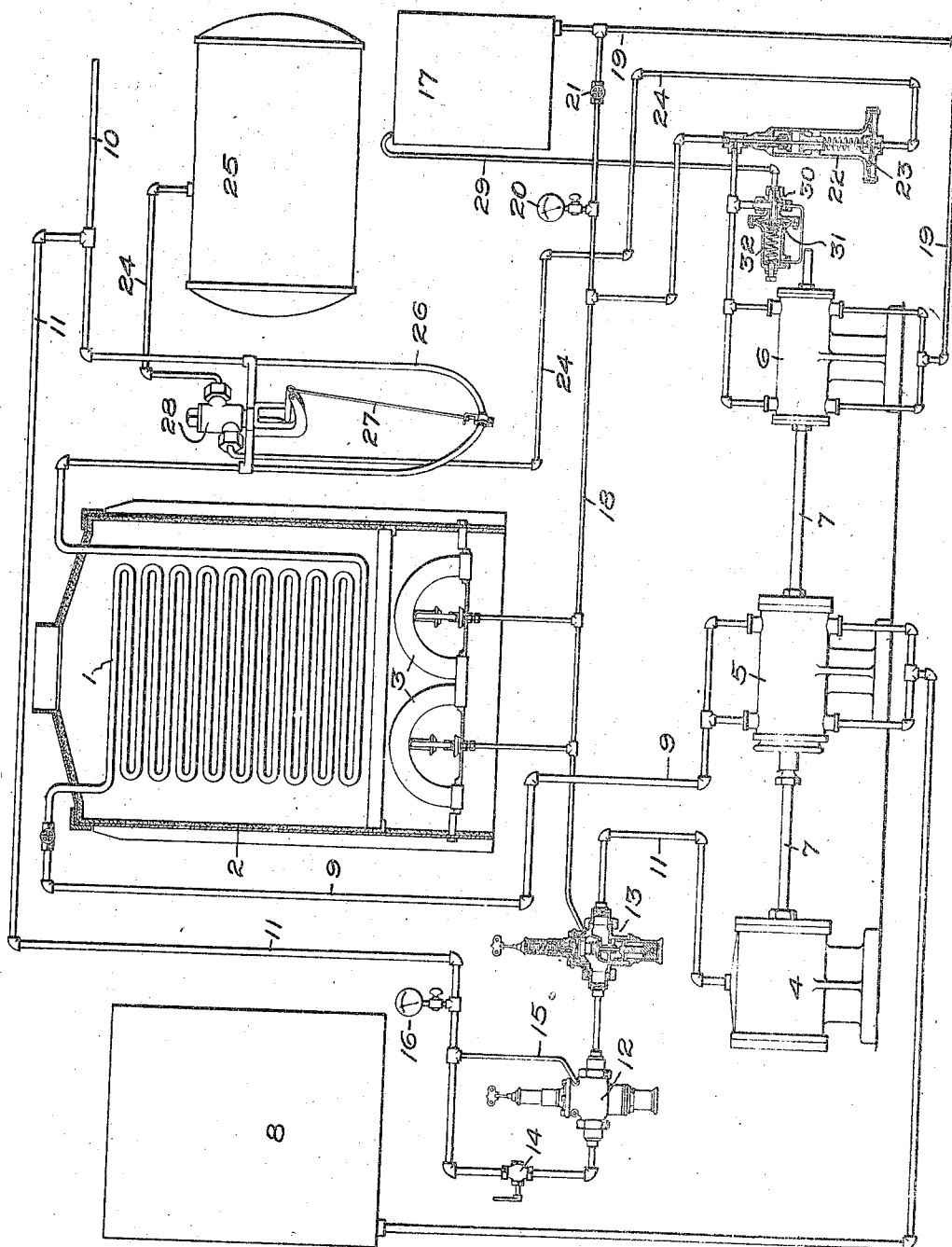


H. LEMP.
 SYSTEM OF FUEL AND WATER SUPPLY FOR BOILERS.
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Witnesses:
J. Earl Ryan
J. Ellis Allen

Inventor,
 Hermann Lemp,
 By *Albert Davis*
 Atty.

UNITED STATES PATENT OFFICE.

HERMANN LEMP, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

SYSTEM OF FUEL AND WATER SUPPLY FOR BOILERS.

994,940.

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To all whom it may concern:

Be it known that I, HERMANN LEMP, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Systems of Fuel and Water Supply for Boilers, of which the following is a specification.

This invention relates to that class of steam generators known as semi-flash boilers, and its object is to regulate automatically the supply of fuel and water in order that the steam pressure may be kept at or near a constant value. The fuel used is ordinarily a liquid hydrocarbon, and this and the feed water are usually supplied to the burner and the boiler respectively by means of pumps. Sometimes pneumatic pressure is substituted for the pump to force the liquid fuel from its reservoir to the burner. It is necessary to regulate very carefully the quantities of fuel and water in order that the boiler may at all times meet the varying demand for steam and maintain a pressure which departs as little as possible from a predetermined normal value. It has been heretofore proposed to accomplish this result automatically in a variety of ways, some of which depend upon the pressure of the steam and some upon its temperature. In the present application I make use of both of these agencies, as will hereinafter appear. Briefly stated, the water feeds by gravity to a pump which forces it into the boiler. The fuel is fed by gravity to the burners, but an additional supply under pressure is provided by a pump. Both pumps are steam-actuated, preferably by a single cylinder, and the supply of steam to said cylinder is governed by two pressure regulators, one responsive to the pressure of the steam and the other to the pressure of the fuel. The fuel supply is governed by a pressure regulator responsive to pneumatic pressure, and said pressure is controlled by a thermostatic valve responsive to the temperature of the steam.

The accompanying drawing is a diagram of parts and connections illustrating my system.

The boiler is conventionally represented as a zigzag coil of pipe 1 inclosed in a casing 2 lined with heat-resisting material. The casing extends below the coil to form a fire chamber in which are burners 3 of any ap-

proved design capable of vaporizing and burning liquid fuel. The pump for supplying fuel and water to this boiler is preferably one in which the steam cylinder 4, water cylinder 5 and oil cylinder 6 are arranged in tandem, with a common piston rod 7. Water is taken from a tank 8, feeding preferably by gravity to the pump 5, which delivers it through a pipe 9 to the upper end of the boiler. Steam is taken from the lower end of the boiler by a main 10 to the engine or other device for utilizing it. A branch main 11 supplies steam to the pump-cylinder 4. Two pressure regulators 12 13, of any approved design, are interpolated in this branch steam main, in series, located between the cylinder 4 and the throttle valve 14. The regulator 12 is controlled by the pressure of the steam in the main before it reaches the throttle, connection being made by means of a small pipe 15. The pressure in the main is shown by a gage 16.

Liquid fuel is contained in a reservoir 17 from which it can flow by gravity through a pipe 18 to the burners 3. A branch pipe 19 feeds fuel to the oil-pump 6 which delivers it into the pipe 18 under considerable pressure which is indicated by a gage 20. A check valve 21 prevents the oil from returning to the reservoir. The pipe 18 connects also with the steam regulator 13. The flow of oil is automatically regulated by a pressure regulator 22, whose movable abutment 23 is responsive to the pressure of elastic fluid in a pipe 24 leading from a suitable source of supply. If compressed air is used, it is confined in a drum 25, and its admission to the regulator 22 is controlled by a thermostat responsive to the temperature of the steam in the main 10. In the drawing, the thermostat consists of a loop 26 of the main itself which is connected by a cord or rod 27 with the operating lever of a valve 28 controlling the air pipe 24.

In order to relieve the oil pump when the delivery is closed or throttled by the regulator 22, a bypass 29 is provided to conduct the liquid fuel back to the reservoir 17. The bypass is normally closed by a relief-valve 30, attached to an abutment 31 which is exposed to the oil pressure. An adjustable spring 32 holds the valve closed against the normal pressure of the oil, but permits it to open when that pressure is exceeded.

The steam cylinder is so proportioned that it will pump water against a back-pressure in the boiler, preferably one which is twice that of the steam pressure. The water and oil pumps are so proportioned that their deliveries are in a fixed ratio of about twelve to one by weight. This gives a trifle more than the correct proportion of oil.

The throttle will be so adjusted as to regulate the speed of the pump to correspond with the normal working conditions. If then the steam main 10 should be closed, the rise in steam pressure in the boiler will operate the regulator 12 and shut down the pump, thereby stopping the water and oil supply. When the pressure falls again, owing either to the stopping of the oil feed, or to reopening of the steam main 10, the regulator 12 will start the pump again. If the oil pressure should be greater than the burners can take care of, the increased pressure will operate the regulator 13 to stop the pump until said pressure falls to normal. For instance, if the water supply should fail, the pump would speed up, but the increased oil pressure would soon stop it. In case the boiler becomes over-heated, superheating the steam to a dangerous degree, the thermostat admits air pressure to the regulator 22 which shuts off the forced flow of oil to the burners and thereby reduces the fire; the oil meanwhile returning to the reservoir through the bypass.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. The combination with a boiler, of a burner therefor, a steam pump for supplying water to said boiler and liquid fuel under pressure to said burner, means for controlling said pump by an abnormal rise either in steam pressure or fuel pressure, means responsive to an abnormal rise in temperature of the steam for controlling the flow of fuel to the burner, and a by-pass for the fuel portion of the pump which becomes operative under certain fuel pressure conditions.

2. The combination with a boiler, of a burner therefor, a steam pump for supplying water to said boiler and liquid fuel under pressure to said burner, two pressure regulators independently controlling the supply of steam to said pump, one responsive to rise in boiler pressure and the other responsive to rise in fuel pressure, a thermostat responsive to changes in tempera-

ture of the steam for controlling the supply of fuel to the burner, a by-pass for the fuel portion of the pump, and a device in said by-pass for controlling the flow there-through which is responsive to the pressure of the fuel.

3. The combination with a boiler, of a burner therefor, a steam pump adapted to supply proper proportions of water and liquid fuel, means for governing said pump by boiler pressure and fuel pressure, means for controlling the supply of fuel by the temperature of the steam, and a by-pass for the fuel portion of the pump which becomes operative under certain fuel pressure conditions.

4. The combination with a boiler, of a burner therefor, a steam pump adapted to supply proper proportions of water and liquid fuel, means for automatically governing said pump, a thermostat responsive to changes in the temperature of the steam and controlling the flow of fuel to the burner, and a by-pass for the fuel end of the pump which becomes operative under certain conditions of fuel pressure.

5. The combination with a boiler, of a burner therefor, a steam pump adapted to supply proper proportions of water and liquid fuel, means for automatically governing said pump, a pressure regulator controlling the flow of liquid fuel, a source of elastic fluid pressure, and a thermostat responsive to changes in the temperature of the steam and controlling the admission of elastic fluid pressure to said regulator.

6. The combination with a boiler, of a burner therefor, a steam pump adapted to supply proper proportions of water and liquid fuel, a thermostat responsive to changes in the temperature of the steam and controlling the flow of fuel, a by-pass for the fuel end of the pump which becomes operative when the supply of fuel to the burner is interrupted by the action of the thermostat, and a pressure regulator responsive to changes of pressure of said fuel and controlling the supply of steam to said pump.

7. The combination with a boiler, of a burner therefor, a steam pump adapted to supply proper proportions of water and liquid fuel, a pressure regulator for controlling the flow of fuel, a source of air under pressure, a thermostat responsive to changes in the temperature of the steam which controls the admission of air pressure to the regulator, and steam-pressure and fuel-pressure devices controlling said pump.

8. The combination with a boiler, of a burner for heating the boiler, a steam pump for supplying water to the boiler and liquid fuel under pressure to the burner, means for governing the pump by boiler pressure and by fuel pressure, a pressure regulator for controlling the flow of fuel to the burner, a

source of air under pressure, and a thermostat responsive to changes in the temperature of the steam which controls the admission of air under pressure to said regulator.

5 9. The combination with a boiler, of a burner therefor, means for supplying water and fuel in suitable proportions to the boiler and burner, a source of elastic fluid under pressure, a pressure actuated regulator for
10 controlling the supply of fuel to the burner, and a thermostat responsive to changes in the temperature of the steam for controlling the admission of elastic fluid from said source to said regulator.

15 10. In a system of fuel and water supply for a boiler, a source of elastic fluid under pressure, means for controlling the supply of fuel by the temperature of the steam, said means including a device which is actuated
20 by the pressure fluid, and means for control-

ling both the fuel and water by the pressure of the steam.

11. The combination with boiler heated by liquid fuel, of a steam main leading therefrom, a steam pump for supplying the boiler with liquid, said pump being connected with the steam main, a pressure actuated regulator for controlling the supply of fuel to the boiler, a source of elastic fluid under pressure, and a thermostat for controlling
25 the application of said pressure fluid to the regulator comprising a section of the steam main between the boiler and the pump.

In witness whereof, I have hereunto set my hand this second day of August, 1907.

HERMANN LEMP.

Witnesses:

JOHN A. McMANUS, Jr.,
HENRY O. WESTENDARF.