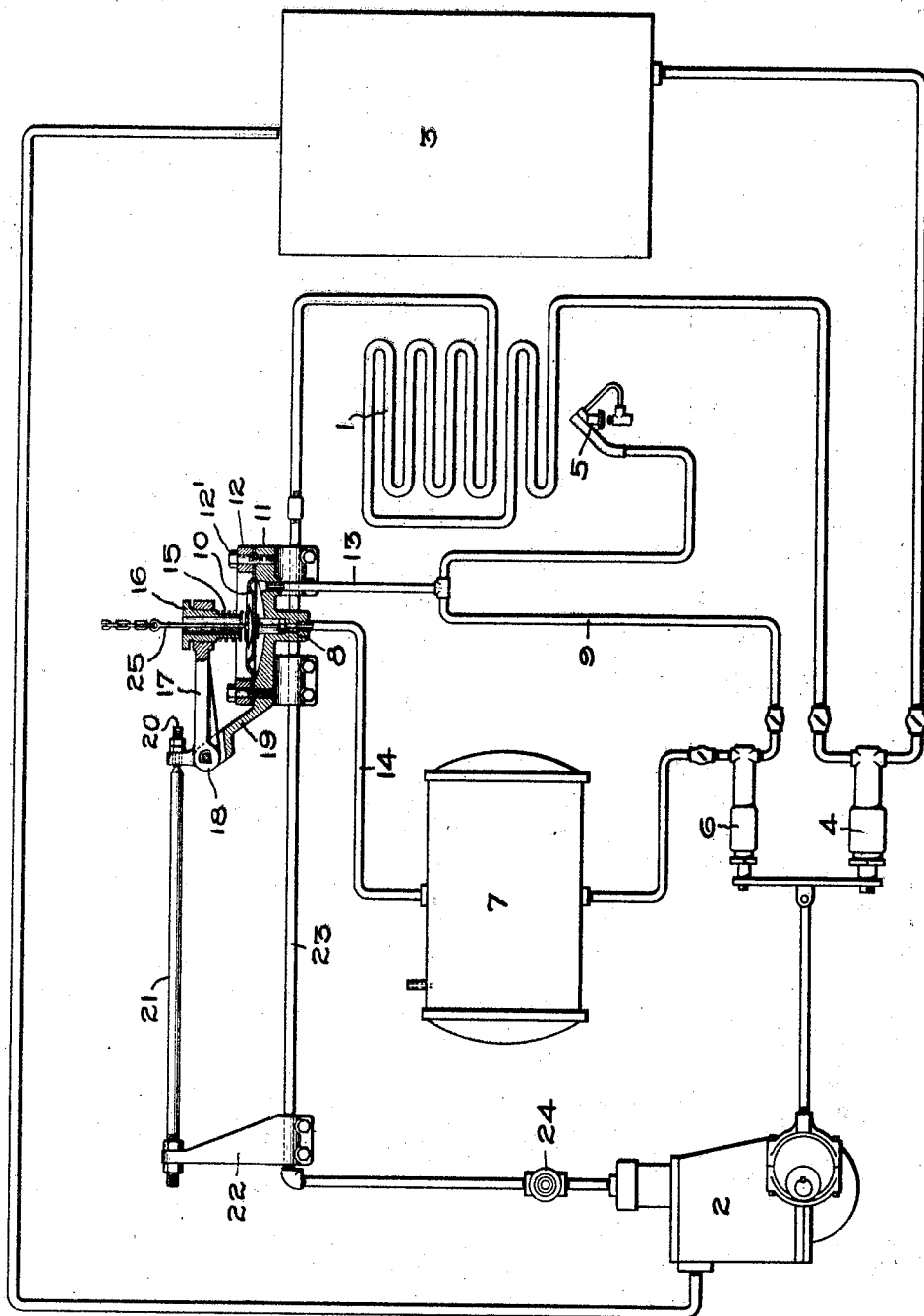


J. G. CALLAN.  
THERMOSTATIC CONTROL OF LIQUID FUELS  
APPLICATION FILED SEPT. 14, 1908.

1,063,654.

Patented June 3, 1913.



Witnesses:

*Benjamin B. Hume*  
*Margaret E. Hoolley*

Inventor,

John G. Callan

By *Alfred D. Davis*  
Att'y.

# UNITED STATES PATENT OFFICE.

JOHN G. CALLAN, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

## THERMOSTATIC CONTROL OF LIQUID FUELS.

1,063,654.

Specification of Letters Patent.

Patented June 3, 1913.

Application filed September 14, 1908. Serial No. 452,923.

*To all whom it may concern:*

Be it known that I, JOHN G. CALLAN, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Thermostatic Control of Liquid Fuels, of which the following is a specification.

This invention relates to systems of liquid fuel supply for vapor generators, especially those known as "coil" or "flash" boilers. The maintenance of a sufficient supply of steam from such a boiler under varying conditions of load is a difficult problem, upon which there has been spent a great deal of thought and experiment.

My invention aims to regulate the output of such a boiler by automatically varying the pressure of the liquid fuel at the burner in accordance with the variations in the temperature of the steam; decreasing said pressure as the temperature rises, and vice versa. By thus varying the pressure, the delivery of liquid fuel at the burner will vary accordingly, irrespective of the speed of the pump within certain limits. In other words, a given temperature of the steam determines a certain normal pressure of fuel at the burner, which can not be exceeded, but will be exactly maintained so long as the pump delivers a sufficiency or a surplus of fuel, regardless of high or low pump speed, or of long or short pump stroke. If the steam temperature rises above the normal, the fuel pressure will be decreased, to cause a smaller delivery, and effect a consequent restoration of the normal steam temperature. If the speed of the pump becomes excessive, the increased pressure of fuel will be relieved automatically and thus avoid the danger of a greater generation of vapor.

The accompanying drawing is a diagrammatic representation of a system of fuel supply embodying my invention.

The coil boiler 1 supplies steam to an engine 2 or other load device. Water is supplied to the boiler from a tank 3 by means of a pump 4. Liquid fuel, preferably a hydrocarbon oil, is supplied under pressure to the burner 5 by means of a pump 6, drawing from a reservoir 7. Both pumps are driven by the engine, as shown. A valve 8 is arranged in a by-pass leading from the oil delivery pipe 9 around the

pump and back to the reservoir 7. The by-pass valve is attached to a movable abutment, preferably a diaphragm 10, suitably secured on the valve-casing 11 by a clamping ring 12 and screws 12'. The diaphragm is exposed on its inner side to the fuel pump pressure of the liquid through the by-pass pipe 13 leading from the delivery pipe 9 to the casing 11. The valve controls the admission of oil from the casing to the return pipe 14 running to the reservoir 7. A spring 15 exerts a constant pressure on the outside of the diaphragm in opposition to the pressure of the oil. It will be seen that so long as the spring pressure balances the pressure on the under side of the diaphragm, (which can be found in a manner well known to those skilled in the art by multiplying the oil pressure per square inch by the diaphragm area in square inches and by a constant) all the oil delivered by the pump will go to the burner, and this will produce the generation of a certain volume of steam at a predetermined temperature. In case the steam is not used as fast as it is generated, its temperature will rise, and I utilize this rise in temperature to effect an automatic opening of the by-pass valve and a consequent diminution of the quantity of oil supplied to the burner, whereby the generation of steam is reduced below normal. It is evident that if the tension of the spring is reduced, the oil pressure will overbalance it and open the by-pass valve at a pressure lower than before. To render it possible to vary the spring tension, its upper end abuts against a tubular nut 16 carried in the end of the long arm of an elbow lever 17 which is fulcrumed at 18 in a bracket 19 projecting from the valve casing 11. The short arm of the lever carries a bearing, preferably an adjustable screw 20, for one end of a strut 21 whose other end is fixed in a standard 22. Both the standard and the valve casing are mounted a suitable distance apart on a length of the steam main 23 between the generator 1 and the throttle valve 24 of the engine, so that this portion of said main is always filled with live steam. The strut 21 is made of 35% nickel steel or some other material which has a low coefficient of expansion under heat relatively to that of the steam main. If desired said main may be lagged. The parts are so adjusted that

at a predetermined steam temperature, and any given output, the strut keeps the lever and nut in a position to maintain such compression on the spring as will hold a burner pressure adapted to maintain that rate of vaporization and output. But an excess of temperature in the steam will cause the steam main to become hotter and to lengthen by expansion, thereby withdrawing the strut and relieving the compression on the spring; whereupon the desired reduction in the oil supply takes place in the manner above set forth. Moreover, if the load on the engine is lessened so that it speeds up, the increased fuel pressure, due to the acceleration in the speed of the pump, will overbalance the spring and cause the by-pass valve to open and relieve this abnormal fuel pressure. A rod 25 is attached to the diaphragm or to the lower end of the spring and passes up through the tubular nut, to afford a means for reducing the spring pressure and checking the fire by hand, when desired, or to clear the by-pass of dirt.

It will be seen that since lengthening of the portion, 23, of the steam pipe, which can be effected only by increase of temperature, is required to reduce burner pressure, it follows that the steam temperature will be slightly higher for small evaporation rates than for larger ones. This is desirable rather than objectionable, since the radiation of the piping and engine, which are constant, should for best results be supplied by superheat in the steam, hence when a smaller amount of steam is used, a higher degree of superheat should be employed to supply this constant loss.

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 vapor generator, of a burner for heating the generator, means for supplying the burner with liquid fuel under pressure, an abutment movable in one direction in response to the pressure of the fuel and adapted to vary said pressure, means which opposes said movement of the abutment, and a device responsive to the temperature of the vapor generated which varies the action of said means on the abutment to thereby control the fuel pressure at the burner.

2. The combination with a vapor generator, of a burner, means for supplying said burner with liquid fuel under pressure, a spring-pressed movable abutment exposed to said pressure and adapted to vary the same,

and a thermostat exposed to the vapor and controlling said spring to regulate the variation of the fuel pressure.

3. The combination with a vapor generator, of a burner, means for supplying said burner with liquid fuel under pressure, a movable abutment exposed to said pressure and adapted to vary the same, a spring pressing on said abutment and opposing the action of the fuel pressure thereon, a movable support for said spring, and a thermostat exposed to the vapor and adapted to move said support.

4. The combination with a vapor generator, of a burner, means for supplying said burner with liquid fuel under pressure, a movable abutment exposed on one side to said pressure, a by-pass valve controlled by said abutment, a spring pressing on the opposite side of said abutment, and a thermostat adapted to vary the tension of said spring in accordance with variations in the temperature of the vapor.

5. The combination with a vapor generator, of a burner, a reservoir for liquid fuel connected with said burner, a pump for forcing the liquid fuel to the burner, a by-pass around said pump to the reservoir, a valve controlling said by-pass and adapted to be opened by the pressure of the liquid fuel, a spring tending to hold the valve closed against the action of said pressure, and a thermostat adapted to vary the tension of said spring in accordance with variations in the temperature of the vapor.

6. The combination with a vapor generator, of a burner, a source of liquid fuel supply, a pump for supplying the burner with fuel from said source, a by-pass for the pump, means for automatically controlling the by-pass to vary the pressure of the fuel supplied to the burner including a spring-pressed movable abutment exposed to the pressure of the fuel and a thermostat exposed to the vapor for controlling said spring, and a device for manually controlling the spring.

7. The combination with a vapor generator, of a burner, a source of supply of liquid fuel, a pump for forcing fuel from said source to the burner, a by-pass for the pump, a valve in the by-pass, and means for controlling the operation of the by-pass valve comprising a diaphragm in engagement with the valve which is subjected to fuel pressure on one side, a spring engaging the opposite side of the diaphragm which yields when the fuel pressure rises to a given value and permits the valve to open, and a thermostat which varies the tension of the spring in accordance with variations of the temperature of the vapor.

8. The combination with a boiler, of a burner for heating the boiler, means for supplying the burner with liquid fuel under

pressure, a by-pass for diverting fuel from the burner under certain conditions, a valve for controlling the flow through the by-pass, means operating to open the valve 5 when the fuel pressure exceeds a predetermined amount, and thermostatic means responsive to the temperature of the vapor generated for also controlling the operation of said valve.

10 9. The combination with a vapor generator, of a burner, means for supplying the burner with liquid fuel under pressure, a by-pass for diverting fuel from the burner under certain conditions, a valve control- 15 ling the by-pass, means permitting the valve to open the by-pass when the fuel pressure rises to a certain point, and a thermostatic device responsive to the temperature of the generated vapor that coöperates with said 20 means to vary the pressure at which the valve opens the by-pass.

10. The combination with a boiler, of a burner for heating the boiler, means supplying fuel under pressure to the burner, 25 a by-pass valve for returning fuel to the

source of supply under certain conditions, a casing in which the valve is mounted, a diaphragm mounted in the casing and connected to the valve, one side of the diaphragm being subjected to the pressure of 30 the fuel, an arm pivotally mounted on the casing with its outer end arranged over the middle of the diaphragm, an adjustable abutment mounted in the outer end of the arm, a spring arranged between the abut- 35 ment and the diaphragm which opposes the movement of the diaphragm and the valve by the pressure of the fuel, and a thermostat responsive to the temperature of the steam generated which moves the arm to vary the 40 tension of the spring and thereby vary the action of the by-pass valve.

In witness whereof, I have hereunto set my hand this eleventh day of September, 1908.

JOHN G. CALLAN.

Witnesses:

JOHN A. McMANUS, Jr.,

CHARLES A. BARNARD.