H. L. NICHOLSON & S. S. WEEKS.

REGULATOR FOR LIQUID FUEL BURNERS.

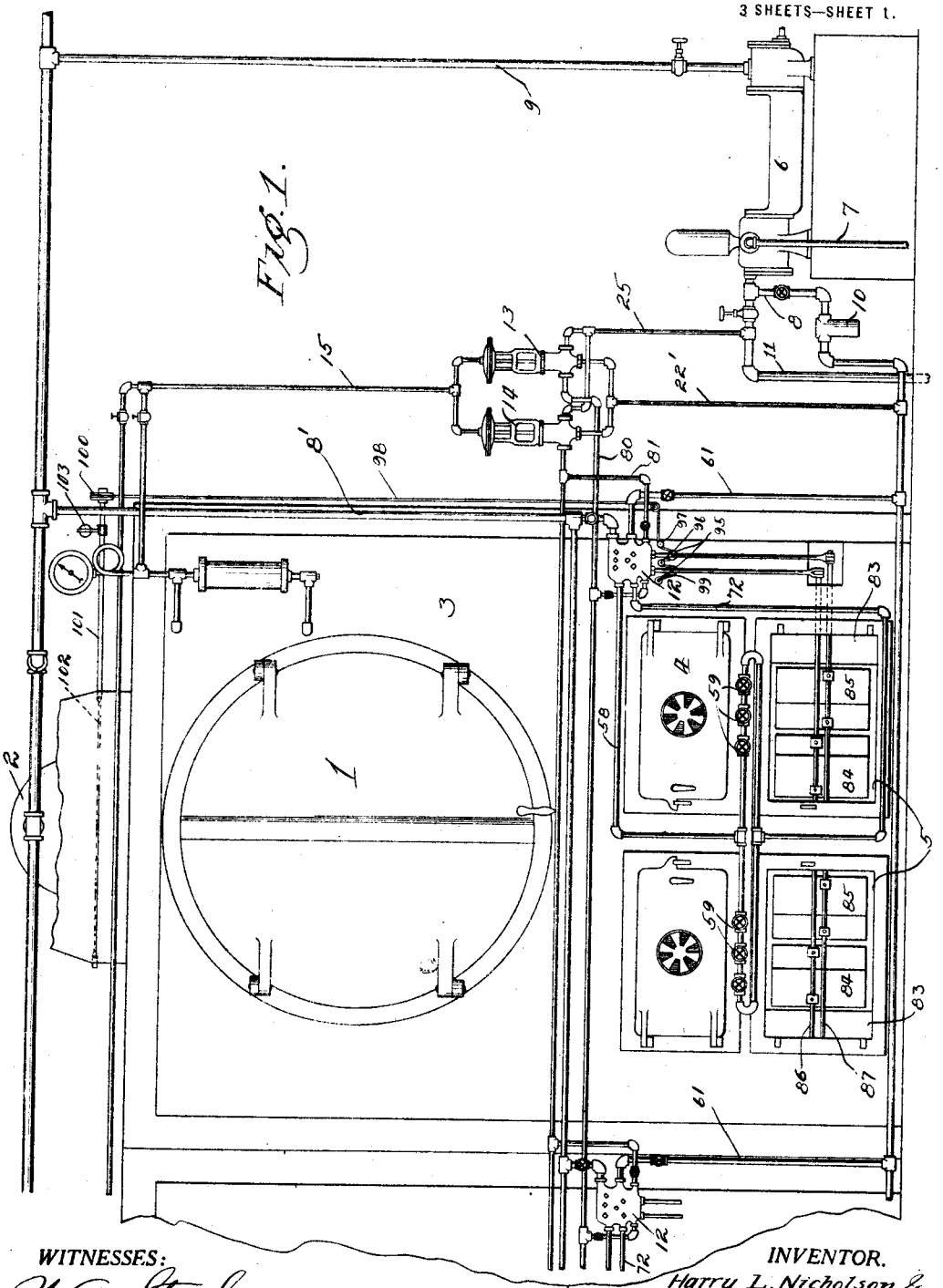
APPLICATION FILED JAN. 12, 1915.

1,197,053.

Patented Sept. 5, 1916.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 2.

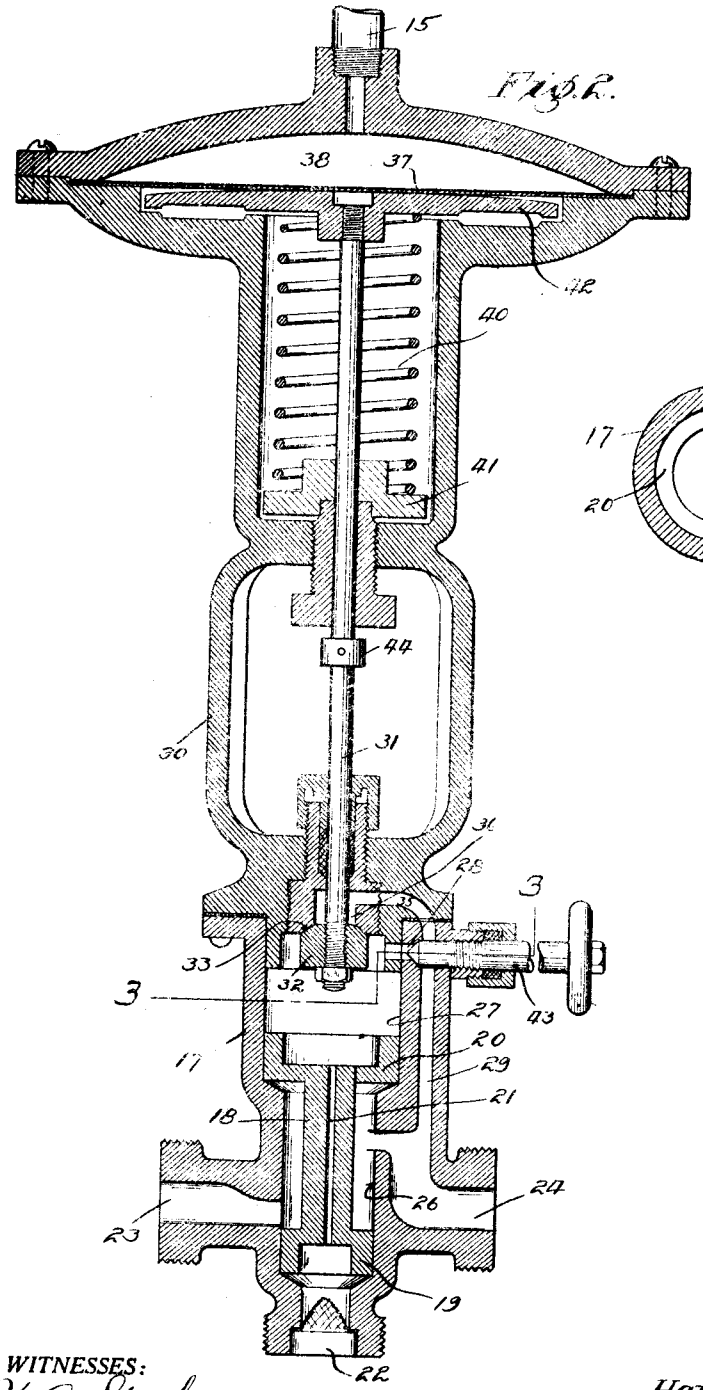
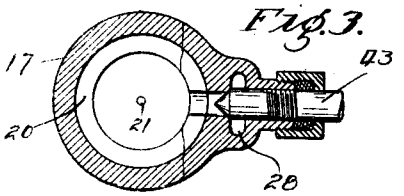


Fig. 3.



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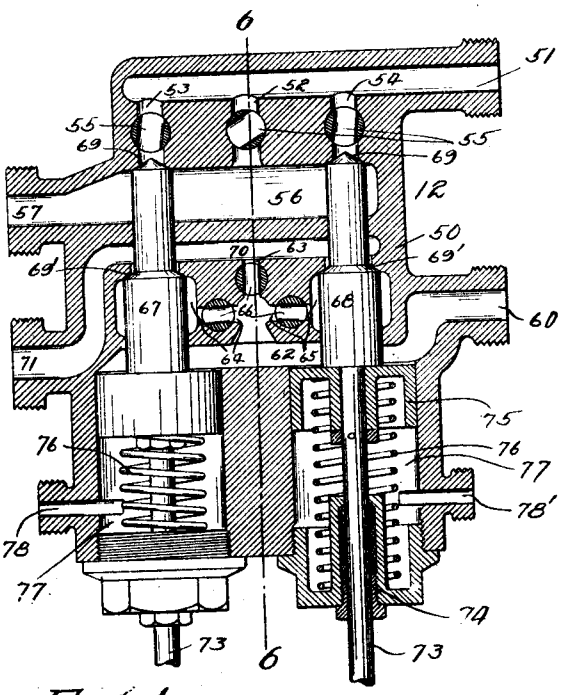


Fig. 4.

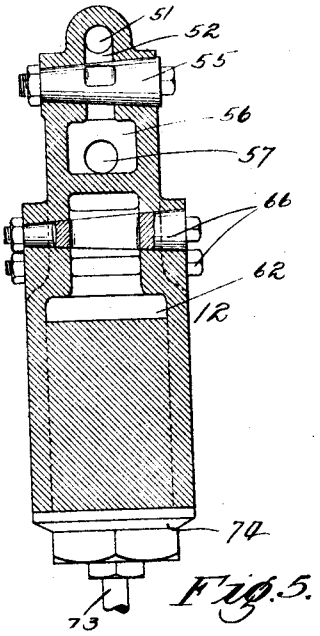


Fig. 5.

Fig. 6.

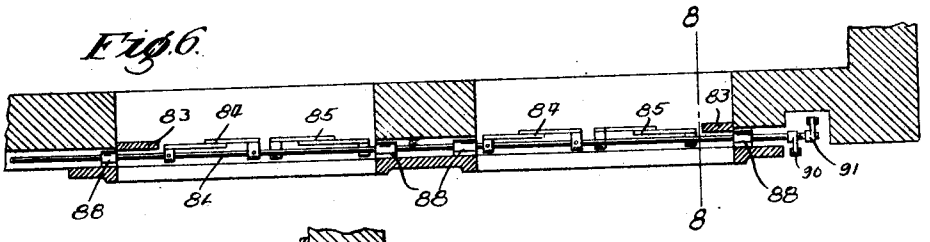
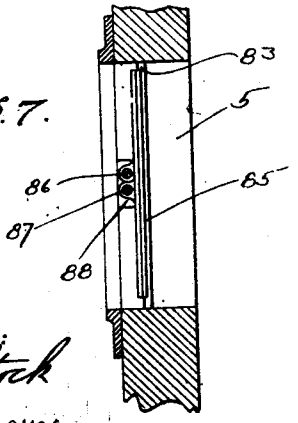


Fig. 7.



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UNITED STATES PATENT OFFICE.

HARRY L. NICHOLSON AND SHIRLEY S. WEEKS, OF OAKLAND, CALIFORNIA, ASSIGNORS TO ASSOCIATED ENGINEERING AND SUPPLY COMPANY, OF SAN FRANCISCO, CALIFORNIA, A CORPORATION OF CALIFORNIA.

REGULATOR FOR LIQUID-FUEL BURNERS.

1,197,053. Specification of Letters Patent. Patented Sept. 5, 1916.

Application filed January 12, 1915. Serial No. 1,762.

To all whom it may concern:

Be it known that we, HARRY L. NICHOLSON and SHIRLEY S. WEEKS, citizens of the United States, residing at Oakland, in the county of Alameda and State of California, have invented certain new and useful Improvements in Regulators for Liquid-Fuel Burners, of which the following is a specification.

This invention relates to improvements in oil burning apparatus and more particularly to means for regulating the fire in connection therewith.

The principal object of our invention is to provide means for automatically regulating the fires under one or a battery of boilers in accordance with the fluctuating of steam pressure therein, by simultaneously varying the quantity of liquid fuel, atomizing medium and the draft.

Another object of our invention is to provide means for independently adjusting the flow of liquid fuel, atomizing medium, and air to the furnace in proper proportions so that perfect combustion and the greatest efficiency is secured, such adjustment remaining constant and independent of the regulating means.

A further object of our invention is to so construct the apparatus that it will control the fires and drafts under a battery of boilers whether they be located together or at a distance, and at the same time cause each of the various boilers to carry its proper share of the load. And still another object of our invention is to admit the liquid fuel, atomizing medium and air by steps rather than by a constant increase, the increased amount of each fluid for each step being predetermined and adjustable.

With these and other objects in view our invention consists in the novel construction, arrangement and combination of parts as herein described and more specifically pointed out in the appended claims.

Reference being had to the accompanying drawings forming a part of this specification, Figure 1 is a view in front elevation of a boiler showing the manner in which our improved controlling apparatus is applied thereto. Fig. 2 is a view in longitudinal section through what is hereinafter termed the control valve. Fig. 3 is a view in section on 3—3, Fig. 2. Fig. 4 is a view in section through what is hereinafter termed the regulator. Fig. 5 is a view in section on 6—6, Fig. 4. Fig. 6 is a plan view of the dampers used in connection with our device. Fig. 7 is a view in section on 8—8, Fig. 6.

Referring to corresponding parts by the same numerals of reference, 1 denotes a boiler having the steam dome 2, and the usual cast iron front 3. The doors closing the fire opening are denoted by 4, and 5 is the ash pit openings shown with the doors removed. An oil pump 6 has the suction line 7, the discharge pipe 8 and steam supply line 9, the discharge pipe 8 being provided with the usual strainer 10 and overflow 11 by which the surplus oil is returned to the storage tank.

A regulator denoted in general by 12, is adapted to control the fuel and atomizing fluid of the fire, by steps, the larger fires being regulated by means of the control valve denoted in general by 13 and 14, there being one of these valves for each degree of heat except the lowest. For the purpose of this specification, we have illustrated and described a regulator and valve arrangement for controlling the fire in three steps, though any number of steps from two up may be used. The valves are similar in construction and are connected with the steam pressure by means of the pipe 15. This pipe may be connected to the steam gage connection as shown in the drawing, or directly into the steam dome boiler, or other position where true boiler pressure is secured.

Referring to Fig. 2 showing one of the control valves in cross section, the latter consists of the casing 17 having mounted therein the double headed piston 8, the lower head 19 having a smaller area than the upper head 20, the heads being connected by a stem through which passes a bleed hole 21. The bottom of the casing is provided with a pressure inlet 22 and on the sides are the outlet 23 and the overflow 24, the latter being connected by suitable pipe 25 with the overflow 11. These openings connect with the small central bore 26, and from the larger central bore 27 a valve control passageway 28 is connected to a longitudinal passageway 29, which in turn opens into the passageway 24 and so to the overflow.

Mounted on the upper part of valve cas-

ing 17 is a frame 30 wherein is suitably mounted a valve rod 31 having attached within the bore 27 a valve disk 32 adapted to rest on the seat 33. This rod passes through a suitable packing gland, and surrounding the stem immediately above the seat 33 is a chamber 36 connected by a passageway 35 with the passageway 29. The upper end of the frame 30 is circular in form and seated therein is a flexible disk 37, and a pressure chamber 38 is formed on the upper side of this disk to which is connected the pipe 15 from the source of steam pressure.

A spring 40 surrounding stem 36, has its lower end resting on an adjustable seat 41 and the upper end abutting against a member 42 on the underside of disk 37. This spring is of sufficient strength to hold the disk 32 on its seat against the normal operating pressure of the boilers. A valve 43 closes the connection between the passageways 28 and 29, but allows the flow of fluid between passageways 35 and 29.

Referring now to the regulating device 12 shown in detail in Figs. 4 and 5, this device consists of a casing 50, having the steam passageway 51 from which are three valve controlled passageways denoted by 52, 53 and 54, controlled by valve or plug cocks denoted by 55. All these passageways open into a passage 56 from which an exit 57 is provided, which is connected by a pipe 58 to the steam connection of the oil burners 59. The oil inlet 60 is connected by pipe 61 with the discharge pipe 8 of the oil pump, and from this inlet is provided a passageway 62, extending across the casing. From the latter passageway in turn are provided three passageways 63, 64 and 65, opening into a common passageway 70, communicating in turn with the exit 71. Each of the passageways 63, 64 and 65 is provided with a cock 66 by which the flow therethrough may be regulated. Communication between 64 and 70 and 65 and 70 is normally held closed by plungers 67 and 68 respectively, each plunger being provided with two conical valve faces, the upper faces 69 being adapted to close the passageways 53 and 54 while the other faces 69′ close the passageways 64 and 65. The exit 71 is connected by pipe 72 to the oil side of the burners 59. The plungers 67 and 68 are provided with a rod 73, extending from the lower end, passing through a suitable stuffing box 74 in the lower end of the casing and are connected to the draft regulators as hereinafter described. Attached to these rods just below the plungers are pistons 75, between the underside of which, and the cap of the stuffing box, are springs 76 normally holding the plungers against their seats. The cavities 77 below the pistons are provided with an opening 78 and 78′, the respective openings being connected by pipes 80 and 81 with the exits 23 of the control valves 13 and 14 respectively.

The doors of ash pit openings 5 are kept wide open when the boiler is in use, and if necessary, the openings are reduced in size by means of permanent attached plates 83 to give the proper amount required by the largest fire. To regulate this opening for smaller size fires, we provide two pair of pivotally mounted doors denoted by 84 and 85, the doors 84 being mounted on shaft 86 and doors 85 on shaft 87. These shafts are suitably supported in bearings 88 and each of the doors is formed in two overlapping parts shown more particularly in Fig. 6, each part being separately attached to the shaft so that the parts may slide past each other, and will thus enable the initial opening around these dampers to be adjusted as required by the smallest fire. The ends of the shafts 86 and 87 are connected by means of cranks 90 and 91 with rods 73 in such a manner that when these rods move downwardly the two sets of dampers are rotated in opposite direction to open the draft, the shaft of one pair of dampers serving as a stop for the other pair.

We also provide means for operating the stack dampers so that when the smallest fire is burning this damper is closed, or partly closed, and is opened as the volume of the fire is increased. This is accomplished by mounting on rods 73 a small sheave wheel 95 and on the boiler frame sheave wheels 96 and 97. A cable 98 is threaded over these wheels as shown and made fast as at 99, the other end of this cable being carried upwardly and connected to a sheave 100 carried by the rod 101 extending from the damper 102. A counterweight 103 is attached to rod 101 in such a manner that it tends to hold the damper closed and consequently, if the cable should break, the damper would be closed by the counterweight.

The operation is as follows:—Assuming that the boiler pressure is normal, that the cocks 55 and 66 are open and that the burners 59 are operating with but the smallest fire burning, then the oil flows from the pump through the discharge pipe 8 and 61 through the passageways 60, 62, 63, 70, 71 and 72 to the burners, and at the same time steam flows through the pipe to the inlet 51 and through passageways 52, 56 and 57 to the pipe 58 and thence to the burners. The plungers 65 and 66 are held on their respective seats by means of the control valves 13 and 14 in the following manner: The pressure on the top of disk 37 is sufficient to counterbalance the lift of spring 40 and so hold depressed the rod 31. This holds unseated the valve 32 placing cavity 27 in communication through 36 and 29 with the overflow 24 and so prevents accu-

mulation of pressure in this cavity. The oil pressure on the small head of piston 18 raises the latter and allows the oil pressure to flow from discharge 8 through pipe 22', passages 22 and 23 through pipes 80 and 81 to the underside of pistons 75. This pressure in connection with spring 77 holds the plungers on their respective seats. The control valves 13 and 14 are set to operate at slightly different pressures by means of the spring 40. Now, if the steam pressure falls below normal, spring 40 of the valve set to operate first, say 13, overcomes the pressure on the upper side of the diaphragm and the valve stem 31 travels upward closing the valve disk 32 in its seat 33, which allows pressure to accumulate within 27 through the bleed hole 21. As this pressure accumulates the piston is forced downwardly owing to the upper head having a greater area than the lower, the under side of each head being at atmospheric pressure through the overflow 24. When the lower end of head 19 passes the opening 23 pressure is cut off therefrom and at the same time the central reduced portion of the piston places 23 in communication with passageway 24 thereby allowing the oil under pressure, which is within the pipe 80, to be discharged through the opening 24 into the overflow. This releases the pressure in chamber 77 of plunger 67 and allows the pressure on the upper side of piston 75 to depress the latter pulling down the plunger opening the passageways 53 and 64. This downward movement continues until the piston comes in contact with the upper portion of the stuffing box 74 giving a free passageway for steam, from passageway 51 to 56 and oil from the passageway 62 to 71. The increased amounts of oil and steam are regulated by cocks 55 and 66 in passageways 53 and 64 respectively, so that the correct proportions of oil and steam are admitted independent of the passageways opened by the plunger. When the piston 75 is depressed rod 73 moves downwardly turning the dampers 84 and allowing an increased amount of air to enter the furnace in order to give the proper combustion. At the same time the dampers to the ash pit are opened, the stack damper is rotated by one of the sheaves 95 moving downwardly and pulling in a corresponding amount of cable 90. When the other rod moves down a corresponding amount of cable is pulled in which still further rotates the stack damper 102. If the pressure continues to fall the second control valve 14 is thrown into operation, opening the passageways 54 and 65 thus admitting an additional flow of oil and steam and at the same time opening the dampers 85. As long as the pressure remains below the point at which the springs are adjusted this condition holds and when the pressure rises the reverse action takes place; diaphragm 37 is depressed causing the valve 32 to open, pressure on the upper side of piston 18 is released, the latter moves upward allowing oil under pressure to flow through the corresponding pipe to the cavity 77 of the corresponding plunger. This forces up the plunger and closes the flow of oil and steam and also closes the dampers.

It will be understood that by suitable branch connections from outlets 23 the valves 13 and 14 may be made to control any number of boilers. If it should be desired to throw the automatic control out of operation it is merely necessary to open the valve 43, which prevents an accumulation of pressure on the upper side of the piston 18 and thus prevents the burners from being thrown on to their full capacity, which is not desirable under certain conditions, as when starting up.

It will be understood that while we have throughout the specification described the device as operating with oil as the fuel, and steam as the atomizing medium, that any liquid fuel may be used, and also compressed air as atomizing medium, may be used.

When the smallest fire is burning a sufficient opening is left around the dampers 84 and 85 to give the necessary air for perfect combustion, and the required amounts of oil and steam for the best results are adjusted by means of the valves in passageways 63 and 52 respectively. In like manner at each of the other steps, the three elements which go to produce perfect combustion are each adjustable so that the proper amount is admitted at each step.

While we have shown the preferred construction and embodiment of our invention it will be understood that changes may be made in details of design and construction without departing from the principles thereof.

What we claim as new and wish to cover by Letters Patent is:—

1. The combination with liquid fuel burners, of a regulator comprising independent valve mechanisms for supplying liquid fuel and an atomizing agent to said burners at different rates and a controller having means for effecting the operation of one valve mechanism through one range of steam pressure and means for effecting the operation of the other valve mechanism through another range of steam pressure.

2. In combination with liquid fuel burners; a regulator adapted to simultaneously vary by steps the fuel and atomizing fluid admitted to said burners, and pressure controlled valves, one for independently governing the operation of one step of said regulator through one range of boiler pressure and another for independently governing the operation of said regulator at

another step through a different range of boiler pressure.

3. In combination with liquid fuel burners; a regulator having a plurality of passageways between the fuel inlet and the exit to said burners, and a plurality of passageways between the atomizing fluid inlet and the exit to said burners; plungers movable in said regulators adapted to simultaneously control one of the fuel passageways and one of the atomizing fluid passageways, and pressure controlled valves adapted to cause the operation of said plungers.

4. In combination with liquid fuel burners; a regulator having a plurality of valve controlled passageways between the fuel inlet and the exit to said burners, and a plurality of valve controlled passageways between the atomizing fluid inlet and the exit to said burners; plungers movable in said regulators adapted to simultaneously control one of the fuel passageways and one of the atomizing fluid passageways, and pressure controlled valves adapted to cause the operation of said plungers.

5. In combination with liquid fuel burners; a regulator having a plurality of valve controlled passageways between the fuel inlet and the exit to said burners, and a plurality of valve controlled passageways between the atomizing fluid inlet and the exit to said burners; plungers movable in said regulators adapted to simultaneously control one of the fuel passageways and one of the atomizing fluid passageways, pistons carried by said plungers having a given pressure on the plunger side thereof, and pressure controlled valves for governing the admission of an equal pressure to the other side of said pistons.

6. In combination with liquid fuel burners, a regulator adapted to simultaneously vary by steps the admission of liquid fuel, atomizing medium and air to the combustion chamber, means for separately adjusting the amount of fuel, atomizing medium, air admitted at each step, and pressure controlled valves, one for independently causing the operation for each step of said regulator.

7. In combination with liquid fuel burners; a regulator having a plurality of valve controlled passageways for the liquid fuel and atomizing medium, a plurality of plungers, each adapted to simultaneously control one of the fuel passageways and one of the atomizing passageways, control valves operated by the governed pressure for causing the operation of said plungers, and means operated by said plungers regulating the admission of air to the combustion chambers.

8. In combination with a regulator for liquid fuel burners, pressure controlled valves for governing said regulator each comprising a casing, a double headed piston movable in said casing, said heads being of unequal size, a stem connecting said heads and having a passageway therethrough from the outer face of the larger head forming one side of a pressure chamber having an outlet passage communicating with the atmosphere, a valve controlling said outlet passage, a diaphragm operated by the controlled pressure, a stem connecting said diaphragm with said valve so that a surplus pressure on said diaphragm will open said valve.

9. In combination with a regulator for liquid fuel burners, pressure controlled valves for governing said regulator, each consisting of a cavity having a fluid pressure inlet, a fluid pressure outlet, an outlet to atmospheric pressure and a central cavity communicating with said inlet and said outlets, a double headed piston movable in said central cavity and having heads of unequal area and connected by a stem of reduced area, the smaller head having the fluid pressure continuously applied to the under face and adapted to place said pressure outlet in communication either with said inlet or said outlet to atmospheric pressure, the inner faces of said heads being continuously in communication with said outlet to atmospheric pressure, said piston having a passageway therethrough from the outer face of the smaller head to a cavity in the outer face of the larger head and whereon the latter moves, the casing being provided with a connecting passageway from said cavity to the outlet to atmospheric pressure, a valve within said cavity controlling the said connecting passageway, a diaphragm subject to the action of the controlled pressure, and means connecting said diaphragm with said valve and a manually operated valve for opening a passage between said cavity and said connecting passageway.

10. In combination with steam boilers and liquid fuel burners therefor; of a regulator for governing the admission of fuel to said burners by steps, dampers pivotally mounted in the air supply opening of said boiler and a positive mechanical connecting means between said regulator and the dampers by which each step in the admission of fuel to said burners produces a corresponding change in the position of said dampers.

11. In combination with steam boilers and liquid fuel burners therefor, a regulator for governing the admission of fuel to said burners by steps, dampers corresponding in number to the number of steps of said regulator pivotally mounted in the air supply opening under said boiler, and positive mechanical means connecting said dampers with said regulator whereby a change in any

step of said regulator produces a corresponding change in one of the said dampers.

12. The combination with liquid fuel burners, of a regulator comprising a plunger for controlling the liquid fuel and the atomizing fluid to the burners and a member attached to said plunger for controlling the air admitted to the combustion chamber.

13. The combination with liquid fuel burners, of a regulator comprising a plunger having valves for controlling the liquid fuel and the atomizing fluid to the burners and a rod attached to said plunger for controlling the air admitted to the combustion chamber.

14. The combination with liquid fuel burners, of a regulator for controlling the liquid fuel and the atomizing fluid to said burners and a controlling valve device for said regulator comprising a main valve for varying the pressure on said regulator to operate same, a diaphragm subject to the controlled pressure, and a pilot valve operated by said diaphragm for varying the pressure on said main valve to operate same.

15. The combination with liquid fuel burners, of a regulator for controlling the liquid fuel and the atomizing fluid to said burners and a controlling valve device for said regulator comprising a main valve for varying the pressure on said regulator to fully open and close same, a diaphragm subject to the controlled pressure, and a pilot valve operated by said diaphragm under a reduction in the controlled pressure for operating the main valve to effect the opening of the regulator and upon an increase in the controlled pressure for operating the main valve to effect the closure of the regulator.

16. The combination with liquid fuel burners, of a regulator operated by liquid under pressure for controlling the liquid fuel and the atomizing fluid to said burners, a controlling valve device governed by the controlled pressure for supplying liquid under pressure to operate said regulator, and a pump for maintaining the liquid under a constant pressure.

17. The combination with liquid fuel burners, of a regulator operated by liquid fuel under pressure for controlling the liquid fuel and the atomizing fluid to said burners, a controlling valve device governed by the controlled pressure for supplying liquid fuel for operating said regulator, and a pump for maintaining said liquid fuel under a constant pressure.

In testimony whereof we affix our signatures in presence of two witnesses.

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SHIRLEY S. WEEKS.

Witnesses:
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