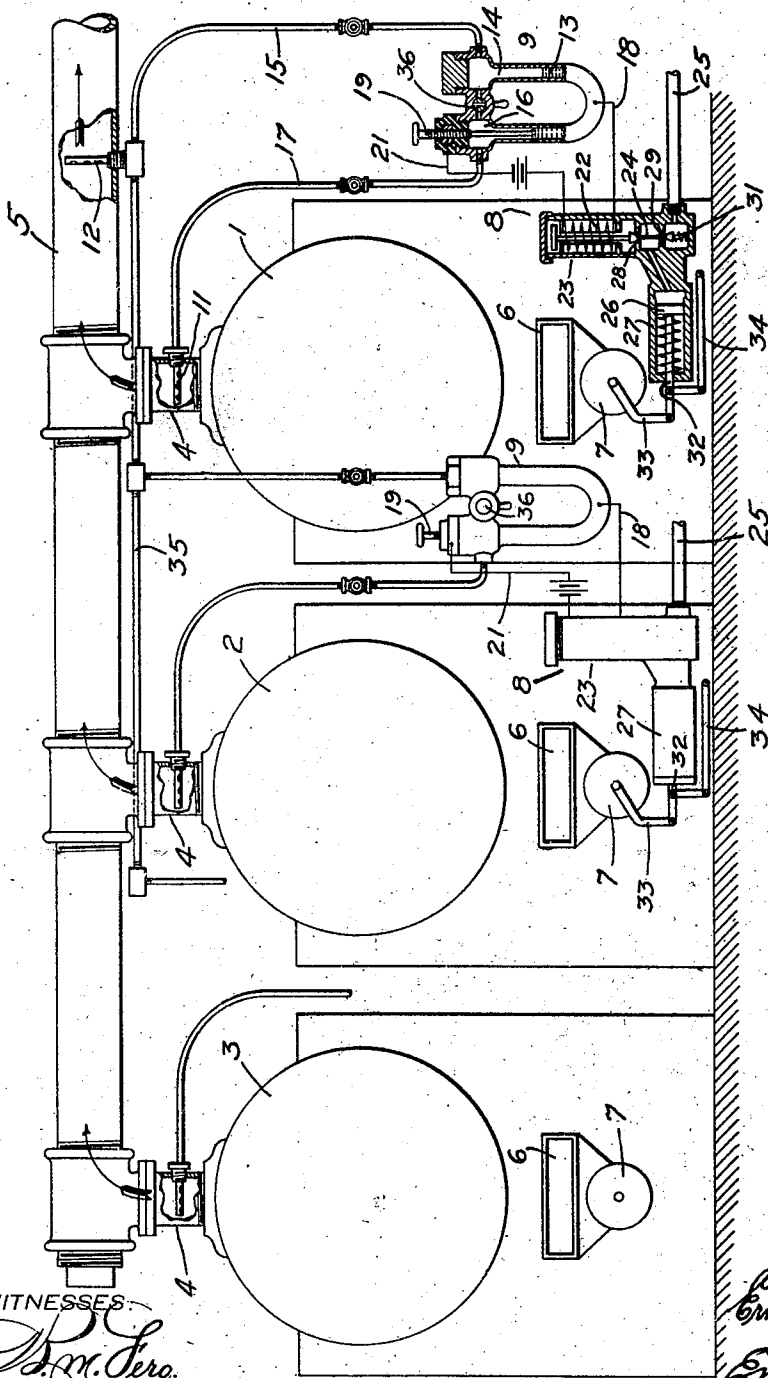


E. F. FISHER.
 MULTIPLE UNIT BOILER CONTROL.
 APPLICATION FILED AUG. 4, 1914.

1,250,832.

Patented Dec. 18, 1917.



WITNESSES:

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ERNEST F. FISHER, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

MULTIPLE-UNIT BOILER CONTROL.

1,250,832.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, ERNEST F. FISHER, a citizen of the United States, and a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have made a new and useful Invention in Multiple-Unit Boiler Controls, of which the following is a specification.

This invention broadly relates to means for maintaining, or for assisting in the maintenance of a constant ratio between the rate of fluid flow through a delivery main or header, and the rate of fluid flow through each of a number of feeder lines which communicate with and deliver fluid to the header. Specifically the invention relates to boiler or steam generator control.

An object of the invention is to produce means for controlling the delivery of fluid through a feeder line in response to variations in the rate of fluid flow through the feeder and the rate of fluid flow through a header or delivery main with which the feeder communicates and which receives fluid from other sources of supply.

A further and more specific object is to produce means for controlling the operation of each of a number of boilers communicating with and feeding a single header, in response to variations in the amount of steam delivered by each boiler as compared with the amount of steam traversing the header or the demand for steam upon the header.

A further object is to produce a multiple unit boiler control such that all the boilers communicating with a header operate together as a unit, or such that the amount of steam delivered by each boiler varies in proportion to the amount of steam delivered to the header for all demands upon the header.

If it were possible to substitute a single large boiler for a battery of smaller boilers, many difficulties now encountered in the operation of power plants would be eliminated, since all the operations would be centralized and each unit of area of heating surface would generate a proportional amount of the steam delivered for all varying demands upon the boiler. Since it is impossible to employ a single large boiler as a substitute for a battery of boilers or a number of single boilers, it is important to provide means for insuring that each boiler supplying a common delivery header shall be so operated that it will supply its proportional

amount of steam for all steam demands upon the header. To accomplish this is an object of my present invention and it is attained by means of apparatus herein described and illustrated as an embodiment of the invention.

In the single sheet of drawings accompanying and forming a part of this application I have illustrated more or less diagrammatically a battery or number of boilers communicating with a single header in which each boiler is provided with an automatic mechanism for controlling its operation. Portions of the header and portions of the leader lines of each boiler are shown broken away for convenience of illustration, and the automatic mechanism for controlling one of the boilers is shown in section.

Referring now to the drawing by means of reference numerals,—the installation illustrated as an embodiment of my invention includes a series of boilers or generators 1, 2, and 3, each of which is provided with a leader 4 which communicates with and delivers steam to a header 5 adapted to deliver steam to steam consuming apparatus.

Each boiler is provided with an automatic mechanism for controlling its operation. The automatic mechanisms are diagrammatically illustrated, since various means may be employed in carrying out my invention. The controlling mechanism for each boiler is the same as the mechanism illustrated in section as operating in conjunction with the boiler 1 and consequently a detailed description of this mechanism only will be given.

As illustrated, the controlling mechanism consists of a fuel feeding hopper 6, a fuel feeding device 7, diagrammatically illustrated, for feeding fuel from the hopper into the furnace associated with the boiler 1, and an automatic device, generally designated by the numeral 8, for controlling the operation of a fuel feeding means and also the operation of other desired furnace mechanisms, as for example, the forced draft mechanism of the furnace and the damper. It will be understood that the fuel feeding means 7 may be arranged to operate constantly during the operation of the furnace associated with the boiler 1 and that the controlling device may operate to accelerate or retard its operation, or that the fuel feeding means may be operated intermit-

tently and under the direct control of the controlling device. I, however, prefer to employ a constantly operating fuel feeding means which is accelerated or retarded in its operation by the automatic controlling device 8.

The automatic controlling device includes a differential pressure device 9, responsive in operation to differences in pressure occasioned by differences in fluid flow through the leader 4 and the header 5 as transmitted by a nozzle plug 11 located in the leader 4 and a nozzle plug 12 located in the header 5.

The differential pressure device 9, as illustrated, consists of a U-tube partially filled with mercury 13, and having the upper end of each leg of the tube sealed so as to produce a pressure chamber 14 which communicates with the nozzle plug 12 through piping 15, and a pressure chamber 16 which communicates with the nozzle plug 11 through piping 17. The mercury in the tube is electrically connected to a lead 18 of an electric circuit and forms a terminal of the circuit. An adjustable terminal 19 of the circuit projects downwardly through the pressure chamber 16 and is adapted to contact with the mercury in the tube and thereby close the circuit when the mercury rises in the chamber 16 in response to a determined preponderance of the pressure in the chamber 14 over that existing in the chamber 16. The terminal 19 is electrically connected to a lead 21 of the electric circuit and the circuit includes a winding 22 of a solenoid or an electro-magnet 23 adapted to move downwardly when the circuit is closed and thereby shift a valve 24 so as to deliver fluid under pressure from a passage 25 to a spring-restrained plunger 26 which is located in a cylinder 27. The valve 24 controls delivery through a fluid discharge port 28 and a fluid inlet port 29 and is so arranged that it will restrict or close the discharge port as the inlet port is opened, and, vice versa, will increase the effective area of the discharge port as the inlet port is closed. With this arrangement the plunger may be subjected to varying fluid pressures, depending upon the position of the valve 24, and consequently upon the position of the electro-magnet 23. The magnet 23 is restrained by a coil spring 31. The plunger 26 is provided with a rod 32, which is operatively connected to the controlling lever 33 of the fuel feeding means 7, and is also operatively connected to a rod 34 which is adapted to operate any other desired furnace apparatus, as, for example, the damper and the compressor or pump delivering air to the furnace. The controlling lever 33 is so arranged that a movement of the plunger in response to fluid pressure will accelerate the fuel feeding means, while a movement

of the plunger in the opposite direction will retard the operation of the fuel feeding means.

It will be understood that the valve 24 and its controlling magnet or solenoid may be so arranged that the plunger 26 will occupy either one extreme position or the other and will either retard or accelerate the fuel feeding means a maximum amount.

The nozzle plug 12 in the header is preferably a simple impact plug and consequently the pressure in the chamber 14 will be directly proportional to the velocity of fluid flow through the header.

The nozzle plug 11 is preferably a simple impact tube and consequently the pressure in the chamber 16 is directly proportional to the velocity of flow through the leader line. With such an arrangement the mercury column in the U-tube will occupy different positions in response to varying ratios of flow through the header and the leader, and the controlling device 8 will operate to maintain a constant ratio between the rate of flow of the fluid traversing the header and the fluid traversing the leader and consequently will accelerate or retard the boiler so as to maintain its output proportional to the demand for steam on the header.

Inasmuch as each boiler is equipped with means similar to the controlling mechanism 8, each leader 4 is provided with a nozzle plug 11 which communicates through suitable piping with the pressure chamber 16 of its corresponding U-tube. The plug 12 in the header is connected through piping 35 with the pressure chamber 14 of each differential pressure device 9 and each boiler will therefore be controlled in response to variations between the demand for steam on the header and the amount of steam it is delivering. Each differential pressure device is provided with an equalizing valve 36 which when opened will place the chambers 14 and 16 in communication and will render the controlling mechanism inoperative.

The operation of the apparatus is as follows: Varying demands for steam on the header will occasion varying fluid velocities through the header and consequently varying pressures within the chamber 14. These varying pressures in the chamber 14 will cause the mercury in the tube to fluctuate and will either open or close the electric circuit to retard or accelerate the operation of the boiler with which the automatic mechanism communicates. When the boiler delivers its proper proportion of the steam to the header, the ratio between the velocity of flow in the communicating leader and the velocity of flow in the header will equal a determined constant and by properly adjusting the automatic controlling mechanism this constant may be maintained within close limits. In the apparatus illustrated adjust-

ment may be made by changing the position of the terminal 19 with relation to the mercury in its corresponding tube. It will be understood that the U-tube may be provided with transparent walls so as to render the mercury visible, or that other means may be employed for indicating the variations between the velocity of flow of the leaders and the header, and that consequently manually controlled means may be employed for controlling the operation of the boilers to maintain the proper ratios of fluid flow between the leaders and the header.

While I have described my invention as applied to the control of steam boilers or generators, it will be apparent to those skilled in the art that it is also applicable to the control of any apparatus delivering fluid, and that various changes, modifications, substitutions, omissions, and additions may be made without departing from the spirit and scope of the invention as set forth by the appended claims.

What I claim is:

1. The combination with a plurality of fluid pressure generators delivering fluid to a common header, of a mechanism for each generator for controlling its operation, and means for operating each controlling mechanism which is responsive to the flow of fluid from the generator to which it is appurtenant and to the total flow through the header.

2. In combination, a header, a plurality of fluid pressure generators, leaders connecting the generators to the header, a mechanism for controlling the operation of each generator, and means for operating each controlling mechanism comprising a flow responsive device in the leader to which the means is appurtenant and a flow responsive device in the header beyond the generators so as to be acted upon by the total flow therethrough.

3. In an apparatus of the character described, a plurality of fluid pressure generators, a header, a separate connecting passage between each generator and said header, a separate mechanism for controlling the operation of each generator, and separate means responsive to variations between the total rate of fluid flow in the header and the rate of fluid flow in each separate passage for separately controlling the operation of each of said mechanisms.

4. A multiple unit boiler control, comprising a plurality of separate boilers, a header receiving steam from all of said boilers, a separate leader for connecting each boiler with said header, an impact tube located in the header beyond the boilers and exposed to the flow of fluid therethrough, a separate

impact tube located in the leader from each boiler and exposed to the flow of fluid there-through, a plurality of differential pressure devices, each communicating with an impact tube, located in one of said leaders, and all communicating with the impact tube located in said header and responsive in operation to the differential of pressures delivered through the communicating tubes, and a separate mechanism for controlling the operation of each boiler, each mechanism responsive in operation to the differential device communicating through an impact tube with the leader of the boiler controlled.

5. In combination with a plurality of boilers and their furnaces, a common header, a separate leader connecting each boiler with its header, an impact tube located in the header beyond the boilers so as to be responsive to the total flow therethrough, an impact tube located in the leader of each of the boilers, a differential pressure device for each boiler communicating with the first named impact tube and with the impact tube of the boiler to which it is appurtenant and responsive in operation to the differential of the pressures delivered by such impact tubes, and means associated with each boiler and controlled by the operation of the device for such boiler for controlling the delivery of the fuel to its furnace.

6. In combination with a plurality of steam generators, a header, a separate leader connecting each generator with said header, an impact tube located in the header and subjected to the total flow of fluid therethrough, an impact tube located in the leader of the generator to be controlled and subjected to the flow of fluid therethrough, a device responsive in operation to the differential of the pressures delivered by both impact tubes, and means controlled by said device for controlling the operation of the generator controlled.

7. The combination with a plurality of fluid pressure generators delivering fluid to a common header, of a mechanism for one of the generators for controlling its operation, and means for operating the controlling mechanism which is responsive to the flow of fluid from the generator to which it is appurtenant and to the total flow through the header.

In testimony whereof, I have hereunto subscribed my name this 31st day of July, 1914.

ERNEST F. FISHER.

Witnesses:

C. W. MCGHEE,
E. W. MCCALLISTER.