vapor reaches the consumer, the entire heat necessary for said evaporation being transferred to the preheated liquid medium from the amount of said superheated vapor actually used by the consumer.

3. The method of indirectly generating steam used by a consumer, which consists continually in generating steam under critical conditions from continually supplied water, highly preheated by waste heat, superheating the generated steam by direct outside heat supply and in bringing the superheated steam into heat transferring contact with the preheated water before the steam reaches the consumer, whereby the entire heat necessary for said steam generation is supplied to the preheated water from the amount of said superheated steam actually used by the consumer.

In testimony whereof I affix my signature.

HANS GLEICHMANN.