Sept. 4, 1956 E. A. FIELD 2,761,494

BAROMETRIC DRAFT REGULATOR AND BURNER CONTROL

Filed Jan. 26, 1953 3 Sheets-Sheet 1

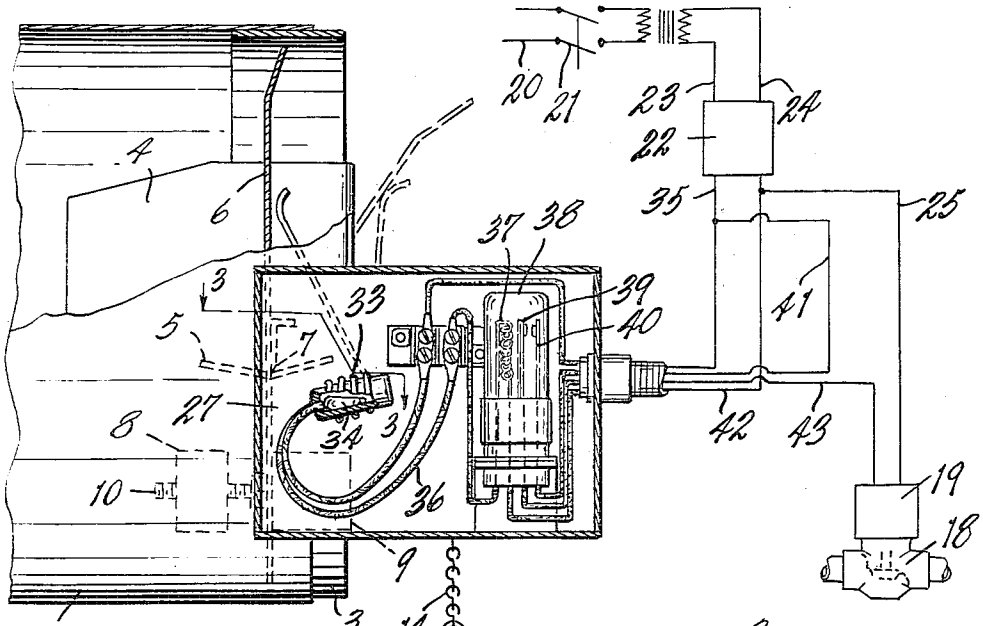


Fig. 1.

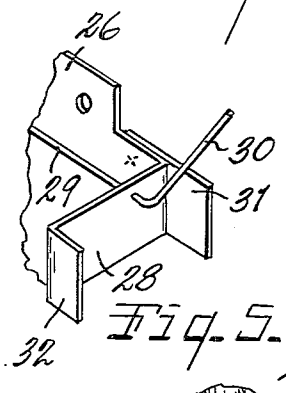


Fig. 5.

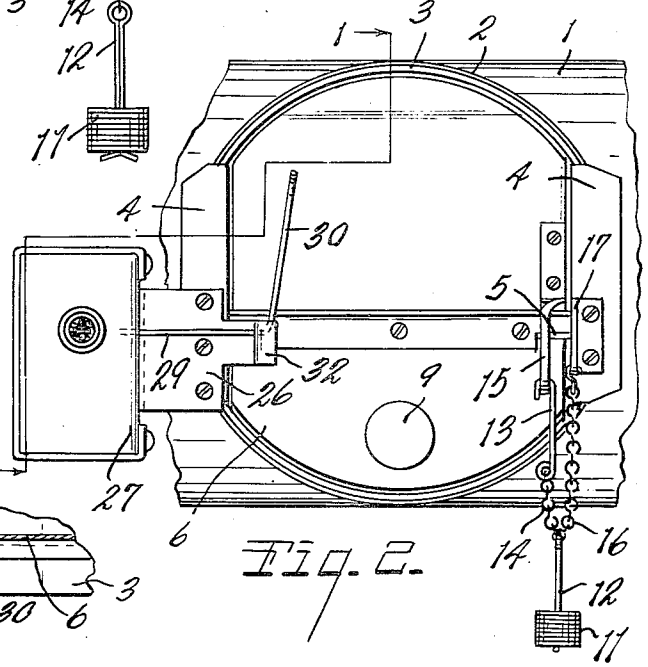


Fig. 2.

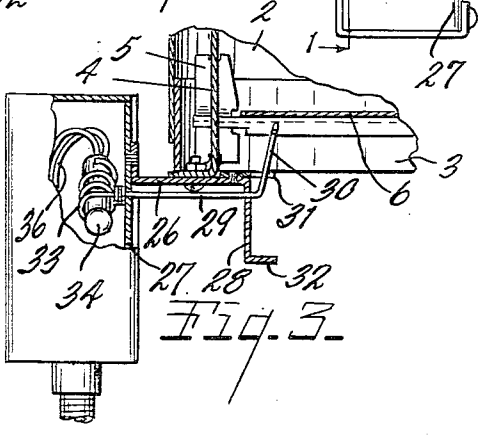


Fig. 3.

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BAROMETRIC DRAFT REGULATOR AND BURNER CONTROL

Filed Jan. 26, 1953 3 Sheets-Sheet 2

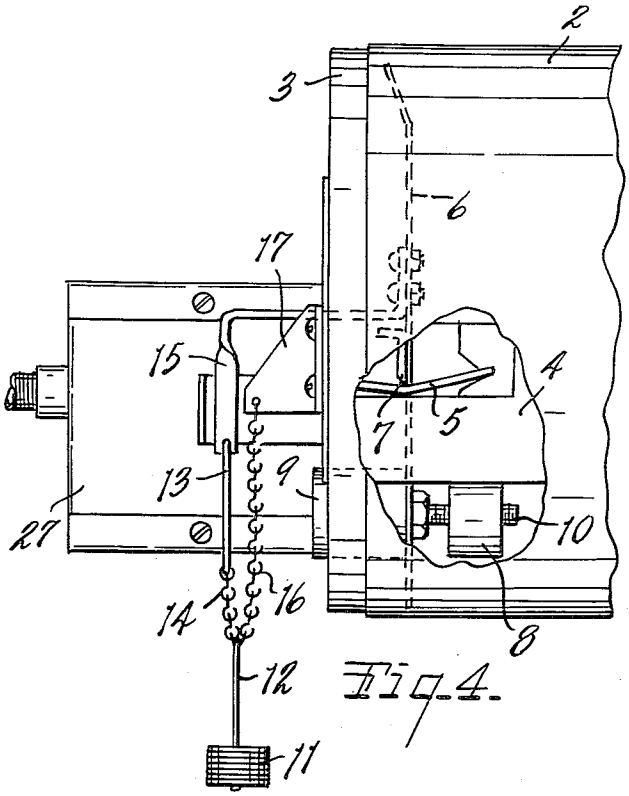


Fig. 4.

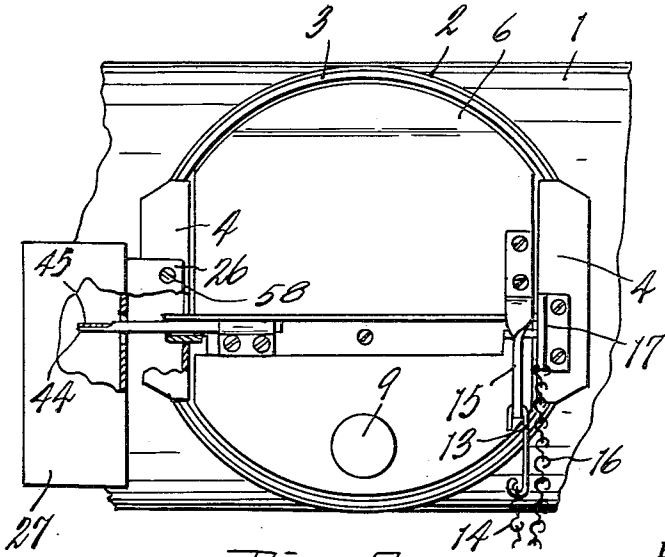


Fig. 6.

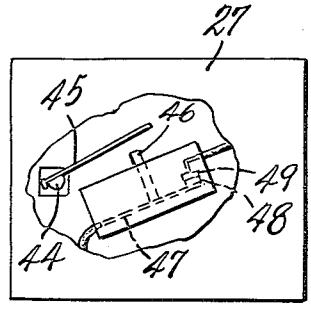


Fig. 7.

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Sept. 4, 1956 E. A. FIELD 2,761,494

BAROMETRIC DRAFT REGULATOR AND BURNER CONTROL

Filed Jan. 26, 1953 3 Sheets-Sheet 3

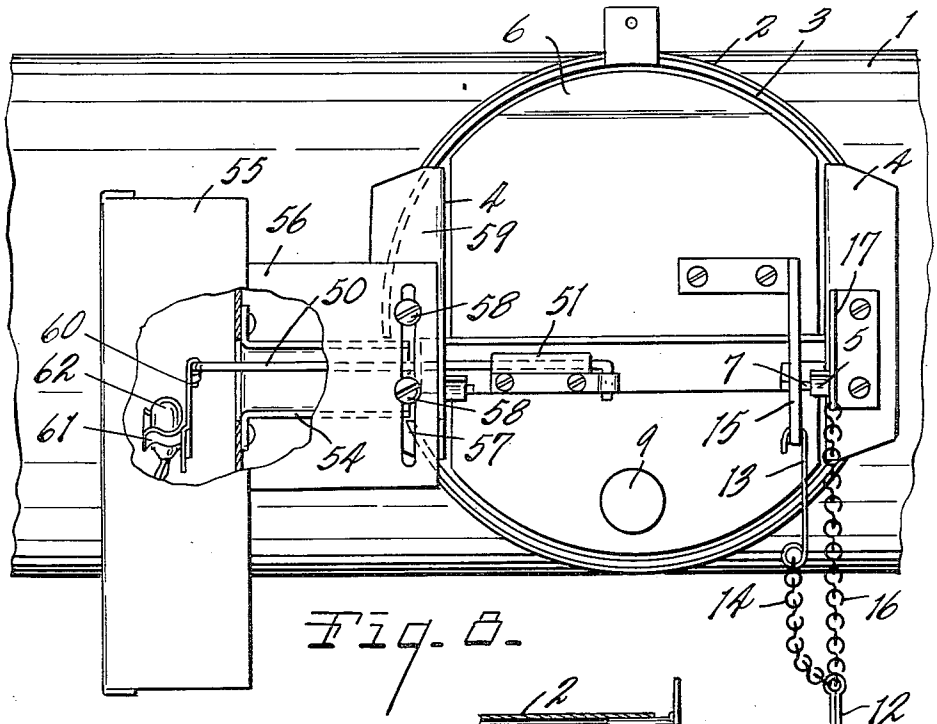


Fig. 8.

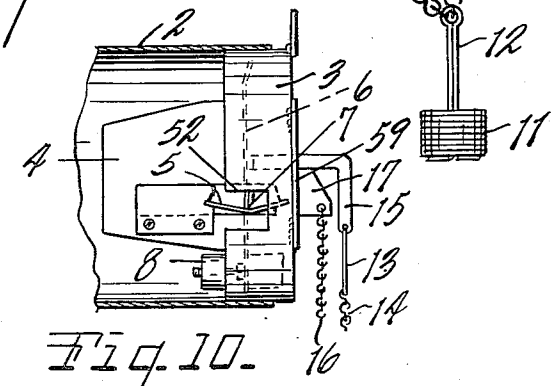


Fig. 10.

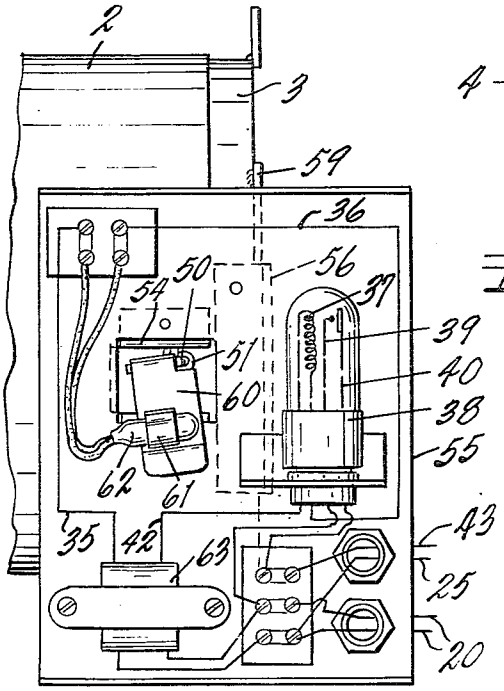


Fig. 9.

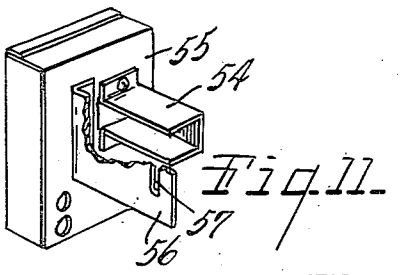


Fig. 11.

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BAROMETRIC DRAFT REGULATOR AND BURNER CONTROL

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Application January 26, 1953, Serial No. 333,308

5 Claims. (Cl. 158—1)

This invention relates to improvements in a barometric draft regulator and burner control.

The main objects of this invention are:

First, to provide a barometric draft regulator and burner control for gas and liquid fuel burners for controlling the updrafts and bypassing the downdrafts and including electrical means controllable by the regulator to close the supply of fuel to the burner in the event of a downdraft flow of a dangerous extent while permitting the valve to remain open in the event of a downdraft for a short period.

Second, to provide a barometric draft regulator as a prime mover in a burner control acting through a thermal time relay switch to control the burner.

Third, to provide a draft regulator and burner control having these features which may be economically produced and installed and one which is not likely to become inoperative but a control which "fails safely" in the event of the failure of the electrical circuits, the burner valve, or the other parts directly associated with the burner in the control thereof.

Objects relating to details and economies of the invention will appear from the description to follow. The invention is defined and pointed out in the claims.

A preferred embodiment of the invention is illustrated in the accompanying drawings, in which:

Fig. 1 is a fragmentary side view of a barometric control embodying my invention, parts being shown conventionally and diagrammatically and certain parts being shown in vertical section on a line corresponding to the broken line 1—1 of Fig. 2.

Fig. 2 is a front elevational view with the electrical connections shown in Fig. 1 broken away.

Fig. 3 is a fragmentary view partially in section on a line corresponding to the broken line 3—3 of Fig. 1.

Fig. 4 is a fragmentary side elevational view viewed from the right of Fig. 2.

Fig. 5 is an enlarged fragmentary perspective view showing further details of the control device.

Fig. 6 is a fragmentary front elevational view of a modified form or embodiment of my invention.

Fig. 7 is a fragmentary view of a modified form of the regulator gate control switch.

Fig. 8 is a fragmentary front elevational view of another modified form or embodiment of my invention.

Fig. 9 is a fragmentary side elevation of the modified form of Fig. 8 with the cover or front wall of the switch assembly housing removed.

Fig. 10 is a fragmentary end elevational view of the modified form of Fig. 8 with the gate housing in vertical longitudinal section.

Fig. 11 is a rear perspective view of the switch control assembly of the embodiment of Figs. 8, 9 and 10.

My present invention relates to an automatic draft regulator and burner control for the fluid fuel supply of burners of heating apparatus or systems and to electrical means operable by the regulator for closing the valve in the event of downdrafts continued for such a period as to

be dangerous. Since gas fired burners and certain liquid fuel burners can be extinguished rather easily by downdrafts, it is important, unless the burner has a forced draft, that means be provided to bypass the downdraft and cut off the supply of fuel to the burner if the downdraft is continued to a dangerous extent as the bypass downdraft carries the products of combustion into the space occupied by the furnace or heater. Further, a downdraft that does not extinguish the flame can create combustion conditions that result in the production of carbon monoxide gas.

The draft regulator of my present invention is designed to barometrically control the updraft and bypass the downdraft preventing the same from extinguishing the gas flame and cutting off the fuel supply in the event the downdraft continues for a substantial period.

In the embodiment of my invention illustrated, 1 represents a horizontal smoke flue and 2 a gate housing of cylindrical section mounted on the side of and opening to the flue. A gate mounting ring 3 is disposed at the front end of the housing and constitutes a part thereof. Side wings 4 project rearwardly from the member 3 and support bearing members 5 for the gate 6.

The gate is provided with knife edge pivots 7 coacting with these bearing members 5 and has weights 8 and 9 mounted on the spindle 10 to balance the gate so that it normally swings to a substantially upright closed position as illustrated in the drawing. The gate is free to swing inwardly on an updraft and outwardly on a downdraft, it being shown in an outward position by dotted lines in Fig. 1. The center of gravity of the gate is such that little back or downdraft will act to swing the gate outwardly. The weights 8 and 9 are balancing weights and are not designed to be adjusted in use.

The auxiliary weight 11 consisting of a plurality of washer-like members is mounted on a hanger 12 connected by the link 13 and the flexible section 14 to an arm 15 projecting forwardly and downwardly from the gate. With the gate in closed position the load of the weight 11 is sustained by the chain or cable 16 connected to the bracket 17. When the gate swings inwardly due to an updraft, the weight 11 is picked up and applies the desired torque to the gate. By varying the number of washer-like elements constituting the weight 11 the torque on the gate may be varied as desired. This weighting means is substantially that shown in my application for letter patent, Serial Number 237,855, filed July 21, 1951, now Patent No. 2,682,299 issued June 29, 1954.

The burner control valve is conventionally shown at 18 in Fig. 1, the valve being actuated by a solenoid or other electrically operated element indicated at 19. 20 indicates a source of current connections provided with a main switch 21. In some installations a gas burner is provided with a gas pilot and control means are associated with the gas supply valve to close the valve in the event of the pilot being extinguished or becoming inoperative. Quite commonly gas and liquid fuel burning furnaces or heaters are provided with other means acting to cut off the fuel supply under certain conditions but my control means is well adapted for such installations and as these control features form no part of my present invention they are not illustrated herein, only such parts being illustrated as are deemed desirable to disclose practical embodiments of my invention.

A controller is conventionally shown at 22, supply leads 23 and 24 being connected to this controller while the control unit 19 is connected by the circuit wire 25 to the lead 24. Other connections will be described after describing the control switch mechanism of my present invention.

In the embodiment illustrated, a bracket 26 is mounted on the gate supporting ring 3 with one end projecting

laterally of the housing and on which the switch housing **27** is mounted. The arm **28** of the bracket projects forwardly therefrom and serves as a bearing for the inner end of switch actuating rockshaft **29**, the inner end of which is journalled in the inner wall of the housing **27**. This rockshaft **29** is mounted parallel to and in a plane adjacent the axis of the gate and is provided with an upwardly projecting arm **30** disposed in front of the gate. In the embodiment illustrated the axis of the rockshaft is slightly above the axis of the gate but it may be below it.

A stop **31** is provided to limit the return movement of the arm which is normally supported adjacent to but slightly spaced from the gate when the gate is in its closed position. A stop **32** on the arm **28** of the bracket limits the outward swing of the rockshaft arm.

The outer end of the shaft **29** is formed into a coil **33** which serves as a holder or socket for the mercury switch **34**. The switch **34** is supported so that the switch is closed when the rockshaft is in its retracted position and when the gate is in its closed position or is swung inwardly as the result of an updraft. Current is supplied to the switch **34** by the wire or conductor **35**. The switch **34** is connected by the connection **36** to the heating element **37** of a time relay switch designated generally by the numeral **38**. The switch element **39** is associated with the heating element **37** to be actuated to close the thermal switch by contacting with the switch element **40** which is connected by the circuit connections **41** to the supply connection **23**.

The heating element **37** of the thermal relay switch is connected by the wires **42** to the control unit **22**. The switch element **39** is connected by the connections **43** to the burner control unit **19**. With the parts thus arranged, the current is normally supplied to the heating element **37** and that results in the closing of the thermal relay switch. The thermal switch is in series with the valve controlled unit **19** and the circuit of this switch and unit is in parallel with the circuit of the heating element **37** and the gate controlled switch **34**. When the gate is swung outwardly, as by a downdraft, the switch **34** is opened and that cuts off the current to the heating element of the relay switch. If this condition remains for a sufficient time for the heating element of the relay switch to cool, the heating element control switch member **39** opens and the current is cut off from the solenoid or other control element for the gas valve when the gas valve closes. In the event of failure of the supply current, the time relay switch is opened and the fuel valve closed. In the event of failure of the gate control switch **34**, the current to the heating element of the thermal switch is cut off and that results in the closing of the fuel supply valve and manual attention is required to reset the parts to operative function and start the burner. It will be noted that the arm **30** of the rockshaft is adjacent but slightly spaced from the gate **6** so that slight fluctuation or fluttering of the gate does not effect the gate controlled switch and, as stated, momentary opening of the switch does not result in closing the burner valve as a little time is required for the heating element **37** to cool to the extent of opening or permitting the relay switch to open.

In the embodiment shown in Figs. 6 and 7, a rockshaft **44** is secured to the pivot member of the gate to project through the side of the housing and into the switch housing **27**. An arm **45** on the shaft **44** coacts with a switch opening plunger **46** coacting with the member **47** with the switch designated generally by the numeral **48**. The switch has a fixed contact **49** with which the switch member **47** is normally in contact, that is, the switch **48** is normally closed as is the case with the mercury type of switch of Figs. 1 to 5 inclusive. The arm **45** is desirably flexible to permit additional outward swing of the gate after the switch is opened. This permits the gases in the flue to freely escape during the delay while the heater element cools.

The embodiment of Figs. 8, 9 and 10 is especially designed to permit the draft regulator being sold with or without the automatic burner control features and further, to provide a very sensitive burner control for small size draft regulators. The parts which constitute the automatic burner control features are hereinafter described.

The gate **6** is mounted and has the same balancing features as in the other embodiments of my invention. In this embodiment a rockshaft **50** is secured to the gate by the clamp **51** to position the rockshaft parallel to and slightly above the pivot axis of the gate. The gate mounting ring **3** is notched or recessed at **52** to receive the channeled arm **54** on the switch assembly or control housing **55**, the shaft **50** being disposed longitudinally within this arm. The housing **55** has a bracket **56** vertically slotted at **57** to receive mounting screws **58** for attaching the assembly to the outwardly projecting flange **59** of one of the side wings **4**.

In the embodiment of Figs. 1 to 5 the bracket **26** receiving the attaching screws is not vertically slotted as in the embodiment of Figs. 8 to 11. The rockshaft **50** has a depending arm **60** at its outer end providing switch mounting clips **61** for the mercury switch **62**. This arrangement results in substantially balancing the mercury switch relative to the axis of the gate but it will be appreciated that the gate may be statically balanced by means of the weights as has been described.

In this embodiment a transformer shown conventionally at **63** is mounted in the housing and connected in the circuit in advance of the mercury switch and time relay switch. The reason for this is that commercial time delay switches are constructed somewhat differently if the heaters are of the low voltage type as compared to 115 volt units. Low voltage heaters have more mass, which retains the heat longer. The delay in time before the relay contacts open after the heater is de-energized is more uniform with low voltage heaters than with line voltage units, so the transformer is provided for use when the circuit is a 115 volt circuit. This does not change the principle of operation but applicant provides for a somewhat wider range of controls and regulators to meet varying conditions. One of the principal advantages of the embodiment of Figs. 8 to 11 is the fact that the control may be assembled substantially as a unit and the draft regulator may be sold for use without the automatic burner control features, which comprise the removable clamp **51**, the removable housing **55**, the control parts in the housing and the electrical connections outside the housing to the control parts in the housing, as above described.

I have illustrated and described two practical embodiments of my invention. I have not attempted to illustrate or describe other embodiments or adaptations as it is believed that this disclosure will enable those skilled in the art to embody or adapt my invention as may be desired.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a barometric draft regulator and burner control, an open ended gate housing, a pivotally mounted control gate disposed in said housing for opening inwardly during an indraft and outwardly during an outdraft, weighting means on said gate, the center of gravity of the gate and weighting means thereon being disposed eccentric to the pivotal axis of the gate to effect a closing torque movement on the gate, a shaft disposed adjacent to the gate and in a plane adjacent and parallel to the axis thereof said shaft being provided with an angularly projecting arm positioned along side of the gate to be engaged by the gate on its outward swinging movement and counterbalanced to return to retracted position, a gate controlled switch operatively associated with said

shaft to be opened by the actuation of the shaft and closed when the arm is in retracted position and the gate in a closed position and in an inward position due to an indraft, an electrically controlled burner fuel supply means, a thermally controlled switch including a heating unit acting to close the thermally controlled switch when the heating element is heated, a first circuit in which the gate controlled switch and heating element are disposed, and a second circuit in which the thermally controlled switch and burner fuel supply means are disposed, an auxiliary weight connected to said gate for producing additional closing torque on the gate when it opens inwardly due to an indraft, and means independent of the gate for sustaining the auxiliary weight when the gate opens outwardly due to an outdraft.

2. In a barometric draft regulator and burner control, a gate housing including a gate mounting ring at the front end of the housing provided with a laterally projecting flange at one side thereof, a control gate swingably mounted in said mounting ring on a horizontal axis to swing inwardly during an indraft and outwardly during an outdraft and weight biased to closed position, said mounting ring having an opening therein aligned with the axis of the gate, a control switch assembly housing provided with a vertically slotted bracket, said mounting ring flange being provided with screws engaging said slot for adjustably securing the bracket thereto, said housing being provided with a channeled arm projecting in said recess in said gate mounting ring, a rockshaft mounted on said gate and projecting through said opening therein and through said channeled housing arm, said rockshaft provided with a switch carrying arm at its outer end, a mercury switch carried by said arm and positioned to be closed when the gate is in closed position and when the gate swings inwardly and opened when the gate swings outwardly due to an outdraft, an electrically controlled burner fuel supply means, and a thermal relay switch including a heating element acting to close the thermal switch when heated, said heating element being connected in series with said first mentioned switch, said thermal switch being connected in series with the electrically controlled burner fuel supply means.

3. In a barometric draft regulator and burner control, a gate housing including a gate mounting ring at the front end of the housing provided with a laterally projecting flange at one side thereof, a control gate swingably mounted in said mounting ring on a horizontal axis to swing inwardly during an indraft and outwardly during an outdraft and weight biased to closed position, said mounting ring having an opening therein aligned with the axis of the gate, a control switch assembly housing provided with a bracket secured to said flange, said housing being provided with a channeled arm projecting in said gate mounting ring, a rockshaft mounted on said gate and projecting through said opening therein and through said channeled housing arm, said rockshaft provided with a switch carrying arm at its outer end, a mercury switch carried by said arm and positioned to be closed when the gate is in closed position and when the gate swings inwardly and opened when the gate swings outwardly due to an outdraft, an electrically controlled burner fuel supply means, and a thermal relay switch including a heating element acting to close the thermal switch when heated, said heating element being connected in series with said first mentioned switch, said thermal switch being connected in series with the electrically controlled burner fuel supply means.

4. In a barometric draft regulator and burner control, a gate housing, a control gate swingably mounted in said housing to swing inwardly during an indraft and outwardly during an outdraft and weight biased to closed position, said housing having an opening therein aligned with the axis of the gate, a control switch assembly housing mounted on said gate housing, a rockshaft mounted on said gate and projecting through said opening therein, a switch mounted on said rockshaft to be closed when the gate is in closed position and when the gate swings inwardly and opened when the gate swings outwardly due to an outdraft, an electrically controlled burner fuel supply means, and a thermal relay switch including a heating element acting to close the thermal switch when heated, said heating element being connected in series with said first mentioned switch, said thermal switch being connected in series with the electrically controlled burner fuel supply means.

5. In a barometric draft regulator and burner control, a housing adapted to constitute a passageway between a flue and the air outside the flue, a swingably mounted control gate disposed in said housing for opening inwardly during an indraft for passage of air from outside of the housing into the flue and opening outwardly during an outdraft for passage of gases from the flue to the air outside of the housing, the center of gravity of the gate acting to return it to closed position, a switch operatively associated with the gate to be closed when the gate is in closed position and when the gate swings inwardly due to an indraft and to be opened when the gate swings outwardly due to an outdraft, an electrically controlled burner fuel supply means, and a thermally controlled switch including a heating element acting to close the thermally controlled switch when the heating element is heated, said heating element being connected in series with the first mentioned switch, said second switch being connected in series with the electrically controlled burner fuel supply means.

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