May 5, 1970 A. DIERMAYER ET AL 3,510,059

AUTOMATIC FLUE DAMPER

Filed April 22, 1968

FIG.1

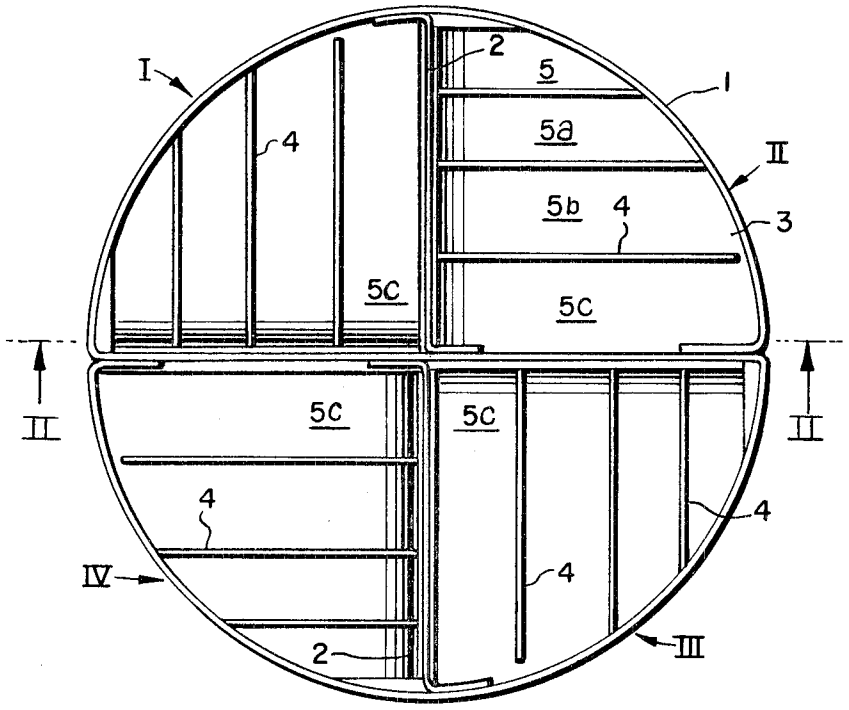
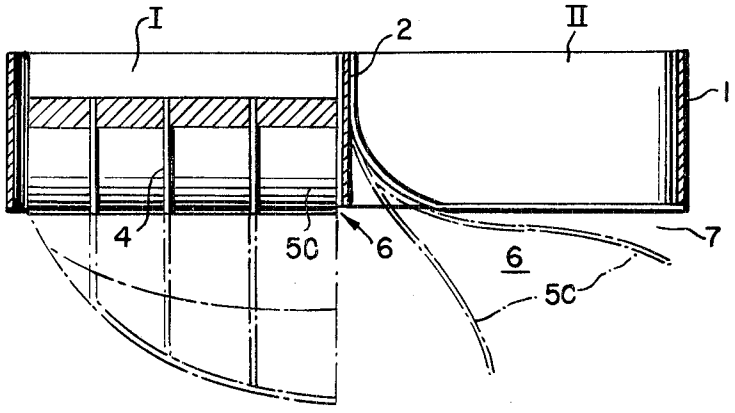


FIG.2



INVENTORS.

ALPHONS DIERMAYER & LUITPOLD KUTZNER

BY Law and Berman

AGENTS

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AUTOMATIC FLUE DAMPER

Alphons Diermayer and Luitpold Kutzner, Munich, Germany; said Diermayer assignor to Werner Diermayer, Lafayette, Calif.

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U.S. Cl. 236—93 5 Claims

ABSTRACT OF THE DISCLOSURE

A flue damper in which a conduit is divided into quadrants by perpendicular partitions. A bi-metallic damper section in each quadrant consists mainly of elongated, transversely juxtaposed strips fastened by one short edge to one partition and parallel to the other partition bounding the quadrant so that a passage is quickly opened between the other partition and the nearest strip when the free edge portions of the strips move axially away from the level of the partitions in response to heat.

BACKGROUND OF THE INVENTION

This invention relates to automatic flue dampers, and particularly to an improvement of the flue damper disclosed and claimed in our Pat No. 3,228,605, which is particularly useful with gas-fired burners. Our earlier invention provided a slotted bi-metallic damper plate which normally extends across a flue duct. The plate is divided by the slots into longitudinal strips. One longitudinal end of each strip is fixedly attached to the duct, and the strips are located in a common plane at normal temperature. When the temperature rises, the free end of each strip moves arcuately away from a fixed duct element and gradually opens a passage for the hot flue gases.

The flow section of the passage is approximately proportional to (1-cos α), wherein α is the angle of overall deflection of the strip, as measured between the aforementioned common plane and a line connecting the fixed and free edges of the strip. As is inherent in such a relationship, the flow section increases very slowly as α increases from zero, and the relatively slow initial response of the flue dampers of our earlier invention to hot flue gases has been found undesirable in some applications.

A primary object of the instant invention is a modification of our earlier flue damper in which the effective flow section of a flue duct increases rapidly from a minimum value in response to a temperature increase in the flue gases.

SUMMARY OF THE INVENTION

In the flue damper arrangement of the instant invention, the passage of a flue conduit is divided into several sections by partitions which extend in a direction from the axis of the conduit to the latter in angularly offset relationship. The axial walls bounding each section are thus constituted by two partitions and a circumferential portion of the conduit.

A damper section arranged in each section of the flue passage includes elongated, transversely juxtaposed strips of laminated, bi-metallic material which extend substantially in a common plane transverse of the conduit axis when cold and define longitudinal slots therebetween. One of the narrow edges of each strip is fixedly fastened to one wall of the corresponding passage section and the other narrow edge is free to move about the fixed portion in response to temperature change. One strip in each passage section has a longitudinal edge closely juxtaposed

to one of the partitions and is approximately parallel thereto.

Preferably, the fixed narrow edge of each strip is fastened to the other partition. When the damper section is deflected by rising temperature, a flow passage opens between the aforementioned longitudinal edge and the closely juxtaposed partition at a rate approximately proportional to the increase in the angle of deflection.

Other features, additional objects and many of the attendant advantages of this invention will readily be appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the appended drawing.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. 1 shows a flue damper arrangement of the invention in top plan view; and

FIG. 2 illustrates the arrangement of FIG. 1 in elevational section on the line II—II.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The flue damper arrangement illustrated includes a short, cylindrical sheet metal tube **1** which may be fitted into a flue conduit or constitute an axial portion of that conduit. Four sheet metal partitions **2**, which are partly integral with the tube **1**, extend from the axis of the tube **1** at right angles to each other so as to divide the passage through the tube into four sections or quadrants I–IV.

Four practically identical damper sections **3** are respectively arranged in the four quadrants. Each section **3** is made of an initially rectangular piece of bi-metallic sheet material by rounding off one corner of the sheet in an arc having the same radius as the tube **1**, and thereafter cutting three slots **4** into the sheet parallel to one of the remaining straight edges and transverse to the arcuate edge. Some of the slots are open in the arcuate edge, but all terminate short of the other straight edge. The sheet is thus partly divided into four strips of increasing length **5**, **5***a*, **5***b*, **5***c* connected at one of their narrow edge portions which are bent upwardly and fixedly attached to one of the partitions **2**. The longest strip **5***c* has a longitudinal edge closely juxtaposed and approximately parallel to the other associated partition **2**.

As long as the damper arrangement is cold, the main portions of the strips **5**, **5***a*, **5***b*, **5***c* extend in a common plane perpendicular to the axis of the tube **1** and obstruct most of the flow section of the tube **1**, only the slots **4** and similar narrow openings along the partitions **2** being available for passing the combustion gases produced by a pilot flame if the damper is used on a conventional gas-fired heater, and for providing minimal draft when the gas burner starts. The free ends of the strips **5**, **5***a*, **5***b*, **5***c* abut from below against the tube **1**.

The hot gases cause deflection of the individual strips **5**, **5***a*, **5***b*, **5***c* as is shown in FIG. 2 in broken and chain dotted lines which indicate sequential positions of the strips. A gap **7** opens between the free narrow edge of each strip and the tube **1** or a non-illustrated further portion of the flue conduit along the circular circumference of the tube **1** or the conduit. The flow section of the gap **7** is approximately proportional to (1-cos α), as discussed above if the non-illustrated conduit is axially aligned with the tube **1**.

The lower edges of the partitions **2** are located in the aforementioned common plane of the cold strips **5**, **5***a*, **5***b*, **5***c*. As the strip **5***c* is deflected, a gap **6** is opened between the lower edge of the adjacent partition **2** and the longitudinal edge of the strip **5***c* as the free end of

the strip 5c moves axially away from the partition. The flow section of the gap 6 is approximately triangular and directly proportional to the value of the deflection angle α. It therefore grows much faster than the gap 7 as long as the angle of deflection is small, and the damper opens quickly.

The more rapid stream of combustion gases passing through the gap 6 quickly heats the bimetallic material, and the angle of deflection increases at a corresponding high rate. The improvement by the instant invention has therefore been found to be an exponential function of the added flow section provided by the gap 6. Dampers of this invention are readily constructed to open almost instantaneously when hit by the first wave of hot flue gases, as a burner is started.

Four partitions 2 at right angles to each other can be constructed at minimal cost, and the necessary damper sections 3 can be prepared from bi-metallic sheet metal in a particularly simple manner. It is advantageous from an economic point of view to have the several sections of the conduit passage and of the damper plate identical in size and shape. However, if special conditions should so require, the passage through the conduit may be divided into fewer or more sections than have been illustrated and described, and the shape of each damper section may be different from that of any other section.

Conduits of circular cross section are preferred for practical reasons, but the invention is applicable to conduits of other cross sectional shape, and the necessary modifications of the partitions and of the damper plate sections will readily suggest themselves to those skilled in the art.

What is claimed is:

1. In a damper arrangement including a conduit having an axis and defining an axial passage, and damper plate means of laminated metallic material having two sheet layers of substantially different coefficient of thermal expansion secured in said conduit for movement between a conduit opening and a conduit closing position in response to temperature change of a fluid in the conduit, the improvement which comprises:

(a) a plurality of partitions extending in a direction from said axis toward said conduit in angularly offset relationship and dividing said passage into a plurality of sections, each partition having a first face in one contiguously adjacent section and a second face in another contiguously adjacent section, the axial walls of each section being constituted by a first face of one of two partitions, a second face of the other one of said two partitions, and a circumferential portion of said conduit;

(b) said plate means including a plurality of damper plate sections having respective first edge portions fixedly fastened to said first faces in said passage sections, and second edge portions remote from said first edge portions and free for angular movement about the associated first edge portions when the damper plate means move between said positions thereof.

2. In an arrangement as set forth in claim 1, each damper plate section being formed with a plurality of slots extending in a direction from said first edge portion toward said second edge portion and defining therebetween strip portions of said damper plate section elongated in said direction, one of said strip portions being closely juxtaposed to said second face in the corresponding passage section and substantially parallel to said second face.

3. In an arrangement as set forth in claim 1, said two partitions being substantially perpendicular to each other.

4. In an arrangement as set forth in claim 3, said circumferential portion being of substantially circular cross section in a plane perpendicular to said axis.

5. In an arrangement as set forth in claim 1, said second edge portions being axially spaced from said other partition at a temperature higher than said predetermined temperature.

References Cited

UNITED STATES PATENTS

3,228,605 1/1966 Diermayer et al. ------ 236—93

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German Utility Patent No. 1,921,683, August 1965.

WILLIAM E. WAYNER, Primary Examiner

U.S. Cl. X.R.

73—363.1; 236—101