

[54] **FORCED DRAFT FURNACE SAFETY SYSTEM**

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[22] Filed: **June 25, 1970**

[21] Appl. No.: **49,886**

[57] **ABSTRACT**

[52] U.S. Cl.126/110 R, 431/20

[51] Int. Cl.F23n 1/06, F24h 3/02

[58] Field of Search.....126/110, 110 B, 116, 116 B; 431/20; 236/45

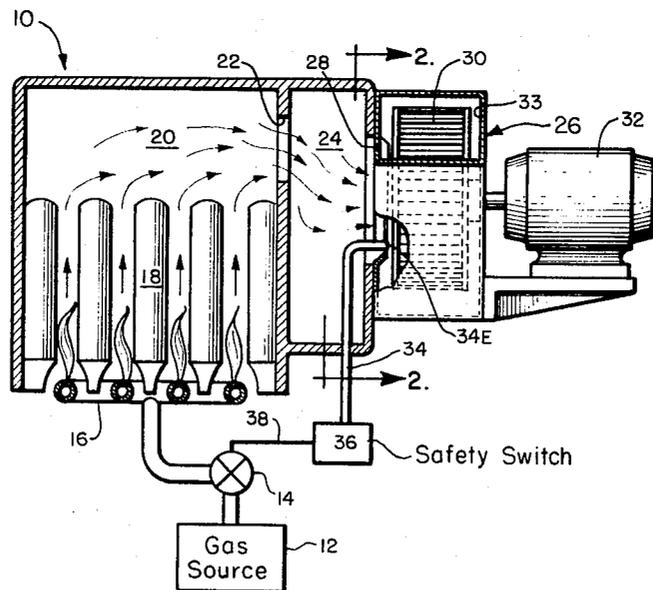
A safety system for sensing the air flow through a forced draft furnace and using that sensed flow to operate a switch which prevents gas fuel from being supplied to the furnace in the absence of such flow is disclosed in which a vacuum sensing tube is positioned at the edge of the inlet to a centrifugal blower within a specific range of angular positions to obtain a sufficiently large magnitude of pressure differential to operate the switch.

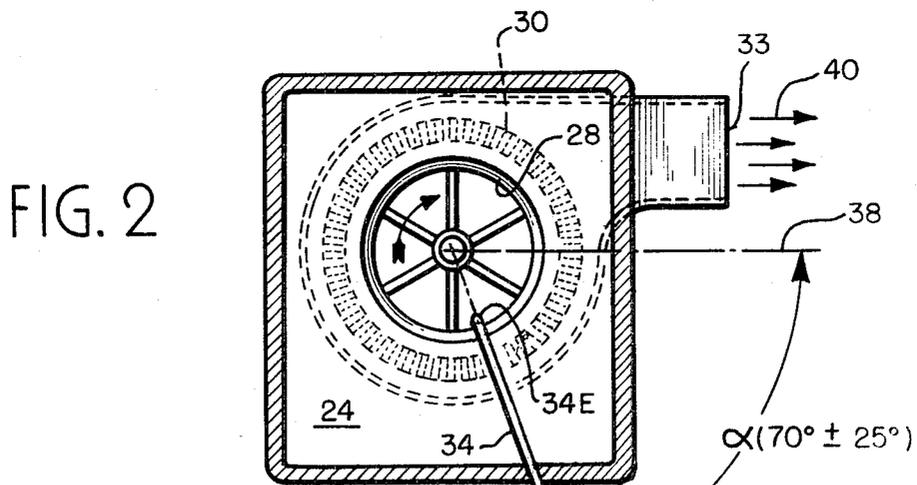
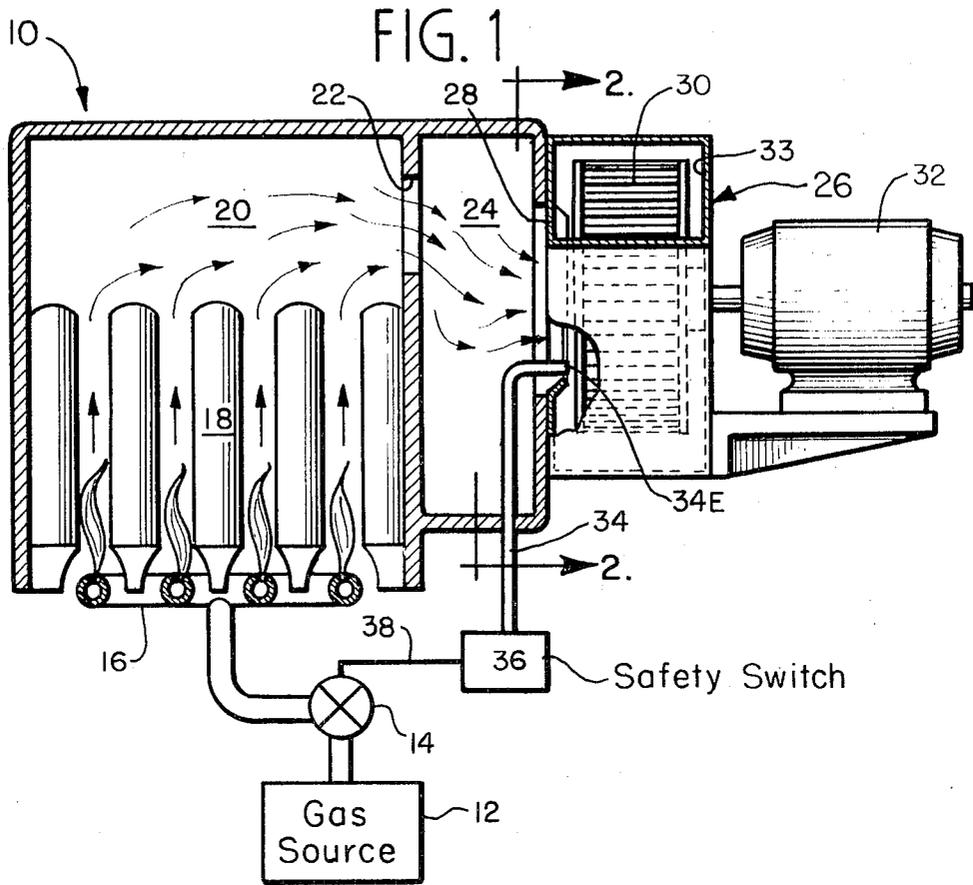
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5 Claims, 2 Drawing Figures





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FORCED DRAFT FURNACE SAFETY SYSTEM

FIELD OF THE INVENTION

The present invention is related to a new and improved forced-draft furnace safety system and particularly to such a system in which ignition and fuel supply are controlled by a sensing of the draft.

BACKGROUND OF THE INVENTION

In forced draft furnace systems it is desirable before ignition and burning of the fuel to sample the flow of air and to determine if a sufficient flow is present for safety. In the past this has been done indirectly, as by a centrifugal switch on the blower drive motor. This may lead to dangerously inaccurate samplings, as it is possible for the motor to rotate sufficiently to activate the switch while the blower is not operated. For example this may occur if a drive pulley belt or other drive connection is broken. To directly sample the air flow in the system and to operate a switch thereby presents certain problems, as the optimum air flow produces a relatively low pressure difference. Thus, either an extremely sensitive (and consequently expensive) sensor must be employed or the direct sensor must needlessly prevent ignition until an unnecessarily large draft is present.

The present invention has as its primary object the provision of a safety system in which the draft vacuum may be sensed directly in a manner to achieve sufficient pressure difference to positively, efficiently and economically prevent burning of the fuel in the absence of a sufficient draft.

In overcoming the above problems in centrifugal blower systems the present invention provides a switch that directly samples pressure differential in the system.

SUMMARY OF THE INVENTION

A safety system constructed in accordance with the present invention comprises a pressure sensitive unit, preferably a vacuum tube or the like positioned at the inlet from the furnace chamber to the centrifugal blower for operating a pressure sensitive switch.

For best results, the present inventors have discovered, the sensor should be located between the 45° and the 95° (and preferably at approximately the 70°) radius from the center of the inlet as measured in the direction of rotation from the radius parallel to the direction of outlet air flow.

BRIEF DESCRIPTION OF THE DRAWINGS

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with the further advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings, in the two figures of which like reference numerals identify like elements, and in which:

FIG. 1 is an elevational view, partly in section and partly in schematic, of a forced draft gas furnace and exhaust system including a safety system embodying the principles of the present invention; and

FIG. 2 is a sectional view of a portion of the system of FIG. 1 as seen from the line 2—2 in that figure.

DETAILED DESCRIPTION

Referring to FIG. 1 there is depicted a furnace system, generally designated by the numeral 10, of the gas-fired forced draft type which incorporates a safety system constructed in accordance with the present invention.

The furnace system 10 is fired by natural or bottled gas from a suitable source 12 through a controlled safety valve 14. From the valve 14 the gas is fed to burner units 16 where it, during operation, is burned. The hot combustion gases rise upward through a heat exchanger 18 to a collection chamber 20 from which they are drawn through an opening 22.

The opening 22 leads to a second flue gas collection box 24 from which they are drawn by a centrifugal blower unit 26. The blower unit 26 includes a circular opening inlet 28 having, as shown, a bell mouth inlet from the chamber 24. Although here depicted as a bell mouth inlet the present invention may equally well be employed with a sharp edge inlet. From the inlet 28 the flue gases are impelled by a blower wheel 30 which is driven by an externally mounted electric motor 32. The flue gases are normally vented to the atmosphere from the blower exit port 34.

As so far described the system 10 is conventional and well-known and has therefore been described and depicted in general terms for brevity and clarity.

In accordance with the present invention, then, an air pressure sampling means including a tube 34 is provided in the chamber 24. The tube 34 is formed in a right angle bend and has an open end 34E terminating at the opening 28 adjacent to but spaced clear from the blower wheel 30. The precise positioning of the tube 34 is best shown in FIG. 2 wherein it can be seen that it opens at the interior of the edge of the circular opening 28 at a position on a radius 36 from the center of the opening 28 that is located at an angle designated α in FIG. 2. The angle α is measured from a radius indicated by a line 38 which is parallel to the gaseous flow (indicated by the arrow 40) from the blower exit port 34. The angle α is preferably about 70° although it has been discovered by the present inventors that superior results will be obtained for the range of α approximately equal to 45° to α approximately equal to 95°. The open end or port 34E in the tube 34 is located at the edge of and flush with the blower inlet opening 28 and parallel to the rotating vanes of the blower wheel 30. As noted above, the maximum effect is sensed through a range of approximately 50°.

The vacuum sensed by the tube 34 in the preferred 70° position is up to five times the magnitude of the vacuum that would be sensed by a tube simply opening into the box 24. As such, it is sufficient to activate a pressure differential switch such as the switch 36, FIG. 1, connected to tube 34 and serving to govern the valve 14, as indicated by the line 38, to prevent flow of gas to the burner 10 in the absence of a sensed vacuum. The pressure sensitive switch 36 employs the tube sampled pressure and the ambient air pressure. However, if a further pressure differential is desired, the pressure at the output of the blower may be substituted for the ambient pressure.

The above described safety system has been tested with satisfactory and high quality results in a modified outdoor furnace unit of the type manufactured by the York Division of Borg-Warner Corporation, the assignee of the present invention, and designated by the type number series SA 24G080 and SA 61G160, which are currently available in commerce. The pressure switch unit 36 employed in these tests was the commercially available Air Pressure Differential Switch designated JH-100-19-05 which is manufactured by the Columbus Electrical Manufacturing Company.

It should now be clear that a new and improved forced draft furnace safety system has been described that is economical and effective in preventing the flow of flammable gas to the furnace burners in the absence of an actual draft. The above described system is safer than the previously employed centrifugal blower motor switch in that it measures directly the presence of a forced draft and prevents false actuation of the gas control valve such as may be occasioned by a broken drive between the motor and the blower.

While particular embodiments of the invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the invention in its broader aspects, and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. The improvement in a forced draft furnace safety system for use with a furnace having a centrifugal blower for moving

air and combustion gases through the furnace, comprising: air pressure sampling means including a tube connected so as to sense the air pressure at the input to the centrifugal blower, and means for controlling the flow of fuel to the furnace in response thereto so as to prevent such flow when there is insufficient draft and to allow such flow when there is sufficient draft.

2. The improvement as defined in claim 1 wherein: said tube has pressure sensing in its opening positioned at the lip of the opening into the blower on a radius from the center of that opening which makes an angle to the radius parallel to the direction of air flow from the blower as measured therefrom in the direction of rotation of the blower wheel, of about 45° to about 95°.

3. The improvement as defined in claim 2 wherein said angle is equal to approximately 70°.

4. A furnace comprising:
a source of flammable gas, (12)
a burner, (16)
a control valve (14) for connecting or not connecting said source and said burner;
a heat exchanger (18) mounted adjacent to said burner with passages for air and flue gases to pass therethrough;
a gas collection box (20) connected to said heat exchanger

for receiving the air and flue gases;
a centrifugal blower (26) having a generally circular inlet coupled to said gas collection box for receiving air and flue gases therefrom, a rotary mounted blower wheel and an exit port for discharging propelled air and flue gases from the blower in a direction generally tangential to the blower wheel;

an air pressure transmitting tube (34) having an inlet mounted so that the inlet is positioned adjacent to the blower generally circular inlet,

an air pressure differential switch (36) coupled to said tube and to the ambient air pressure for activation in response thereto, and coupled to said control valve for controlling said valve so as to not connect said gas source to said burner in the absence of a sufficient difference in pressure between said tube and ambient air pressure.

5. The furnace as defined in claim 4 wherein: said tube is positioned so as to sample the drop in air pressure at said inlet at a point adjacent to and interior of the rim of said blower opening, along a radius from the center thereof which radius is at about 70° from, in the direction of travel of the blower wheel, the tangential direction of air flow from the exit port of said blower.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,650,262 Dated March 21, 1972

Inventor(s) Warren W. Root, et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 27, change "about °" to read -- about 70° --

Signed and sealed this 31st day of October 1972.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents