United States Patent [19]

Alley

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[54] **PROTECTIVE DAMPER FOR GAS EXHAUST DUCT**

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[52] **U.S. Cl.** **98/110,** 98/32, 98/95, 98/119, 137/512.1, 137/520, 137/521

[51] **Int. Cl.** **F24f 13/16**

[58] **Field of Search** ..... 98/110, 119, 121 A, 121 R, 98/107, 95, 116, 32; 49/31, 89; 160/5, 517; 137/521, 512.1, 493.1, 520

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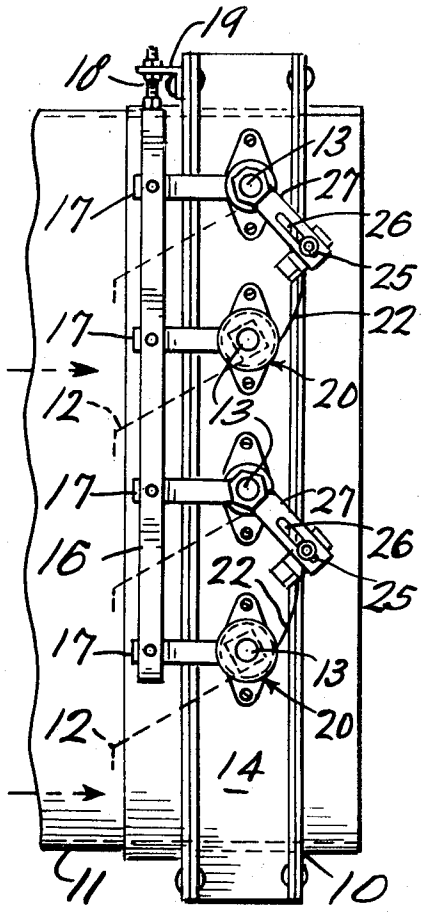
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Assistant Examiner—Paul Devinsky
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[57] **ABSTRACT**

A damper that is normally biased toward open position against the pressure of air flowing through the damper and rapidly closed by the increase of such pressure resulting when pressure exteriorly of the damper abruptly drops to a predetermined level. The damper comprises a plurality of parallel blades mounted on parallel axes and coupled to each other for movement between a closed position with the blades lying generally in a vertical plane across the damper and normally open position with the blades lying in parallel spaced planes inclined into the air flow. Means are connected to the blades for biasing them inwardly toward open position against the pressure interiorly of the damper caused by the air flow which tends to swing the blades in an outward direction toward closed position. When the atmospheric pressure on the outside of the damper drops, as by the presence of the negative phase of a tornado, the damper closes immediately.

3 Claims, 5 Drawing Figures



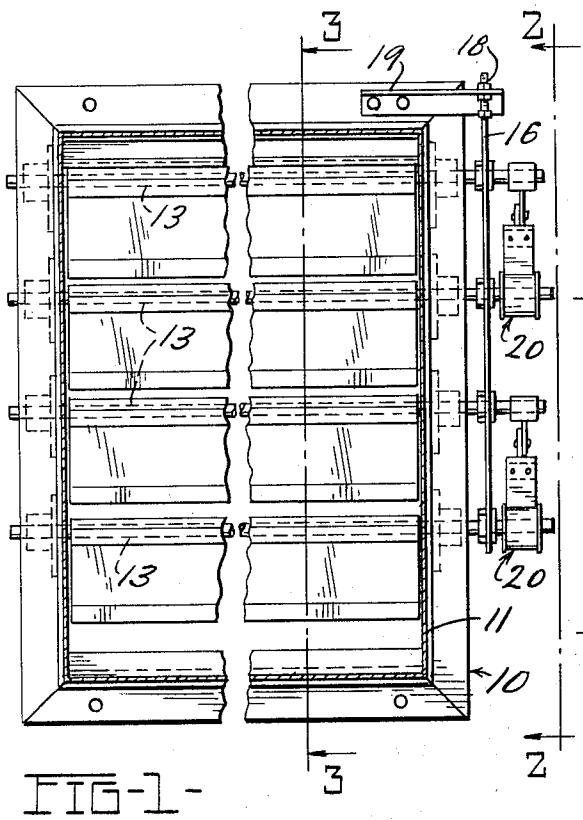


FIG-1-

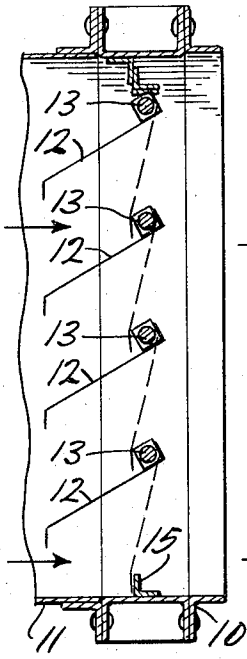


FIG-3-

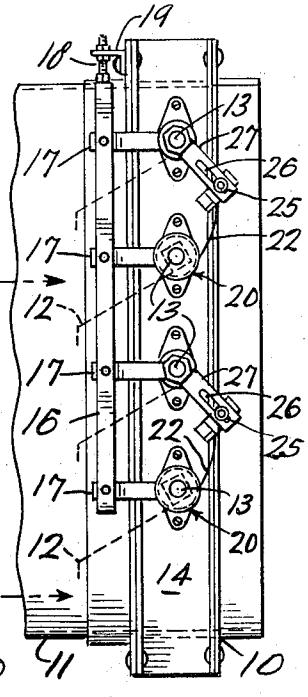


FIG-2-

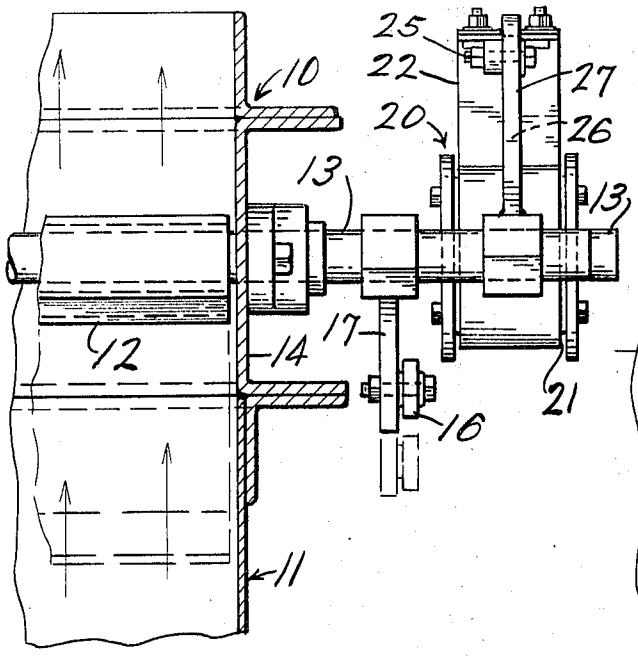


FIG-5-

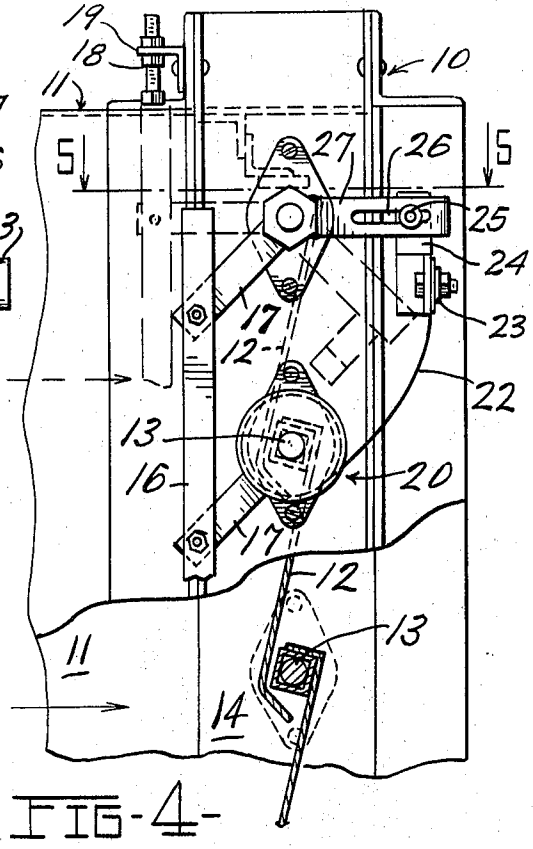


FIG-4-

PROTECTIVE DAMPER FOR GAS EXHAUST DUCT

BACKGROUND OF THE INVENTION

In many types of commercial and industrial buildings it is necessary to provide fan-actuated exhaust systems to carry away contaminated air from within the establishment and, in many instances, the exhaust systems are also utilized for removing particulate material from the areas of operation for the protection of persons in the areas. Exhaust systems of this type are equipped with filtering media in order to filter the contaminants out of the exhaust air before it is discharged to atmosphere. When such an arrangement exists in a building in the area of the country which is subject to tornados, an unexpected event frequently occurs.

Because of the forced draft exhaust from the building, when the negative phase of a tornado passes the building, the sudden drop in atmospheric pressure results in an immediate increase in the relative pressure between the interior and the exterior of the building and thus the application of an instantaneously higher pressure to the filters which may be placed in the exhaust system. As a result the filters frequently are blown out of the exhaust system and destroyed or severely damaged.

It is therefore the principal object of the instant invention to provide a protective damper for an exhaust gas system which will close immediately upon the existence of a predetermined low pressure exteriorly of the building thus preventing a sufficient build-up of the pressure differential to destroy the filtering media.

Attempts have been made to accomplish this objective by the utilization of dampers which are closed by relatively rapidly actuated mechanical means such as the release of pretensioned springs or the energization of power means of one kind or another but most of these attempts have failed because they are not rapid enough in actuation or because they have been so designed as to operate contrary to the instantaneously increased pressure differential which results when the negative phase of the tornado is present.

In contrast to these previous attempts, the present invention contemplates the utilization of the instantaneously increased pressure differential, itself, to close the protective damper.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary vertical view in elevation of a protective damper embodying the invention taken from the inner side of the damper and showing a gas duct in cross-section;

FIG. 2 is a fragmentary side view in elevation taken from the position indicated by the line 2—2 of FIG. 1;

FIG. 3 is a vertical sectional view taken along the line 3—3 of FIG. 1;

FIG. 4 is a fragmentary side view, partly in section and partly in elevation, illustrating details of a damper embodying the invention and shown on an enlarged scale; and

FIG. 5 is a fragmentary, horizontal sectional view taken along the line 5—5 of FIG. 4 and shown on a still further enlarged scale.

DESCRIPTION OF PREFERRED EMBODIMENT

The illustrated embodiment of the invention comprises a rectangular frame **10** mounted at the outer end of a rectangular duct **11.** The duct **11** is an exhaust gas passageway leading from a source of contaminated air within an enclosure and opening on the outer side of the frame **10** to atmosphere. Frequently in such exhaust gas systems filters are located along the duct **11** to screen out of the air any contaminants from the exhaust gases prior to their discharge in atmosphere. Although no such filter is shown in the drawings, it is assumed that the duct **11** is so equipped.

The frame **10** mounts a plurality of transversely extending damper blades **12** each of which is pivotally mounted on one of a series of spaced parallel axles **13,** the axles **13** being journalled in side members **14** of the frame **10.** The axles **13** are spaced vertically from each other a distance such that when the damper blades **12** are all swung to closed position (FIG. **4**) each of the blades **12** overlaps the axle **13** of an adjacent lower blade and the lower-most one of the blades **12** engages a sealing strip **15** (FIG. **3**) extending along the bottom of the frame **10.** Thus when the blades **12** are swung to closed position they all lie in substantially the same vertical plane and the duct **11** is closed so that gases normally being exhausted, as indicated by the arrows in FIGS. **2, 3,** and **4,** can no longer flow out of the duct **11.**

All of the blades **12** are coupled to each other for simultaneous angular movements by a vertically extending link **16** which is pivotally attached to the ends of lever arms **17,** each of the arms **17** being pinned or otherwise secured on one of the blade axles **13.** The link **16** also functions as a stop means to limit the inward angular movement of the blades **12** and thus the maximum open position of the damper, the upper end of the link **16** engaging a stop **18** to accomplish this objective. The stp **18** is mounted on a bracket **19** and is vertically adjustable in order to vary the stop position and thus the maximum angle to which the blades **12** can be opened.

In the illustrated embodiment of the invention, means for biasing the damper blades **12** inwardly toward their open position are illustrated as comprising constant tension coil springs **20** of which two are shown. Each of the springs **20** comprises a drum **21** around which a ribbon **22** is wound in such fashion that tension is applied to the ribbon **22** seeking to rewind it on the drum **21.** The free end of the ribbon **22** is connected by a clamp **23** to a finger **24** and the finger **24** is mounted by a lock-screw **25** for movement along a slot **26** in a lever **27.** The lever **27,** in turn, is welded, rivoted, pinned, or otherwise secured on the end of the respective one of the blade axles **13.** By sliding the lock-screw **25** and the finger **24** along the slot **26,** the moment of force applied by the spring **20** to the respective blade axle and through the link **16** to all of the blades **12** can be varied as desired.

While it might be possible to predetermine the final positions of the stop **18** to limit the inward movement of the blades **12** into the flow of gases and to preadjust the positions of the fingers **24** in their levers **27,** to establish the bias applied to the blades **12,** in most instances these adjustments are made after the installation of the damper embodying the invention. The degree of adjustment of both of these variable items will be determined by the precise volume and rate of air flow out of the damper, by calculating the pressure applied over the projected area of the blades **12** when

they stand in their inner, open position, inclined into the flow of gases.

The tension applied by the springs **22** to the blades biases them toward their open, inclined positions against the force applied to the blades **12** by the pressure created by the exhaust fans. Under normal operating conditions the balance of forces is such that the force applied to the blades **12** by the exhaust gases is insufficient to swing them to their closed positions and the blades are held in the normal operating position illustrated in FIGS. **2** and **3** by the tension applied thereto by the biasing means, i.e., the springs **20** and their mechanical connections.

When an abrupt drop in atmospheric pressure occurs, as for example by the passage of the negative phase of a tornado, the relative pressures between the inner side and outer side of the blades **12** increases instantaneously. The absence of positive pressure on the external side of the blades **12** thus results in the normal airflow pressure being sufficient to abruptly swing the blades **12** to their closed position almost instantaneously and rapidly enough so that the otherwise occuring "blow-out" of the filter in the duct does not occur. Upon restoration of a normal exterior atmospheric pressure, the biasing springs **20** once again swing the blades **12** to their predetermined open position and normal operation follows.

What I claim is:

1. A protective damper for a gas exhaust opening, said damper comprising, in combination,

a. an open rectangular frame defining an exhaust opening to atmosphere,

b. a plurality of rectangular essentially planar damper blades, extending across such opening, said blades being mounted on parallel, spaced axes extending along corresponding edges thereof for angular movement between closed position with all of said blades lying generally in a plane transverse to the flow of gas through said frame and with said blades engaging each other and open position with all of said blades swung inwardly against such flow of gas and lying in spaced parallel planes inclined into such gas flow,

c. means coupling said blades for movement together,

d. means biasing said blades inwardly away from closed position to open position against such flow of gas and the force of gravity, and

e. wherein said damper blades are responsive solely to atmospheric pressure drop to move to closed position.

2. A damper according to claim **1** in which the means for biasing the blades comprises a constant tension spring means and which has adjustable force applying means.

3. A damper according to claim **1** and stop means for limiting the angular movement of said blades away from closed position to a predetermined maximum.

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