PUBLISHED
MAY 25, 1943.
BY A. P. C.

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FLUE GAS CONTROL DEVICES

Filed April 2, 1940

Serial No. 327,512

2 Sheets-Sheet 1

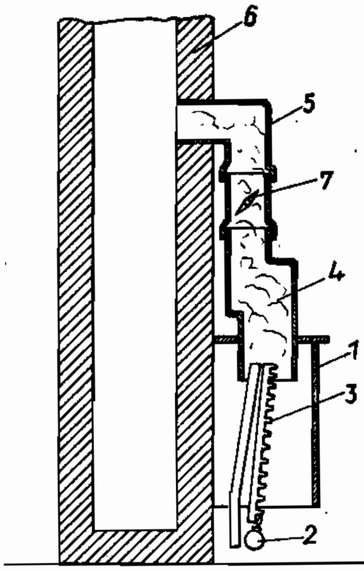

Fig. 1

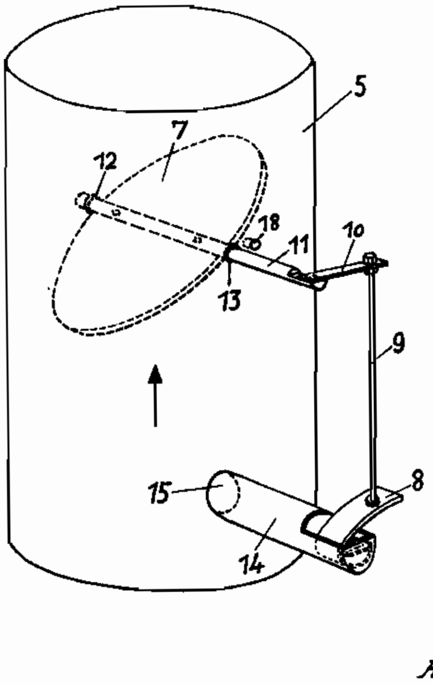

Fig. 2

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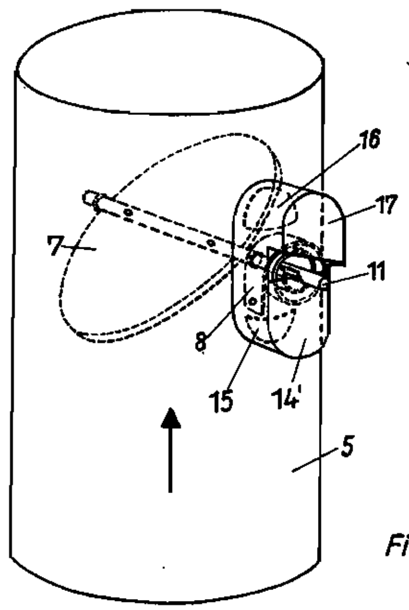

Fig. 3

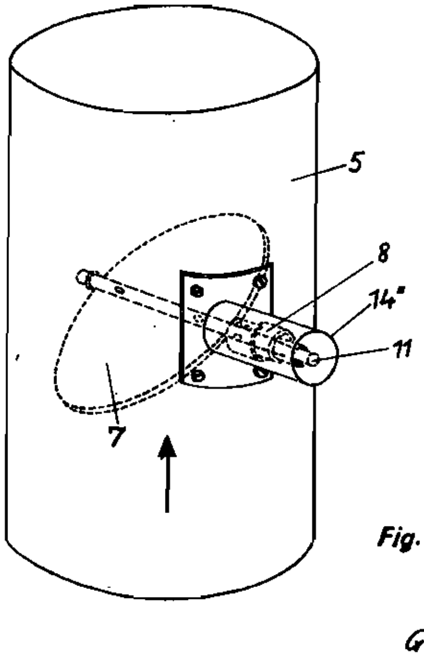

Fig. 4

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ALIEN PROPERTY CUSTODIAN

FLUE GAS CONTROL DEVICES

Guido Wünsch and Herbert Bulnheim, Berlin, Germany; vested in the Alien Property Custodian

Application filed April 2, 1940

This invention relates to improvements in furnaces and more particularly to a device for controlling the draught of flue gases coming from a furnace.

The main object of our invention is to provide a simple and inexpensive arrangement for automatically controlling the flow of flue gases in such a manner that, in spite of changes in the rate of flow as well as in spite of any other influences, as for instance by wind, gusts or the like, on the chimney, the draught will be maintained substantially constant.

Other aims, objects and distinguishing features of our invention will be apparent from the following description in connection with the accompanying drawings showing by way of example only some embodiments of the invention.

In the drawings Fig. 1 represents a gas heated stove the flue gas conduit of which communicates with the chimney and is provided with our new useful draught control device.

Fig. 2 is a perspective view of the flue gas conduit comprising a damper and temperature responsive means for controlling it.

Figs. 3 and 4 represent two other modifications of the control device.

Referring now to Fig. 1 a gas heated stove comprises in well known manner a gas supply burner 2 and radiants 3 mounted above said burner so as to be heated thereby. A chamber 4 is provided for receiving the upwardly flowing flue gases and communicates with a flue gas conduit 5 leading to a chimney 6. In the conduit 5 a damper 7 is provided for varying the flow cross section in response to the draught to be controlled. For automatically controlling the damper 7 a temperature responsive means—as more fully shown in Fig. 2—is operatively connected to the damper and heated by transmission of heat from the flue gases or from conduit 5 and simultaneously cooled by the atmospheric air.

As may be seen from Fig. 2, according to this embodiment the temperature responsive means is shown to be a bi-metallic strip 6, the outer end of which is connected to a rod 9 which is rotatably connected to an arm 10, the arm 10 being fastened to the axis 11 of the damper. The axis 11 is rotatably mounted at 12 and 13 in the wall of the conduit 5. For mounting the bi-metallic strip 8 at the conduit I a tube piece 14 is arranged on the outside of the conduit 6 in front of the damper 7. The inner end of the strip 8 is secured in any suitable manner to the piece 14. Within said tube piece 14 the wall of the conduit 5 is provided with an orifice 15 so that a portion of the flue gases flows out through the orifice 14 into the piece 14 as soon as a pressure in the conduit in front of the damper 7 exceeds the atmospheric pressure, whilst atmospheric air enters the conduit through the orifice 15 as soon as the pressure therein is smaller than that of the atmospheric air. Accordingly the temperature of the bi-metallic strip will either be increased by the outflow of flue gases through the orifice or decreased by the inflow of air through the orifice, as the case may be, in dependence on the pressure condition in the conduit in front of the damper.

If it is assumed that the draught in the conduit is equal to the value to be maintained constant, the damper 7 will have a position relative to the bi-metallic strip at which the pressure in the conduit 5 is equal to the atmospheric pressure. Under this circumstance a flow through the orifice 15 cannot take place. Therefore, a temperature equilibrium in the bi-metallic strip exists between the cooling action by the atmospheric air and the heating action from the conduit 5 and the tube piece 14. The position of the bi-metallic strip 8 as determined by the temperature equilibrium corresponds to the draught to be maintained constant. If due to an increase in the rate of flow of the flue gases the pressure in front of the damper 7 increases, the temperature of the bi-metallic strip determined by the equilibrium will be likewise increased by the outflow of flue gases through the orifice. Thus the outer end of the bi-metallic strip is raised and the flow cross section at the damper 7 is increased as is apparent from Fig. 2. In this way the draught will be increased and the pressure at the orifice decreased as long as the increased draught causes an air inflow into the conduit and an increased cooling action of the bi-metallic strip. As a result of this operation, a new equilibrium is obtained at which in spite of the increased rate of flow of flue gases the pressure in the conduit, i. e. the draught, remains the same as before.

If on the other hand due to a decrease in the rate of flow of the flue gases the draught in front of the damper 7 will be increased, the decreased pressure causes an air inflow through the orifice into the conduit 5 thereby increasing the cooling action of the bimetallic strip 8 so that the outer end thereof is lowered and the flow cross section of the damper is decreased. Hence the pressure in front of the damper will again be increased as long as due to the increased pressure an outflow of the flue gases through the orifice 15 takes place. In a similar manner as that described above a new equilibrium of the damper 7 is obtained.

As will be readily understood, the invention is not restricted to the special case in which the pressure in the conduit 5 corresponding to the draught to be maintained constant will be controlled so as to remain equal to the atmospheric pressure. On the contrary, it may be desirable to control the damper 7 in such a way that the temperature equilibrium in the bi-metallic strip exists if either a small air inflow enters the orifice 15 or a small outflow of flue gases takes place through the orifice so that at this equilibrium the bimetallic strip is additionally cooled by an air inflow or additionally heated by a flue gas outflow. In this respect it may be submitted that the pressure obtained by the controlling operation depends on the one hand on the supply of heat to the bi-metallic strip and on the other hand on the removal of heat by the air, i. e. the mean temperature of the strip, and furthermore on the stroke or deflection of the strip per temperature unit.

At all events we prefer to have the damper 7 entirely closed if the furnace is out of operation.

In order to prevent the flue gases from continously entering into the room, it may be advisable to determine the temperature equilibrium at which a small air flow enters the conduit 5 through the orifice 15, i. e. at which the pressure in the conduit in front of the damper due to being maintained constant is slightly smaller than the atmospheric pressure.

In the other case in which a portion of the flue gases continuously flows out through the orifice, means may be provided for reintroducing the outflow of flue gases into said conduit.

A modified construction comprising such means is shown in Fig. 3. According to this embodiment the conduit 5 does not only possess the orifice 15 in front of the damper but also a second orifice 16 behind the damper. In addition a hood 17 is mounted in any convenient manner at the wall of the conduit 5 above the orifice 16, this hood being formed so as to receive the discharge flow of flue gases from the bimetallic strip.

Furthermore this embodiment differs from that of Fig. 2 therein that the bi-metallic strip is arranged in a casing 14' above the orifice 15 in order to utilize the buoyancy of the flue gases for bringing about a closer contact between the gases and the bi-metallic strip and for facilitating the reintroduction of the gases. In this instance the bi-metallic strip is coiled in the form of a spiral around the axle 11 of the damper 7, the inner end of the strip being fastened to the axle and the outer end to the casing 14'.

In all other respects the construction and operation of the controlling device according to Fig. 3 is the same as that shown in Figs. 1 and 2 as fully described above. It is a matter of course that the embodiment shown in Fig. 3 may be modified so as to omit the second orifice 16 and the means 17.

Fig. 4 deals with another modification according to which the casing 14'' surrounding the strip 8 is a tube arranged substantially coaxially with the axle 11 of the damper 7. In this event the orifice 15'' in the wall of the conduit 5 has a segmental form in view of the necessity of arranging the orifice in front of the damper.

Regardless of the special form and arrangement of the bi-metallic strip and the casing, we prefer to provide means for limiting the angle of rotation of the damper 7 so as to ensure that in one end position the conduit 5 is entirely closed whilst in the other end position the damper 7 does not reduce the flow cross section of the conduit 5. To this end a stop 18 is fastened to the wall of the conduit 5 in proximity to the damper axle, this stop projecting into the circular part of the damper which therefore in one end position touches the upper side and in the other end position the lower side of the stop.

Likewise the casing 14, 14' or 14'' may project partly into the conduit 5. At all events, it is essential merely that a sufficient cooling action of the bimetallic strip by the air is ensured so that the mean temperature resulting from the cooling action and the heating action sufficiently differs from the air temperature and the flue gas temperature. The greater the difference between the mean temperature and the air temperature, the greater is the sensitivity of the controlling system, since at a great temperature divergence already a small air inflow or a small flue gas outflow causes a considerable controlling action. Hence the controlling exactness amounts to .02 millimeter water head.

In the above description reference is had to a gas heated stove for the purpose of illustration only and it is to be understood that the draught controlling device according to my invention may be applied just as well to any gas heated apparatus or furnace of any other kind. However, we desire to point out that my control system is destined for furnaces in which the heat produced is substantially independent of the draught of the flue gases. This is the case for instance in any gas heated apparatus or system and in any oil burner installation. It is apparent that in furnaces of this kind the heat produced remains practically uninfluenced by the controlling operation of the damper in the flue gas conduit.

GUIDO WÜNSCH.
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