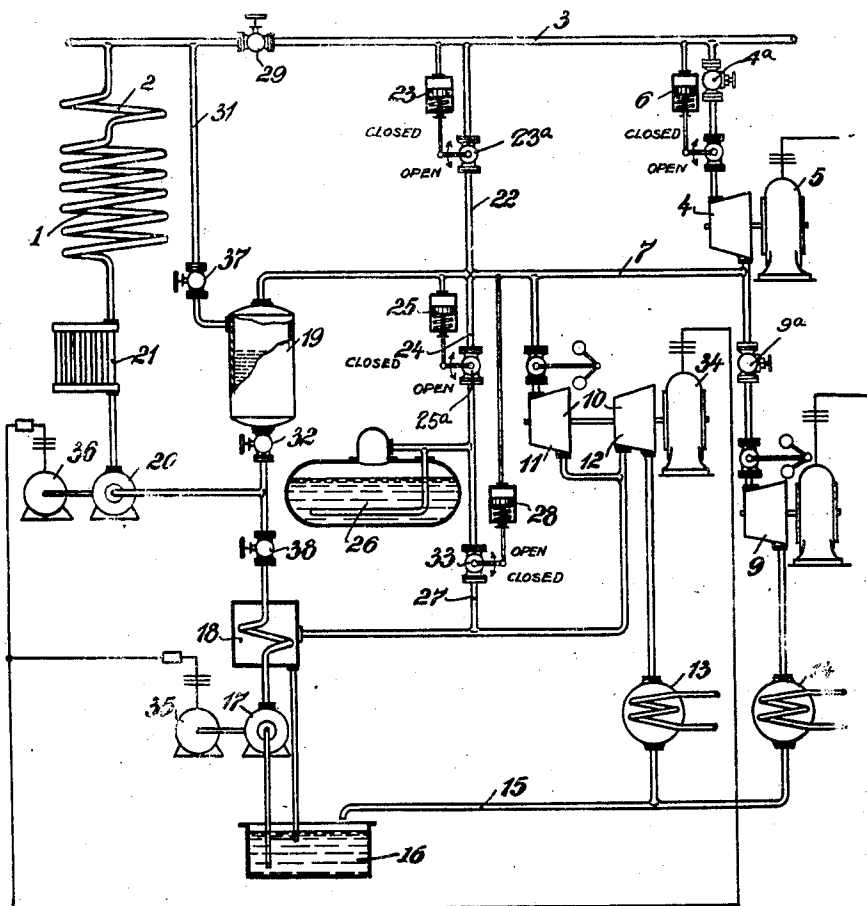


Sept. 17, 1929.

W. STENDER
PROCESS OF UTILIZING THE HEAT OF THE GENERATOR
OF SUPERPRESSURE STEAM GENERATORS
Filed Dec. 1, 1926

1,728,375



Inventor
Waldemar Stender

by Knight B. Attorneys

UNITED STATES PATENT OFFICE

WALDEMAR STENDER, OF BERLIN-CHARLOTTENBURG, GERMANY, ASSIGNOR TO
SIEMENS-SCHUCKERTWERKE GESELLSCHAFT MIT BESCHRANKTER HAFTUNG, OF
BERLIN-SIEMENSSTADT, GERMANY, A CORPORATION OF GERMANY

PROCESS OF UTILIZING THE HEAT OF THE GENERATOR OF SUPERPRESSURE STEAM GENERATORS

Application filed December 1, 1926, Serial No. 151,942, and in Germany December 4, 1925.

My invention relates to a process of utilizing the heat of the generator of super-pressure steam generators.

Super-pressure or maximum pressure steam generators consist substantially of a heated system of pipes and thus possess either a very small water space or none at all. If such a steam generator is stopped a large quantity of heat is stored up in its material which it was impossible heretofore to utilize economically. In order not to endanger the system of pipes by the accumulation of heat after the stoppage of the steam generation, it was hitherto necessary to open an outlet for the steam either into the condenser or through the safety valve into the atmosphere so that circulation of the water within the generator could be maintained. In both cases the quantity of heat which has to be discharged from the boiler is a waste. It is the object of my invention to eliminate this waste and I attain this end in view by continuing to pass water through the generator after the closing of the live steam supply pipe and the stopping of the furnace, but leading this highly heated water into an accumulator until the generator is cooled down.

In the accumulator there is thus at the end of this procedure stored up a certain quantity of heat, which may in an economical manner be utilized for heating up the generator when commencing operations. This is effected in such a way that when taking the generator into service the feed water is first taken from the accumulator only and kept in circulation between the generator and the accumulator until the steam has attained the desired state (pressure, temperature). Only then is the steam service pipe opened. If desired the generator may be fed from the accumulator until the latter is run empty.

The foregoing idea may be still further developed in economical respects in cooperation with a steam regenerative accumulator. If after stoppage of the furnace the water is pumped into the water accumulator a part of the water will turn into steam, since the pressure in the accumulator is preferably kept lower than in the generator. This steam

is first transmitted to the pump driving engine and the excess to a steam regenerative accumulator. When the plant is to be taken into service again the available quantity of steam in the accumulator is so great that the power required for the pump is covered by it.

In the drawing affixed hereto my novel idea is embodied in a practical arrangement or system illustrated diagrammatically.

Referring to this drawing, 1 is a steam generator with a superheater 2 which feeds a live steam pipe 3 leading to the steam engine 4 which drives a dynamo 5. The quantity of steam supplied to the engine 4 by the pipe 3 is regulated in well known manner by means of a throttling valve 6 which operates in dependence from the pressure in the pipe 3. The engine 4 operates as a so-called back-pressure engine upon a back pressure pipe 7 with which are connected the engines 9 and 10. The engine 10 comprises the stages 11 and 12. The exhaust of the engines 9 and 10 is condensed in the condensers 13 and 14, the condensate from which is passed into a feed water well 16 by a pipe 15. A pump 17 withdraws the feed water from the well 16 and forces it into a steam preheater 18 and from it partly into an accumulator 19 whose input side is controlled by a valve 32 and partly to a pump 20 according to the requirements of the steam generator 1. Between the pump 20 and the generator is further connected a flue gas preheater 21. Between the high-pressure and the low-pressure vapour system is provided a connecting pipe 22 which in the event of an excess of steam in the pipe 3 allows steam to flow into the pipe 7 by a pressure responsive device 23 controlling throttle valve 23^a. If the steam consumption of the engines 9 and 10 is less than the volume of steam available in the pipe 7, the surplus steam is passed to a steam accumulator 26 by a pipe 24 in which a throttle valve 25^a, controlled by a pressure responsive device 25 is located. This steam accumulator 26 communicates with the stage 12 of the prime mover 10 by a pipe 27. A control valve 33 controlled by a pressure responsive

device 28 opens a path for the accumulator steam to the stage 12 if the supply from line 7 no longer suffices for covering the power requirement of the two engines 9 and 10.

5 The stopping of the plant according to the present system occurs in the following manner:

Assuming that engines 4 and 9 are stopped by shut off valves 4^a and 9^a, respectively located in their immediate supply line connection, and assuming that the engine 10 supplies the driving power for the feed pumps through the dynamo 34 coupled with it and which supplies the driving motors 35 and 15 36 of the pumps 17 and 20 with current. Assume further that the entire steam supply to main 3 is stopped by closing the main service valve 29, and that the heat supply (not shown) to the generator is discontinued. 20 Valve 32 is now closed and the pumps 17 and 20, still running feed water into the generator 1 which water becomes heated to quite a high temperature due to the heat stored in the boiler and thus removes the 25 heat from the boiler. The water accumulator 19 is connected with the pipe 3 by a pipe 31 controlled by a valve 37 and receives this way the water forced by the pump through the boiler. The valve 32 remains closed during the stopping process, while valve 37 in 30 pipe 31 is opened. The steam expelled from the water in the accumulator 19 enters the pipe 7 and continues to drive the engine 10. If the quantity of steam issuing from the accumulator 19 is larger than the requirement 35 of the engine 10 the surplus is conveyed to the accumulator 26 by way of valve 25^a. If the volume of steam issuing from the accumulator 19 does no longer suffice for driving the engine 10, the pressure responsive device 40 28 opens the valve 33 and allows steam to flow from the accumulator 26 to stage 12 of the engine 10. The accumulator 19 should be so dimensioned that it is able to hold the 45 quantity of water necessary for cooling the generator.

The starting of the steam generator is effected in the following manner: The valves 29 and 38 remain closed while the valve 32 50 is now also opened. The pressure in pipe 7 being probably then quite low, valve 33 opens and stage 12 of the engine 10 consequently receives steam from the steam accumulator 26 and starts. The cold water pump 17 is 55 still assumed to be inoperative, while the pump 20 commences to run and withdraws water from the water accumulator 19, which it circulates between the generator 1 and the accumulator 19 until the water has attained 60 the necessary temperature and required pressure. As soon as the desired condition of the steam has been obtained, the valves 29 and 38 are opened while valve 37 is closed and the normal service commences.

65 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 placed thereon as are imposed by the prior art.

I claim as my invention:

1. In a steam power plant in combination with a steam generator consisting substantially of a heated pipe system, a service steam pipe and consumers connected to the 75 output side of said generator, and a feed water supply means connected to the input side of the generator, and a main valve in the service pipe for cutting off the steam from the consumers, of a pipe circuit containing a hot feed water accumulator and 80 being connected in parallel to the output side of the generator and the input side of said feed water supply, and valves suitably disposed in said circuit for permitting a 85 fresh feed water supply through the generator into said accumulator when the operation of the generator is discontinued, to transfer the heat stored in the generator pipes into said accumulator. 90

2. In a steam power plant in combination with a steam generator consisting substantially of a heated pipe system, a service steam pipe and consumers connected to the 95 output side of said generator, and a feed water supply means connected to the input side of the generator, and a main valve in the service pipe for cutting off the steam from the consumers, of a pipe circuit containing a hot feed water accumulator, and 100 being connected in parallel to the output side of the generator and the input side of said feed water supply, and a valve disposed at each end of said hot water accumulator for permitting the feed water supply 105 means to deliver fresh feed water through the generator into said accumulator when the consumers steam supply has been cut off, and when the operation of the generator is discontinued to transfer the heat 110 stored in the generator pipes into the feed water delivered into said accumulator, and to permit circulation of heated feed water between the accumulator and said generator by said supply means when the generator operation is resumed and before the consumers steam supply is restored, and means 115 for cutting off the fresh feed water during said circulation period.

3. In a steam power plant in combination 120 with a steam generator consisting substantially of a heated pipe system, a service steam pipe connected with the output side of said generator for feeding steam to consumers including a back pressure engine, 125 and a main valve in the service pipe for cutting off the steam from the consumers, a secondary steam supply system connected with the exhaust side of said engine, a prime mover supplied by said secondary system 130

and a steam regenerative accumulator connected with said secondary system to receive the surplus steam not consumed in said secondary system, and a feed water pump connected to the input side of said steam generator and being operated by said prime mover, of a pipe circuit, containing a hot feed water accumulator and being connected in parallel to the generator output side and the feed water pump intake side, valves suitably disposed in said circuit for permitting the feed water pump to deliver fresh feed water through the generator into said accumulator when the consumers steam supply has been cut off and when the operation of the generator is discontinued, to transfer the heat stored in the generator pipes into the feed water delivered into said accumulator, and a pipe connection between the upper portion of said water accumulator and said secondary steam supply system to deliver any steam developed during the heat storage in said water accumulator into said secondary system, said prime mover being operated during said heat transfer from the generator jointly by the steam developed in said water accumulator and the steam stored in said steam accumulator, and suitable pipe connection between said steam accumulator and said prime mover and control means in said connection for permitting the operation of said prime mover from said steam accumulator during said resumption period of the generator operation and during said hot water circulation period.

In testimony whereof I affix my signature.

WALDEMAR STENDER.

4. In a steam power plant in combination with a steam generator consisting substantially of a heated pipe system, a service steam pipe connected with the output side of said generator for feeding steam to consumers including a back pressure engine, and a main valve in the service pipe for cutting off the steam from the consumers, a secondary steam supply system connected with the exhaust side of said engine, a prime mover supplied by said secondary system and a steam regenerative accumulator connected with said secondary system to receive the surplus steam not consumed in said secondary system, and a feed water pump connected to the input side of said steam generator and being operated by said prime mover, of a pipe circuit, containing a hot feed water accumulator and being connected in parallel to the generator output side and the feed water pump intake side, valves suitably disposed in said circuit for permitting the feed water pump to deliver fresh feed water through the generator into said accumulator when the consumers steam supply has been cut off and when the operation of the generator is discontinued, to transfer the heat stored in the generator pipes into the feed water delivered into said accumulator, said valves also permitting circulation of hot feed water between the water accumulator and said generator by said supply pump when the generator operation is resumed, means for cutting off the fresh feed water supply during said circulation period, and a pipe connection between the upper portion of said water accumulator and said second-