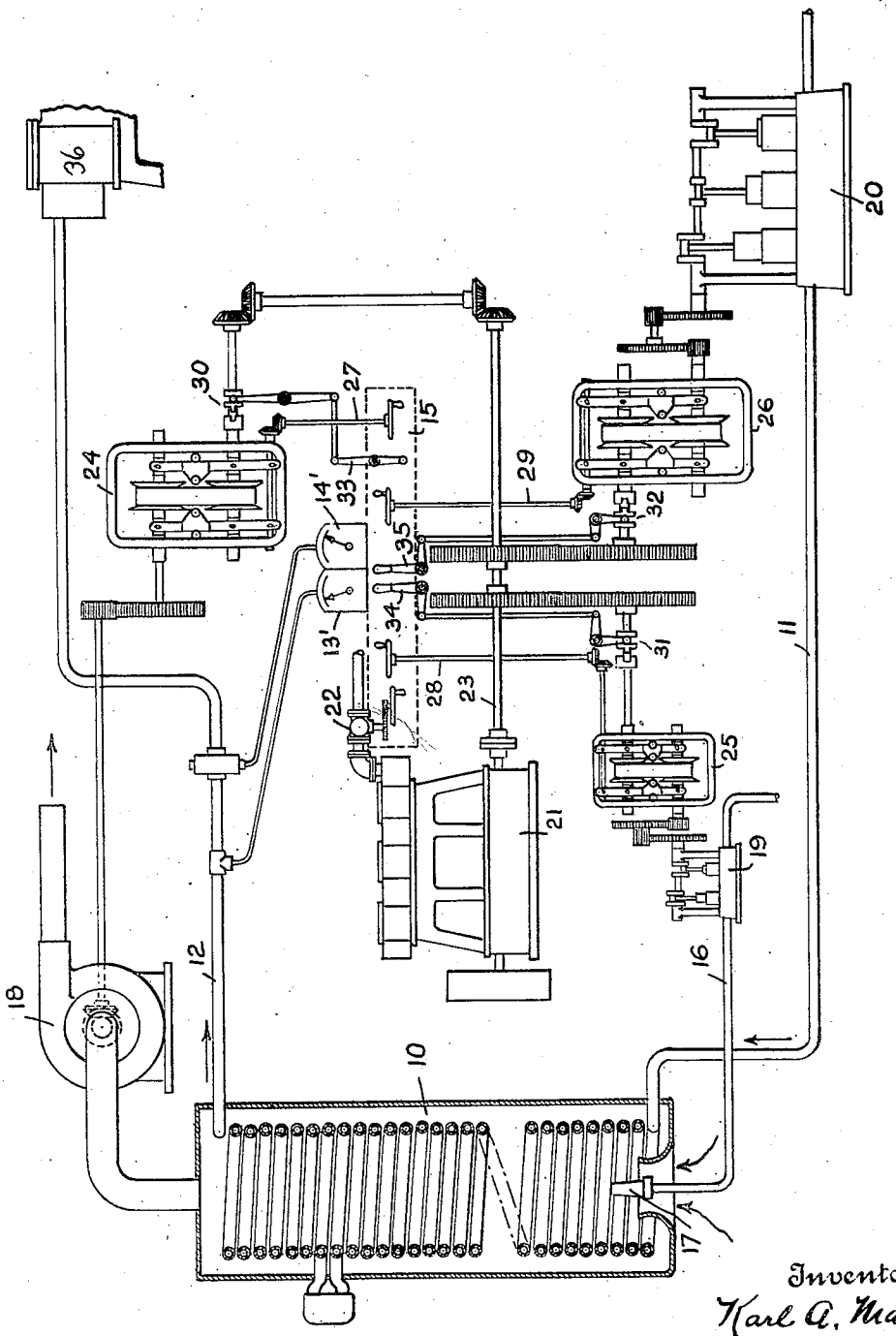
Aug. 18, 1931. K. A. MAYR 1,819,186

STEAM GENERATING SYSTEM

Filed Dec. 14, 1927



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Patented Aug. 18, 1931 1,819,186

UNITED STATES PATENT OFFICE

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STEAM GENERATING SYSTEM

Application filed December 14, 1927. Serial No. 239,869.

This invention relates to improvements in steam generators and in methods and means for supplying and controlling the supply of fuel, feed water and air to a steam generating system. While the present invention has particular utility for use with steam generating systems having boilers with a small water, steam or heat storage capacity as compared with the output of the boiler, the invention is not limited to use in steam generating systems with such kinds of boilers, but is adaptable for other boilers as well. It, however, has particular merit when used in steam generating systems wherein the boiler has low storage capacity.

In so-called flash types of boilers, the water flows through a heated pipe system and is therein converted into steam. Generally the steam output of such a type of boiler is high compared with its steam or steam and water storage capacity and accordingly, with such types of boilers, the steam output is equal or almost equal to the feed water input. Practically no reserve is kept in the boiler, but water is generated into steam at a rate which is substantially equal to the rate of the feed water supply. For generating stem, the boiler must be supplied with feed water and a heating material or heating medium must also be supplied to convert the water into steam. Any suitable heating material or heating medium may be used but as herein shown by way of illustration, such material includes a supply of fuel and a supply of air to support combustion to thereby obtain the heating material or medium. The fuel may be any desired fuel but for purposes of illustration, the present invention is shown in connection with an oil fuel system.

Assuming constant feed water temperature conditions and constant steam conditions, viz. constant pressure and temperature, a boiler will require a certain amount of heating material to generate a given quantity of steam in a certain unit of time. To generate more steam in the same unit of time requires a proportionately greater feed water supply and a proportionately greater supply of heating material. The proportion of feed water to heating material will remain substantially constant, provided the temperature or heat content of the feed water per weight unit remains the same and provided the heating value of the fuel and the heat content of the air for combustion (i. e. heat content of heating material) remains constant. Accordingly, for operation of boilers with variable steam outputs, to increase the steam generation, it is only necessary that the supply of feed water be increased and that the supply of heating material be increased in proper and related proportion.

However, operating conditions of steam generating systems are not always constant as above set forth. The initial heat content of the feed water may be a variable one, the heating value of the heating medium may be variable, the boiler efficiency may vary according to the output, the condition of the boiler as to soot, scale, etc. may vary, and for starting up the boiler a great excess supply of heating material over the supply of water may be temporarily required.

The present invention is directed to the provision of a system and apparatus for supplying feed water and heating material to a boiler in such a manner that steam may be generated in the boiler and to provide for the substantial maintaining of the relative proportion of feed water and heating material while permitting variable outputs of steam. This is effected by increasing and decreasing the supply of feed water and heating material conjointly, automatically and in maintained proportion to each other and in proportion to the desired output of the prime mover.

To provide for the variable factors which are encountered in practice, provision is made for permitting a variation in the relative proportion of feed water and heating material. It will be understood that while such variation may be attained as desired, the proportions once determined and set will be automatically maintained for other and variable outputs, or if desired, subsequent changes in the proportions can be made at any time by the operator. In short, a number of supplying instrumentalities are provided for automatically introducing feed

water, fuel and air. Provision is made for varying the rate of operation of any of the instrumentalities, independently of the others, to supply feed water, fuel and air in the proportions desired by the operator, and then provision is made for operating all of the instrumentalities automatically and conjointly to maintain that proportion until again changed by the operator. Furthermore, the rate of conjoint operation can be controlled in accordance with a given factor, such as energy demand or steam output of the steam generating system.

Other objects and advantages will be hereinafter set forth in the accompanying specification and claims and shown in the drawing, which shows by way of illustration a somewhat diagrammatic representation of one embodiment of my invention.

In the drawing, 10 is a steam generator which may be of any desired type, but which is here shown as a flash type with a suitable conduit system to receive feed water from a feed water inlet pipe 11 and which is adapted to generate and deliver steam to outlet pipe 12, which leads to the steam consumer shown at 36. To show at all times, the steam outlet pressure and temperature suitable pressure and temperature gages 13′ and 14′ may be provided which are preferably mounted on the control board 15. These gages are suitably controlled in accordance with the pressure and temperature of the steam in outlet pipe 12. Heating material is supplied to the boiler in any desired manner and in the disclosed embodiment provision is made for supplying oil fuel through pipe 16 to nozzle or burner 17.

The air for supporting combustion can be supplied in any manner and as here shown, a fan 18 acts as an air supplying means by exhausting the products of combustion and excess air to a stack (not shown) and inducing a flow of air into the boiler. The volume or amount of air which is supplied by induction obviously can be varied by controlling the speed of the fan. Taking the variable resistance of the boiler at variable gas flows into account the amount of gas or air flow will be closely proportional to the speed of the fan.

For supplying fuel through pipe 16 to the boiler, a fuel pump 19 is provided and in the present embodiment it is contemplated that the quantity of fuel which is supplied will be proportional to the speed of the pump. The details of the fuel burner system forms the subject matter of my co-pending application, Serial No. 240,657, filed Dec. 17, 1927.

To supply feed water, a pump 20 is provided which delivers the feed water in amounts proportional to the speed of drive, to the steam generator through pipe 11. 21 is any suitable source of power for driving the fan and the two feed pumps. It is here shown as a steam engine with a throttle valve 22 which may be manually manipulated for controlling its speed. The throttle valve 22 is preferably disposed on the control board 15. The engine or other source of motive power drives a shaft 23. Drive of the feed water pump, the oil feed pump and the fan is through suitable gearing and shafting and in each driving train is disposed a speed changing mechanism which may be of any desired type. The three speed changing mechanisms here shown at 24, 25 and 26 are of the continuously variable pulley type and each may be controlled from the distant control board 15 by independent control mechanisms 27, 28 and 29.

To provide for completely disconnecting any supply means from the drive shaft, separate clutches 30, 31 and 32 may be provided, which clutches may also be controlled from the control board by suitable levers 33, 34 and 35.

In practice one of the continuously variable speed transmissions may be omitted and control of the corresponding supply unit may then be effected by the control of the main drive. By the arrangement shown a steam generating system is provided in which heating material and feed water can be supplied in proportional amounts and the proportion can be maintained for variable steam output conditions or this proportion can be varied at the will of the operator. The system furthermore provides for independent variation of fuel, air and feed water.

In operation of this system the operator may set the throttle valve 22 of the main driving engine 21 for the supplying means for a speed which secures the desired output. He can observe the steam pressure and temperature gages and then set the variable gearing so that the proportions are such that steam of the desired pressure and temperature is produced. Then as energy demands vary the main throttle valve 22 only need be manipulated. The operator at any time may make slight variations in the ratio to meet any operating conditions which may be encountered. The general interrelation of supply will be self-maintained irrespective of total steam output, but flexibility or readjustment may be secured whenever desired.

For starting up the clutches may be manipulated. For example in starting up, the drive of the water feed pump may be either slowed up or disengaged altogether by the clutch and a great excess of heating material may be temporarily supplied.

With some steam plants the entire control of steam delivered to a consumer may be secured by merely manipulating valve 22. Such a system of control is particularly valuable with comparatively small plants, such as steam motor cars or locomotives or the like. My invention however, while contem-

plating such mode of operation is not limited thereto.

What I claim is:

1. A method of controlling the quantity of steam supplied to consuming means in a steam power plant, which comprises supplying all the steam which is produced by the generator to the consuming means, and in regulating the input of steam to the consuming means wholly by conjointly controlling the feed water and heating material which is supplied to the generator.

2. The method of controlling the quantity of steam supplied to steam consumer means by a steam generator which comprises wholly controlling the steam supply by regulating and coordinating the supply of feed water and the supply of heating material for the steam generator.

3. The method of controlling the quantity of steam supplied to a consuming means which utilizes the entire generator output which comprises wholly regulating the steam supply to the consumer by controlling the feed water input and the heating material supply to the steam generator, and in coordinating the supply of feed water to the supply of heating material.

In testimony whereof I hereto affix my signature.

KARL A. MAYR.