

June 18, 1929.

C. L. BRYANT

1,717,658

HEATING APPARATUS

Original Filed Aug. 13, 1925 3 Sheets-Sheet 1

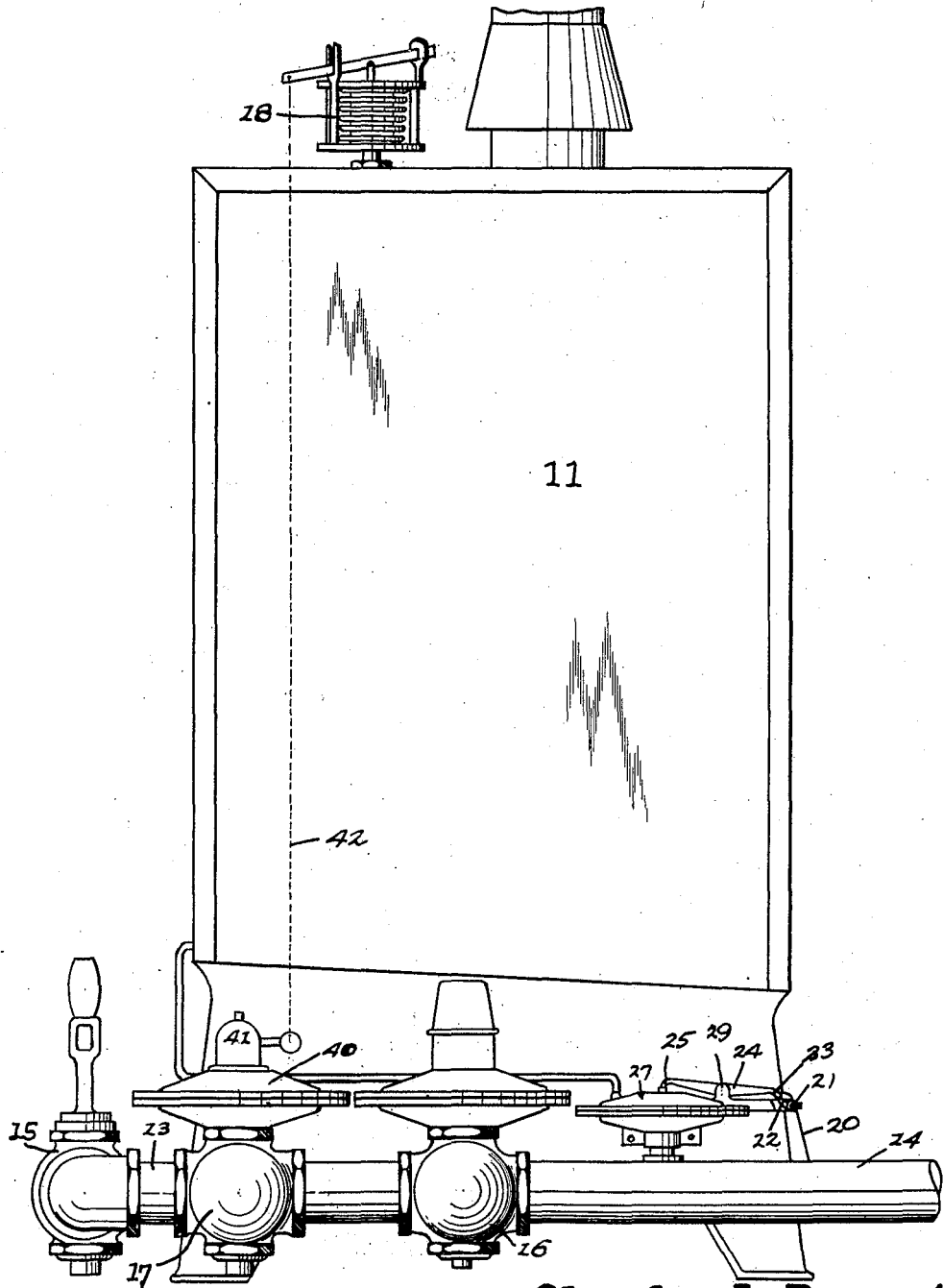


Fig. 1

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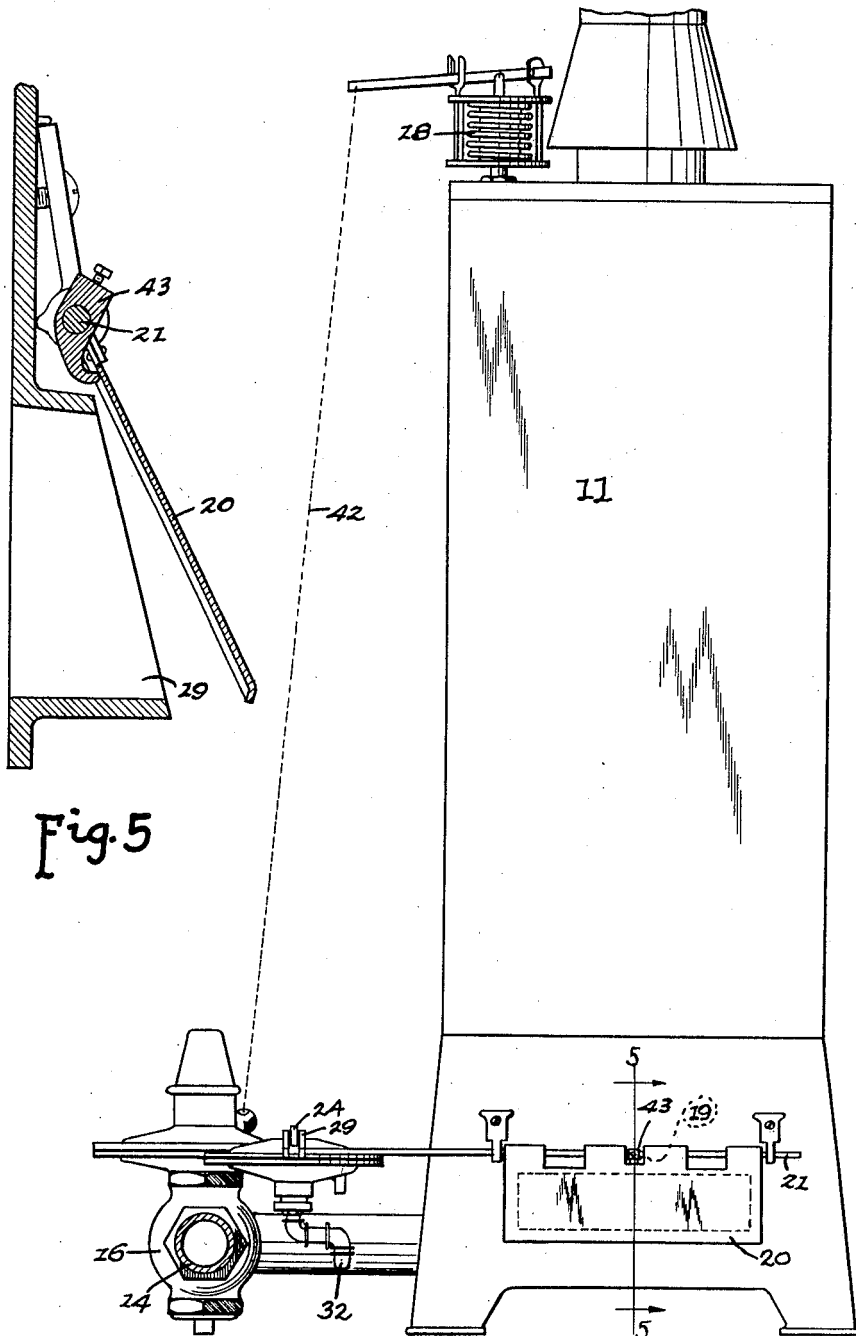


Fig. 5

Fig. 2

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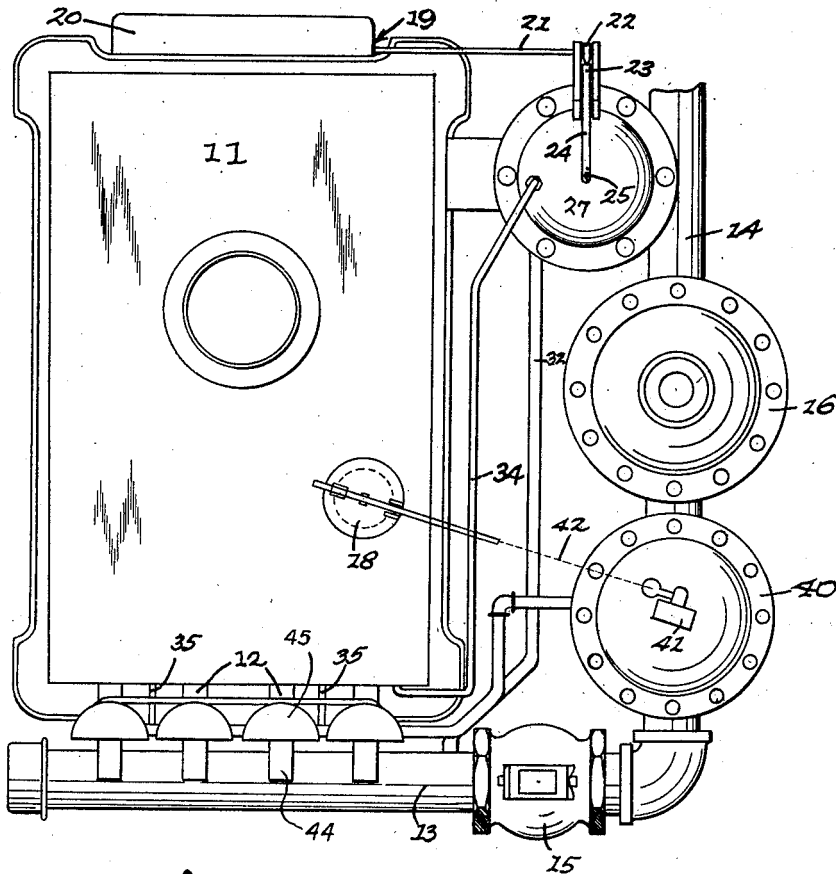


Fig. 3

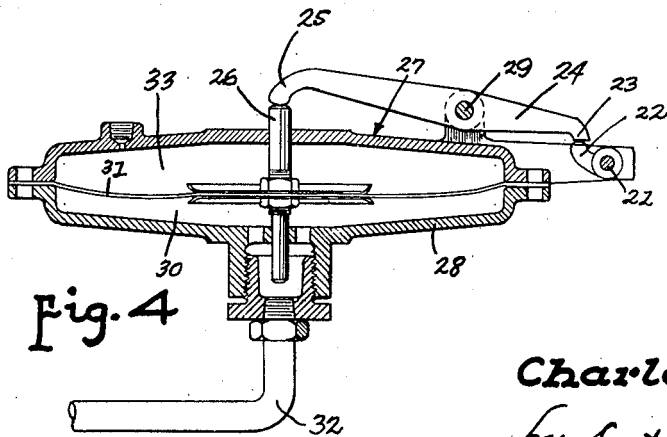


Fig. 4

**Charles L. Bryant**  
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# UNITED STATES PATENT OFFICE.

CHARLES L. BRYANT, OF CLEVELAND, OHIO.

## HEATING APPARATUS.

Application filed August 13, 1925, Serial No. 49,935. Renewed September 20, 1928.

My invention relates to heating apparatus and more particularly to heating apparatus of the type wherein the supply of fuel to a fluid fuel burner is alternately turned on and cut off, and the principal object of my invention is to provide apparatus of this type embodying satisfactory means for preventing heat loss during the periods over which the fuel supply is cut off. In the drawings accompanying this specification and forming a part thereof I have shown, for purposes of illustration, one form which my invention may assume. In these drawings:

Figure 1 is a side elevation of this illustrative form of my invention,

Figure 2 is a rear elevation of the device shown in Figure 1,

Figure 3 is a top plan view of this same device,

Figure 4 is an enlarged detail of the diaphragm motor, while

Figure 5 is a detail of the secondary air damper.

The embodiment of my invention herein shown comprises a boiler 11 heated by means of a plurality of fluid fuel burners 12 each receiving its fuel from the common conduit 13 connected to the fuel supply main 14 through a shut-off valve 15, through a branch duct 44 in which is interposed a mixer 45 of usual construction for mixing primary air with the fuel. The embodiment of my invention herein shown comprises also a fluid pressure regulator 16, and an automatic fuel control valve 17 actuated by a diaphragm motor 40 controlled by a control valve 41 itself controlled by a bellows 18 responsive to the pressure of the steam within the boiler 11 and acting through the chain 42 to shift the control valve 41 and thus position the valve 17 alternately in open and closed positions as the steam pressure within the boiler 11 alternately falls below a fixed minimum or exceeds a fixed maximum.

The casing of the boiler 11 is closed to substantially prevent the entrance of the secondary air required for combustion of the fuel other than at the opening 19 provided for that purpose in the rear wall in this casing and arranged to be closed by a damper 20 pivotally mounted along its upper edge upon a pivot shaft 21 provided with a lug 43 arranged to engage the

damper 20 to lift the damper 20 upon corresponding rotation of the shaft 21, and provided at its free end with a lever arm 22 engaging the lower end 23 of a lever 24 having its upper end 25 positioned in engagement with the stem 26 of a diaphragm motor 27 supporting on its housing 28 a fulcrum 29 for the lever 24, having the space 30 below the diaphragm 31 connected by means of a duct 32 to the conduit 13, and having the space 33 above the diaphragm 31 open to the atmosphere through a duct 34 carried into the interior of the boiler 11 and opening at a point in proximity to one of the pilot burners 35 so that any fuel escaping by leakage through the diaphragm 31 will be burned in the furnace 11 rather than escape into the room.

From the above description it will be obvious to those skilled in the art that the bellows 18 will operate in response to the steam pressure in the boiler 11 to act through the control valve 41 and diaphragm motor 40 to alternately open and close the fuel control valve 17, that in the open position of the valve 17 the pressure within the conduit 13 will operate to maintain the diaphragm 31 in raised position and the damper 20 open, that in the closed position of the valve 17 the absence of pressure in the conduit 13 will permit the diaphragm 31 to drop into its lower position and the damper 20 to close, and that in any case the damper 20 is free to open under the influence of an excess pressure within the casing of the boiler 11 such, for example, as might result from an explosion of the fuel, the damper 20 in such case operating by free and independent rotation about the axis of the shaft 22 without the necessity of operating the diaphragm 31 and stem 26, or even the lever 24, this action being permitted because the actuation of the damper 20 from the diaphragm 31 is through an abutting and separable connection between the end 23 of the lever 24 and the arm 22. It will therefore be apparent that as long as the fuel is being supplied to the burners 12 the damper 20 is maintained in position to permit the full supply of the secondary air required by the burners 12 for complete combustion of the fuel, that as soon as the supply of fuel is cut off the damper 20 automatically drops to closed position to cut off this supply of secondary air and thus substantially eliminate radiation from the boiler

11 during the periods of inactivity of the burners, and that danger from explosion is not increased.

Those skilled in the art will therefore  
 5 realize that the device herein shown possesses advantages over similar devices heretofore used, particularly the substantial  
 10 elimination of radiation loss during the periods of inactivity of the burners. At the same time, those skilled in the art will also  
 15 realize that the device herein shown possesses advantages other than those particularly pointed out, and also that the particular embodiment of my invention herein  
 20 shown and described may be variously changed and modified without departing from the spirit of my invention or sacrificing the advantages thereof. It will therefore be understood that this disclosure is  
 25 illustrative only and that my invention is not limited thereto.

I claim:

1. In a boiler provided with a combustion chamber, having within said combustion  
 25 chamber a fluid fuel burner comprising duct means for the supply of fluid fuel and primary air to said burner, and provided also with a port for the admission of secondary  
 30 air to said combustion chamber: valve means controlling the supply of secondary air through said port; and operating means for  
 35 said valve means responsive to a pressure condition within said duct means, acting to move said valve means toward open position upon  
 40 increase in such pressure and toward closed position upon decrease in such pressure, and operating said valve means through an abutting  
 45 connection at all times permitting said valve means to open independently in response to abnormal pressure in said combustion  
 50 chamber.

2. In a boiler provided with a combustion chamber, having within said combustion  
 45 chamber a fluid fuel burner comprising duct means for the supply of fluid fuel and primary air to said burner, and provided also with a port for the admission of secondary  
 50 air to said combustion chamber: valve means controlling the supply of secondary air through said port; and operating means for  
 55 said valve means comprising biasing means tending to move said valve means toward closed position, and actuating means responsive to a pressure condition within said duct  
 60 means acting against said biasing means to move said valve means toward open position and connected to said valve means through an  
 65 abutting connection at all times permitting said valve means to open independently against said biasing means in response to abnormal pressure in said combustion chamber.

3. In a boiler provided with a combustion chamber, having within said combustion  
 chamber a fluid fuel burner comprising duct means for the supply of fluid fuel and pri-

mary air to said burner, and provided also with a port for the admission of secondary air to said combustion chamber: valve means controlling the supply of secondary air  
 70 through said port; and operating means for said valve means responsive to a pressure condition within said duct means, acting to move said valve means toward open position  
 75 upon increase in such pressure and toward closed position upon decrease in such pressure, and operating said valve means through a connection at all times permitting said  
 80 valve means to open independently in response to abnormal pressure in said combustion chamber.

4. In a boiler provided with a combustion chamber, having within said combustion chamber a fluid fuel burner comprising duct means for the supply of fluid fuel and primary  
 85 air to said burner, and provided also with a port for the admission of secondary air to said combustion chamber: valve means controlling the supply of secondary air through said port; and operating means for  
 90 said valve means comprising biasing means tending to move said valve means toward closed position, and actuating means responsive to a pressure condition within said duct means acting against said biasing means to  
 95 move said valve means toward open position and connected to said valve means through a connection at all times permitting said valve means to open independently against  
 100 said biasing means in response to abnormal pressure in said combustion chamber.

5. In a boiler provided with a combustion chamber, having within said combustion chamber a fluid fuel burner comprising duct means for the supply of fluid fuel and primary  
 105 air to said burner, and provided also with a port for the admission of secondary air to said combustion chamber: valve means controlling the supply of secondary air through said port; and operating means for  
 110 said valve means responsive to a pressure condition within said duct means, acting to move said valve means toward open position upon increase in such pressure and toward closed position upon decrease in such pressure,  
 115 and operating said valve means through a one-way operating connection at all times permitting said valve means to open independently in response to abnormal pressure in said combustion chamber.

6. In a boiler provided with a combustion chamber, having within said combustion chamber a fluid fuel burner comprising duct means for the supply of fluid fuel and primary  
 120 air to said burner, and provided also with a port for the admission of secondary air to said combustion chamber: valve means controlling the supply of secondary air through said port; and operating means for  
 125 said valve means comprising biasing means tending to move said valve means toward

closed position, and actuating means responsive to a pressure condition within said duct means acting against said biasing means to move said valve means toward open position  
5 and connected to said valve means through a one-way-operating connection at all times permitting said valve means to open independently against said biasing means in response to abnormal pressure in said combustion chamber.  
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7. In a boiler provided with a combustion chamber, with a burner located within said combustion chamber and receiving fluid fuel admixed with primary air, with a port for the admission of secondary air to said combustion chamber, and with fuel supply means for supplying fuel to said burner and comprising control means for controlling such supply: valve means controlling the supply of secondary air through said port; and operating means for said valve means, operating automatically to open said valve means when said fuel supply means assumes fuel supplying condition, and operating said valve means through connections at all times permitting said valve means to open independently in response to abnormal pressure in said combustion chamber.  
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8. In a boiler provided with a combustion chamber, with a burner located within said combustion chamber and receiving fluid fuel admixed with primary air, with a port for the admission of secondary air to said combustion chamber, and with fuel supply means for supplying fuel to said burner and comprising control means for controlling such supply: valve means controlling the supply of secondary air through said port; means biasing said valve means toward closed position; and operating means for said valve means, operating automatically to open said valve means against said biasing means when said fuel supply means assumes fuel supplying condition, and operating said valve means through connections at all times permitting  
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said valve means to open independently in response to abnormal pressure in said combustion chamber.

9. In a boiler provided with a combustion chamber, with a burner located within said combustion chamber and receiving fluid fuel admixed with primary air, with a port for the admission of secondary air to said combustion chamber, and with fuel supply means for supplying fuel to said burner and comprising control means for controlling such supply: valve means controlling the supply of secondary air through said port; and operating means for said valve means, operating automatically to open said valve means when said control means assumes fuel supplying condition, and operating said valve means through connections at all times permitting said valve means to open independently in response to abnormal pressure in said combustion chamber.  
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10. In a boiler provided with a combustion chamber, with a burner located within said combustion chamber and receiving fluid fuel admixed with primary air, with a port for the admission of secondary air to said combustion chamber, and with fuel supply means for supplying fuel to said burner and comprising control means for controlling such supply: valve means controlling the supply of secondary air through said port; means biasing said valve means toward closed position; and operating means for said valve means, operating automatically to open said valve means against said biasing means when said control means assumes fuel supplying condition, and operating said valve means through connections at all times permitting said valve means to open independently in response to abnormal pressure in said combustion chamber.  
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In testimony whereof I hereunto affix my signature.

CHARLES L. BRYANT.