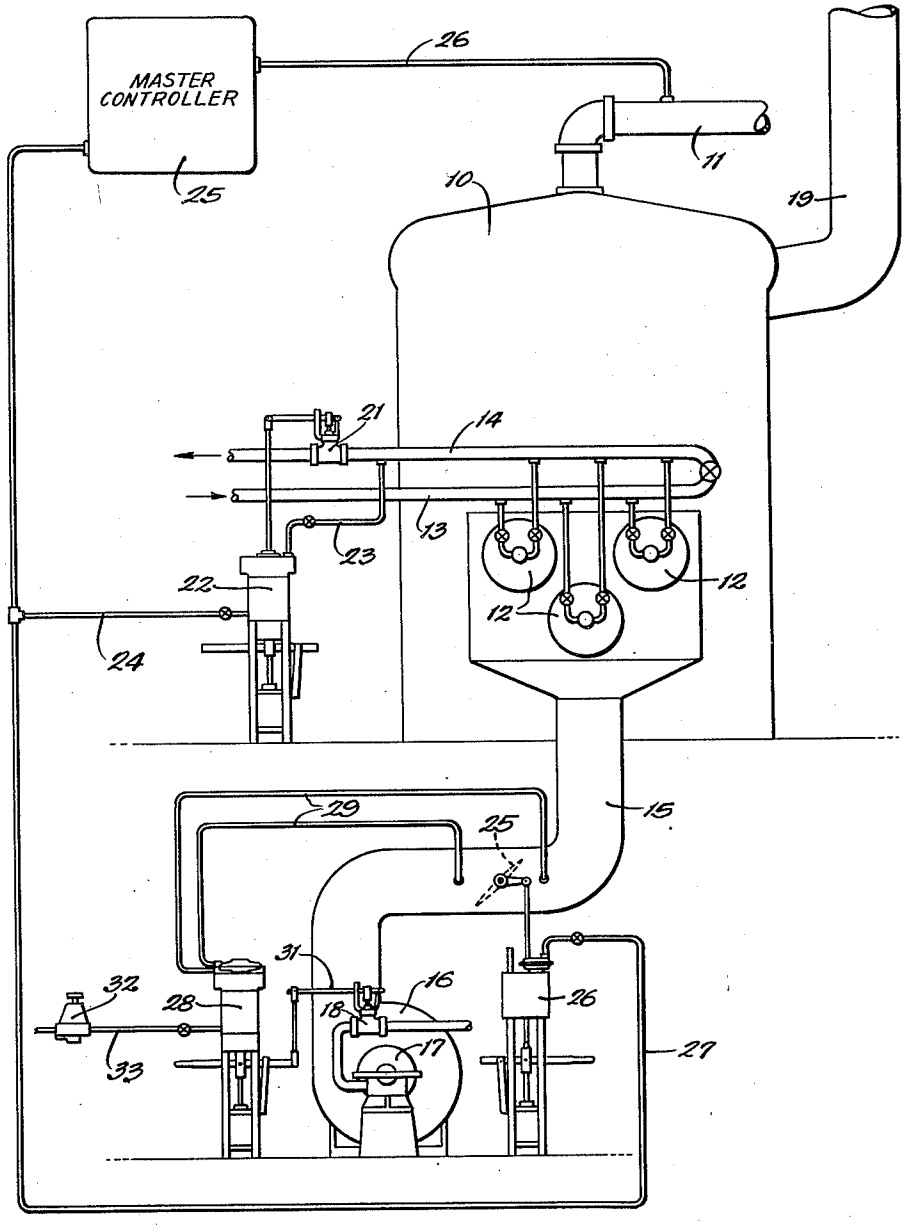
Feb. 28, 1950 A. J. ROSENBERGER 2,499,076

APPARATUS FOR CONTROLLING FUEL AND AIR SUPPLY TO BOILERS RESPONSIVE TO BOILER DEMAND

Filed April 28, 1945



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Patented Feb. 28, 1950 2,499,076

UNITED STATES PATENT OFFICE

2,499,076

APPARATUS FOR CONTROLLING FUEL AND AIR SUPPLY TO BOILERS RESPONSIVE TO BOILER DEMAND

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Application April 28, 1945, Serial No. 590,922

3 Claims. (Cl. 110—54)

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This invention relates to flow control method and apparatus and more particularly to the regulation of fluid flow to a boiler or other fluid consuming device. While the invention is shown and described in connection with the control of combustion air to a boiler, it will be understood that it is not limited thereto but may be applied to the control of any fluid flowing in a confined stream.

In the control of fluid flow through pipes or ducts the simplest method of control is by means of a valve or like restricting device in the conduit. Such valves can be positioned in accordance with the demand for fluid and provide a satisfactory control as long as the upstream and downstream pressure conditions remain constant. However, variations in pressure conditions will produce corresponding variations in flow.

It is one of the objects of the present invention to provide a flow control method and apparatus in which the pressure differential across a valve or the like is held constant.

Another object is to provide flow control by adjusting a restriction in accordance with the demand for fluid and maintaining the differential across the restriction constant regardless of its adjustment.

Still another object is to provide for adjustment of the flow rate which will be produced at any given adjustment of the restriction by varying the differential which will be maintained across the restriction.

A specific object is to provide a boiler control in which a draft valve is adjusted in accordance with the demand on the boiler and a draft fan or blower is controlled in accordance with the pressure drop across the valve.

The above and other objects and advantages of the invention will be more readily apparent from the following description when read in connection with the accompanying drawing, in which—

The single figure is a diagrammatic view of a boiler control apparatus embodying the invention.

The apparatus shown includes a boiler 10 supplying steam to a header 11. The boiler is heated by three fluid fuel burners 12 connected to a fuel supply pipe 13 and a return pipe 14 and supplied with air through a duct 15. A forced draft fan 16 driven by a turbine 17 which is controlled by a valve 18 which may be constructed in accordance with the patent to O'Connor No. 2,115,998 forces air through the duct 15. A stack 19 conducts away the combustion gases.

The supply of liquid fuel to the burners 12 is

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controlled by a valve 21 similar to the valve 18 in the return line 14. The valve 21 is adjusted by a regulator 22 which may be constructed in accordance with the patent to O'Connor No. 2,039,924 connected by a pipe 23 to the return line 14 ahead of the valve to be responsive to the fuel pressure therein. The regulator 22 is loaded through a line 24 by a master loading pressure produced by a master controller 25' which is connected through a line 26' to the steam header 11 so that the master controlling pressure will be proportional to the pressure in the steam header as indicative of the demand on the boiler. When the valve 21 is closed, the back pressure in the return line 14 will be increased to increase the supply of fuel to the burners while when the valve is opened the return pressure will decrease to reduce the fuel supply to the burners. The supply of fuel is regulated through the master controlling pressure in accordance with the demand on the boiler and is balanced against the return pressure through the line 23 to maintain the back pressure in the return line 14 constant for any given master loading pressure.

The supply of air to the burners through the duct 15 is primarily controlled by a damper or valve 25 in the duct which is connected to a regulator 26 to be adjusted thereby. The regulator 26 is connected through a pipe 27 to a master controller so that it will position the valve 25 in accordance with the master loading pressure. The regulator 26 may be of any desired type which will vary the valve position in accordance with variations in the master loading pressure such for example as shown in my Patent No. 2,220,176, November 5, 1940.

In order to maintain the flow through the duct 15 constant for any given valve setting, the fan 16 is controlled to maintain the pressure drop across the valve constant. For this purpose, a regulator 28 similar to the regulator 22 is connected across the valve 25 by pipes 29 to be responsive to the pressure differential across the valve. The regulator 28 is connecteed by a linkage 31 to the turbine valve 18 to control the speed of the turbine. If the differential across the valve tends to increase, the regulator 28 will reduce the speed of the turbine until the differential is brought back to the desired value. Similarly, if the pressure differential decreases, the valve 18 will be opened to increase the flow of air until the pressure drop across the valve is raised to the desired value.

In order to vary the flow through the pipe 15 without required adjustment of the regulator 26

or of the master controller, the loading on the regulator 28 may be manually varied by an adjusting valve 32 supplying a loading pressure to the regulator 28 through a line 33. This adjustment provides a convenient means of changing the fuel air ratio when desired and is particularly useful in the event it is desired to cut out one or more of the burners 12. For this purpose, when one of the burners is disconnected, the valve 32 may be adjusted to vary the air flow through the duct 15 so that the proper amount of air will be supplied to the remaining burners. If desired, the adjusting valve 32 may be calibrated in terms of the number of burners in operation so that the system can be very simply changed to accommodate the desired operation. For any given setting of the valve 32, the regulator 28 will function to maintain the pressure differential across the valve 25 constant regardless of the valve position so that flow through the duct 15 will be controlled in accordance with the valve position.

One important feature is that this means of measurement and control provides a means of controlling a ratio between fuel and air irrespective of the nature of the two control functions. For instance the oil pressure in a return system varies approximately as a straight line with flow whereas the air duct pressure or differential pressure of an orifice in the duct varies as the square of the flow. Consequently, two flow controllers operating from a common master loading pressure would not work.

While one embodiment of the invention has been shown and described in detail, it will be understood that this is illustrative only and is not intended as a definition of the scope of the invention, reference being had for this purpose to the appended claims.

What is claimed is:

1. Boiler control apparatus for a boiler having a forced draft fan comprising a valve between the fan and the boiler adjustable to vary the air supply for the boiler, a master controller responsive to a condition of operation of the boiler to produce a regulating pressure, a regulator responsive to said pressure and connected to the valve to adjust it, a regulator responsive to the pressure differential across the valve, and means operated by the regulator to control the fan.

2. Apparatus for controlling flow of fluid through a conduit comprising a conduit, a valve in the conduit having non-linear characteristics, a regulator responsive to a condition affected flow of fluid through the conduit to change the throttling position of the valve, pressure means connected to the conduit to produce a flow of fluid therethrough, and control means responsive to the pressure drop across the valve to control the pressure produced by the pressure means thereby to compensate for said non-linear valve characteristics.

3. Apparatus for controlling flow of fluid through a conduit comprising a conduit, a valve in the conduit having non-linear characteristics, a regulator responsive to a condition affected flow of fluid through the conduit to change the throttling position of the valve, a pump connected to the conduit to produce a flow of fluid therethrough, and a regulator responsive to the pressure drop across the valve to control the pump thereby to compensate for said non-linear valve characteristics.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
886,261	Smith	Apr. 28, 1908
894,784	Vivian	July 28, 1908
991,641	Plantinga	May 9, 1911
1,052,796	Brown	Feb. 11, 1913
1,360,285	Gibson	Nov. 30, 1920
1,655,683	Standerwick	Jan. 10, 1928
1,813,921	Bumz	July 14, 1931