Jan. 10, 1967 L. F. PFISTER 3,297,251

DOUBLE ACTING DRAFT CONTROL WITH SLEEVE

Filed Jan. 14, 1965

Fig. 1.

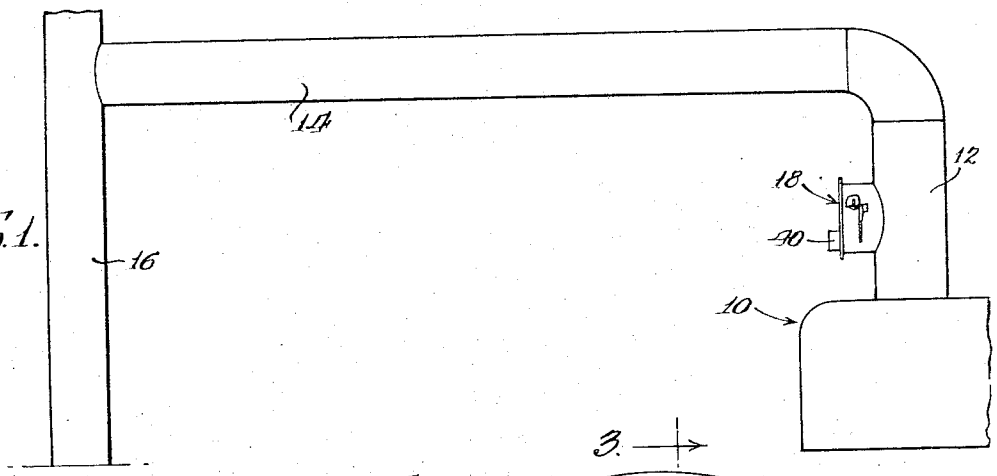



Fig. 2.

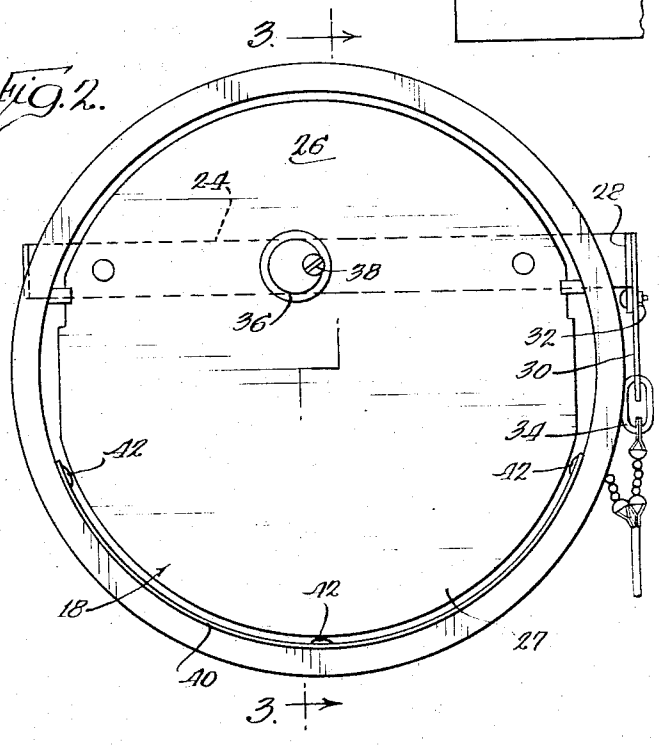
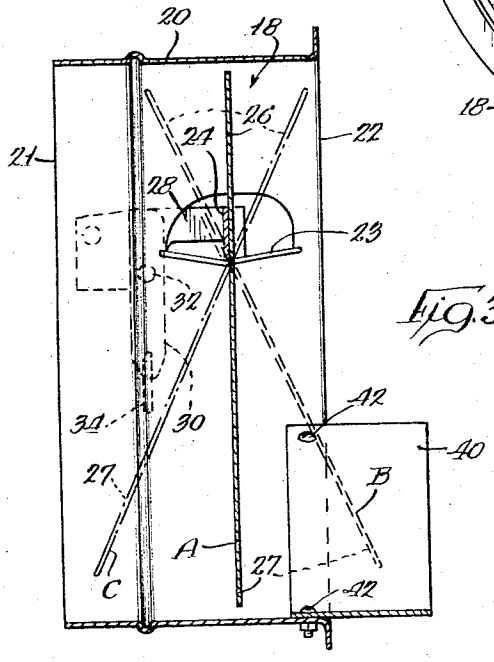



Fig. 3.

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# DOUBLE ACTING DRAFT CONTROL WITH SLEEVE

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7 Claims. (Cl. 236—45)

This invention relates to improvements in double acting barometric draft controls.

The use of double acting barometric draft controls in combustion systems serves two purposes. The first is to regulate and maintain the draft at a substantially constant value such that the maximum efficiency of the unit may be maintained. With an excessive draft, the products of combustion pass through the heat exchange section of the combustion unit at a higher velocity than is desired because of the increased volume. When this occurs, the gases will not contact the heat exchanger surfaces for a sufficiently long period of time to allow maximum heat to be absorbed from them, and fuel is wasted. Too little draft can cause poor combustion so that excessive carbon monoxide is present in the products of combustion. Free carbon or soot may also occur which will be deposited on the walls of the heat exchanger of the device. Since soot is a poor conductor of heat, the accumulation of it upon the heat exchanger wall results in inefficient heat exchange and wasted fuel.

The other purpose of a double acting barometric draft control is to relieve downdrafts or overpressure in the stack that will affect the flame in the combustion unit. Commonly, such an overpressure will cause partial blockage or reversal of flow of the products of combustion within the stack. In a standard installation, the relieving of the pressure condition in the stack permits the spillage of the products of combustion into the room housing the combustion unit. While such spillage may be tolerated for periods of short duration, it is apparent that if this condition is prolonged, the atmosphere of the room housing the combustion unit will be severely contaminated with the products of combustion. Such a result will inevitably lead to the choking of the flame of the combustion unit due to lack of oxygen and/or an unsafe condition for the operator of the combustion unit.

Accordingly, it has been good engineering practice to associate with the double acting barometric draft control, a cut-off mechanism, such as a mercury switch in a time delay control circuit, for the burner that will be actuated a predetermined time after the initiation of spillage of the products of combustion into the room housing the combustion unit. Such mechanisms are customarily actuated by the movement of the control gate to a specified spillage position. It is therefore apparent that the sensitivity of the control in responding to a downdraft in the stack plays a great part in the actuation of the cut-off mechanism and the safeness of the entire combustion system. It is further apparent that the sensitivity of the control is the major factor in determining the rate of response of the control to a downdraft in the stack, and thus, the effect of the downdraft upon the flame in the combustion unit.

It is, therefore, the principal object of the invention to provide a new and improved double acting barometric draft control.

More specifically, it is an object of the invention to



provide a double acting barometric draft control that is extremely sensitive to the existence of a downdraft within the stack.

Another object of the invention is the provision of a double acting barometric draft control having a housing and a gate pivotally mounted within the housing wherein the housing is provided with an extension adjacent the gate such that at least a portion of the gate will swing into an overlapping relation with the extension.

Another object of the invention is the provision of a double acting barometric draft control including a housing having a gate pivotally mounted therein and an extension on the housing adjacent the gate wherein the distance from the gate in a closed position to the end of the extension is in the range of 25 to 75% of the width of the housing.

Another object of the invention is the provision of a double acting barometric draft control including a housing having a gate pivotally mounted therein, and an extension mounted on the housing adjacent the gate wherein the extension extends about at least 5% of the periphery of the housing.

Another object of the invention is the provision of a double acting barometric draft control including a housing and a gate pivotally mounted therein, and a separate extension member attached to the housing adjacent the gate that is easily removable such that the sensitivity of the control may be adjusted in accordance with the requirements of any given application of use.

Other objects and advantages of the invention will become apparent from the following specification and drawings in which:

FIGURE 1 is a side elevation of a heating appliance having a flue and stack and using a double acting barometric draft control made in accordance with the invention;

FIGURE 2 is a view of a double acting barometric draft control according to the invention; and

FIGURE 3 is a sectional view of a double acting barometric draft control made in accordance with the invention taken along line 3—3 of FIGURE 2.

For purposes of illustration only, there is shown an embodiment of the invention mounted on a double acting barometric draft control of the type disclosed in U.S. Patent No. 2,819,024. It is to be understood, however, that the use of the invention is not limited to any specific type of control such as that named above, but is readily adapted to virtually every double acting barometric draft control.

A heating appliance of the fuel burning type is generally designated **10** as shown in FIGURE 1. A vertically arranged flue **12** communicates with the heating appliance **10** to receive the products of combustion therefrom. A second flue duct **14** channels the products of combustion from the flue **12** to a stack **16**. Mounted on the flue **12** and communicating therewith is a double acting barometric draft control generally designated **18**.

As seen in FIGURES 2 and 3, the control **18** comprises a generally cylindrical housing **20** having open ends **21** and **22**, the first of which is adapted to be attached in a communicating relationship with the flue **12**, and a pair of side openings **23** adjacent the end **22**. The lower edges of the openings **23** serve to pivotally support a torque arm **24** having knife edge bearings. A gate **26** of a size and shape such as to substantially close the housing **20**,

when it is in a position such as position "A" as seen in FIGURE 3, is eccentrically mounted on the torque arm **24**. By virtue of the pivotal mounting of the torque arm **24**, and thus the gate **26**, the gate **26** may assume a variety of positions within the housing in addition to the position "A" wherein the control or major portion **27** of the gate **26** is outwardly swung, such as in position "B," or inwardly swung as in position "C," also shown in FIGURE 3. It is to be noted, in normal operation, i.e., an updraft existing within the stack, the gate **26** will assume a position such as the inwardly swung position "C" in FIGURE 3, or perhaps, if the proper draft is present in the stack **16** without admission of extra draft gases by the control **18**, closed position "A" will be assumed. On the other hand, if there is a downdraft within the stack **16** that requires relief, the gate **26** will assume an outwardly swung position such as position "B" in FIGURE 3.

The torque arm **24** includes an offset portion **28** from which a link **30** is supported. The link **30** is attached to the torque arm portion **28** by means of a pivotal connection **32**. A yoke chain **34** is connected to the link **30** and to the housing (not shown) and is adapted to support various weights (not shown) which apply a substantially constant bias to the torque arm **24** in an updraft condition, and thus, normally maintain the gate **26** at an attitude that properly controls the draft in the stack. The weights (not shown) attached to the yoke chain **34** are suitably chosen in accordance with the draft requirements of any given installation of a heating appliance.

On the side of the gate **26** opposite from the torque arm portion **28** is an adjustable counterweight **36** which is mounted on a threaded screw member **38**. The counterweight **36** is adjusted along the length of the screw member **38** to substantially balance the weight of the major portion **27** of the gate **26** and the yoke chain **34** about the pivotal axis of the torque arm **24**, but not the weight of the weights (not shown) supported by the yoke chain **34**. Accordingly, the gate **26** will swing within the housing **20** according to the dictates of the stack pressure and the restraining torques exerted on the torque arm **24** by the weights on the yoke chain **34**.

The structure thus far described is conventional, it being that disclosed in the aforementioned U.S. patent. While such prior art devices have served satisfactorily in many installations, their construction has not been endowed with the degree of sensitivity for downdraft control achieved in a control made in accordance with the invention. To achieve the greater sensitivity contemplated by the invention, there is mounted on the open end **22** of the housing **20** an arcuate plate **40** which serves as an extension of at least a portion of the housing **20**. The length of the extension plate **40** and the portion of the periphery of the housing **20** about which the plate **40** extends can be varied within certain limits depending upon the degree of sensitivity required by any given installation as will be seen hereinafter.

The connection between the extension **40** and the housing **20** may be achieved by conventional securing means such as screws **42**. While it is not critical, the use of releasable securing means, such as screws, permits ready interchangeability of various extension plates such that a supplier of the controls may stock a single control and a variety of extension plates, any one of which may be selected to suit a given installation. The extension plate **40** is placed on the housing **20** in such a manner that the control or major portion **27** of the gate **26** will swing outwardly into an overlapping relation with the extension plate **40**, such as is indicated by the outwardly swung downdraft position "B" of the gate **26** as seen in FIGURE 3.

The following tables, the data for which was obtained on an eight inch, cylindrical double acting barometric draft control, illustrate the effects of varying the length and peripheral extent about the housing of the extension plate.



TABLE I.—EFFECT OF EXTENSION LENGTH

| Distance between outer end of extension and gate in position "A," percent of width of housing | Overpressure in stack required to swing gate 55° outwardly, inches W.C. | Percent of housing periphery about which extension plate extends |
|---|---|---|
| 75.0 | .0075 | 33.3 |
| 62.5 | .0080 | 33.3 |
| 56.3 | .0085 | 33.3 |
| 50.0 | .0100 | 33.3 |
| 43.8 | .0110 | 33.3 |
| 37.5 | .0120 | 33.3 |
| 31.3 | .0135 | 33.3 |
| 25.0 | .0155 | 33.3 |
| (1) | .0200 | (1) |

[1] No extension.

TABLE II.—EFFECT OF PERIPHERAL EXTENT OF EXTENSION

| Percent of housing periphery about which extension plate extends | Overpressure in stack required to swing gate 55° outwardly, inches W.C. | Distance between outer end of extension and gate in position "A," percent of width of housing |
|---|---|---|
| 50.0 | .0065 | 62.5 |
| 33.3 | .0080 | 62.5 |
| 27.7 | .0095 | 62.5 |
| 22.2 | .0100 | 62.5 |
| 16.7 | .0125 | 62.5 |
| 11.1 | .0145 | 62.5 |
| 5.6 | .0160 | 62.5 |
| (1) | .0200 | (1) |

[1] No extension.

It is believed that the increased sensitivity and response to small overpressures or downdrafts in the stack found in a double acting barometric draft control made in accordance with the invention is due to a directing action by the extension on the flue gases as the latter are spilled into the room housing the heating appliance. For example, if one were to consider the control shown in FIGURE 3 without the extension plate **40**, it would be apparent that a greater percentage of the gases being spilled could leave the control when the gate **26** is in a position such as position "B" without exerting a force on the gate **26** than would be the case with the extension present. In other words, the extension **40** serves to confine the gases and direct them against the gate **26** when it is in an outwardly swung position, such as position "B" where the major portion **27** of the gate **26** protrudes from the housing end **22**. Thus, by directing a higher proportion of the flue gases being spilled against the gate, greater gate swing and control sensitivity will be accomplished at the same stack overpressure.

Thus, it is believed apparent, that the invention does not rely on any particular housing shape or extension plate shape. Similarly, it will be recognized that the use of various means for controlling the inwardly swung gate position during admittance of draft gases to the flue (such as the gate position shown as "C" in FIGURE 3) does not substantially affect the increased sensitivity and response to stack overpressure obtainable when an extension according to the invention is used with the double acting barometric draft control. It will be equally apparent, in view of the foregoing tables, that the various interrelations between housing width, extension length, and peripheral extent of the extension about the housing are factors of importance. Accordingly, it is believed obvious that a double acting barometric draft control constructed in accordance with the invention is particularly well suited, although not limited thereto, for use in installations having automatic burner cut-off means effective after prolonged spillage of flue gases caused by overpressure within a stack because of the characteristic wherein a substantial gate swing, suf-

ficient for tripping a switch or the like to actuate the burner cut-off means, is produced by very low overpressures.

Having disclosed a specific embodiment of my invention as required by 35 U.S.C. 112, I do not wish my invention to be limited to the construction set forth, but rather, to be construed according to the true spirit thereof as set forth in the following claims.

I claim:

1. In a double acting barometric draft control including a cylindrical housing having an end adapted to be attached to a flue; a gate including a control portion and having a shape and size substantially conforming to the cross section of said housing such that said gate will close said housing in at least one position of said gate within said housing, and means pivotally mounting said gate within said housing for swinging movement to either side of said one position; the improvement comprising: an arcuate plate having an inner edge facing said end and an outer edge directed away from said end and mounted on the other end of said housing and projecting outwardly therefrom to one side of said gate whereby at least the control portion of said gate may swing into an overlapping relation with said plate; said housing abutting said inner edge along the entire extent thereof; said plate extending about the portion of the periphery of said housing adjacent said control portion at least 120°; the outer end of said plate being a distance of about 62–75% of the diameter of said housing from said gate when said gate is in said one position.

2. A double acting barometric draft control comprising: a cylindrical housing having an end adapted to be attached to a flue; a gate including a control portion and having a shape and size substantially conforming to the cross section of said housing such that said gate will close said housing in at least one position of said gate within said housing; means pivotally mounting said gate within said housing for swinging movement to either side of said one position; and an arcuate extension on the other end of said housing and having an inner boundary embracing said housing along the entire peripheral extent of said extension, said arcuate extension projecting outwardly therefrom and to one side of said gate whereby at least the control portion of said gate may swing into an overlapping relation with said extension; said extension extending about at least the portion of the periphery of said housing adjacent said control portion; the outer end of said extension being a distance of about 25–75% of the diameter of said housing from said gate when said gate is in said one position.



3. The draft control of claim 2 wherein said extension comprises a separate member attached to said housing.

4. In a double acting barometric draft control including a housing having an end adapted to be attached to a flue, a gate having a shape and size substantially conforming to the cross section of said housing in at least one position of said gate within said housing, means pivotally and eccentrically mounting said gate within said housing for swinging movement to either side of said one position, said gate including a major portion on one side of said pivotal mounting means and a minor portion on the other side of said pivotal mounting means, said major portion being swingable away from said end and toward the other end of said housing in response to a positive pressure in said flue and swingable toward said end in response to a negative pressure in said flue; the improvement comprising: an outwardly directed extension on said other end of said housing along the periphery thereof adjacent said major portion and to one side of said gate whereby said major portion may swing into an overlapping relation with said extension, the inner boundary of said extension forming a substantially continuous surface with said housing.

5. The draft control of claim 4 wherein said extension comprises a separate member attached to said housing.

6. The draft control of claim 4 wherein said extension extends beyond said gate in said one position a distance in the range of about 25–75% of the width of said housing.

7. The draft control of claim 4 wherein said extension extends about at least 5% of the periphery of said housing.

**References Cited by the Examiner**

UNITED STATES PATENTS

2,818,216 12/1957 Field ..... 236—45

FOREIGN PATENTS

638,922 12/1952 Great Britain.

ALDEN D. STEWART, *Primary Examiner.*