United States Patent [19]

Alley

[11] **3,894,481**

[45] **July 15, 1975**

[54] **MULTI-BLADE DAMPER**

[75] Inventor: **Raymond L. Alley**, Toledo, Ohio

[73] Assignee: **American Warming and Ventilating Inc.**, Toledo, Ohio

[22] Filed: **Apr. 3, 1972**

[21] Appl. No.: **322,603**

[52] **U.S. Cl.** ..... **98/121 A**; 49/91

[51] **Int. Cl.** **F34f 13/08**

[58] **Field of Search** ..... 98/110, 121 R, 40 VM, 98/121 A; 126/285; 49/91, 92

[56] **References Cited**

UNITED STATES PATENTS

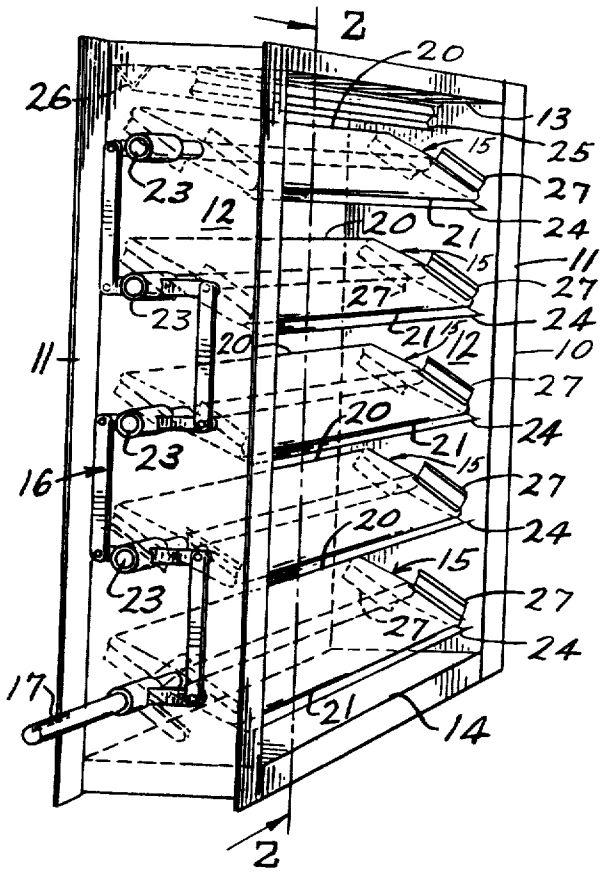
2,394,059	2/1946	Hite	98/110
3,170,547	2/1965	Wilcox	98/121 R
3,604,458	9/1971	Silvey	98/110 X

Primary Examiner—Meyer Perlin
Assistant Examiner—R. Capossela
Attorney, Agent, or Firm—Henry K. Leonard

[57] **ABSTRACT**

A multiple blade damper having a rectangular frame and a plurality of identical rectangular blades mounted on transversely extending parallel shafts. When the blades are swung to closed position, resilient sealing strips on their "downwind" edges engage the surfaces of adjacent blades near their edges and the sealing strip on one end blade engages the surface of one end frame member. A downwardly extending, elongated, resilient sealing strip on the other end frame member engages the surface of the other end blade near its edge. A gas deflector extends along such other end frame member at the "upwind" side of the sealing strip. Sealing flaps on the ends of the blades engage the surfaces of the side frame members.

12 Claims, 9 Drawing Figures



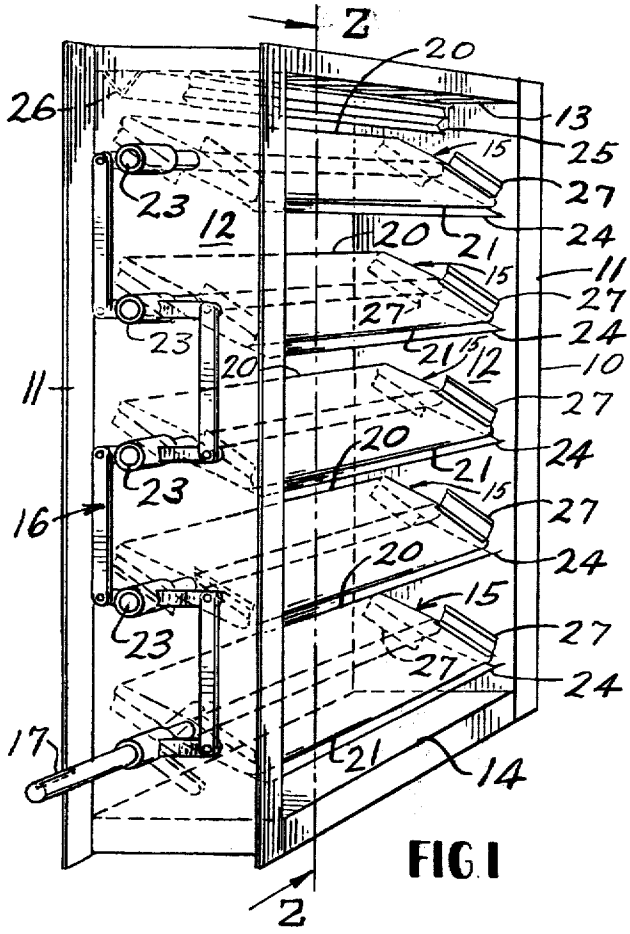


FIG. 1

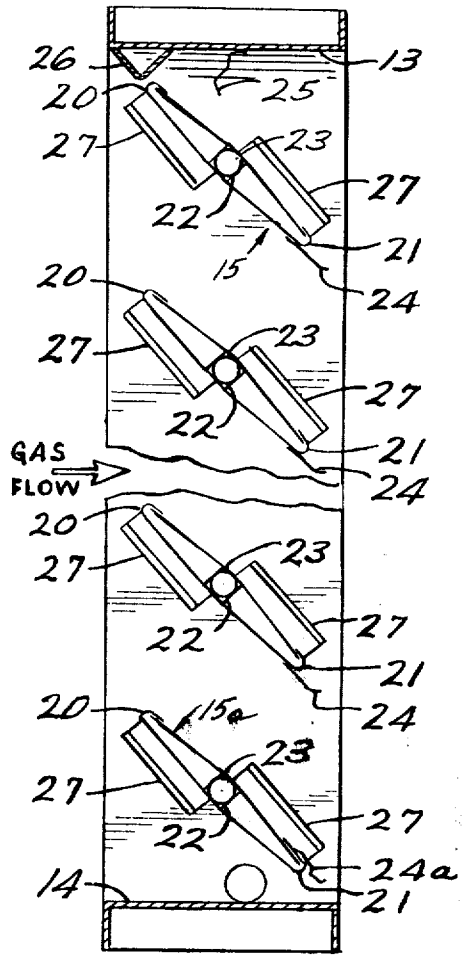


FIG. 2

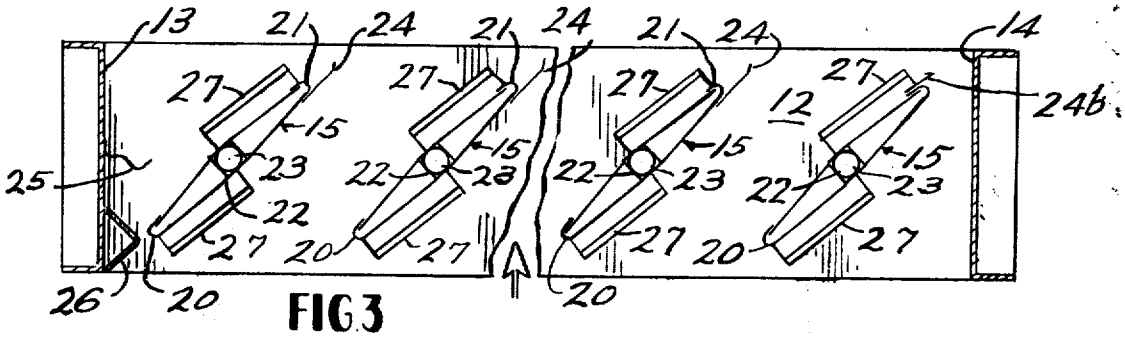


FIG. 3

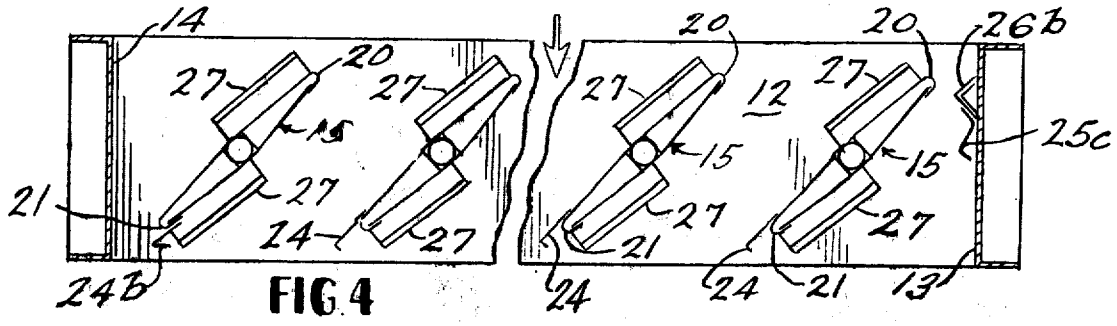


FIG. 4

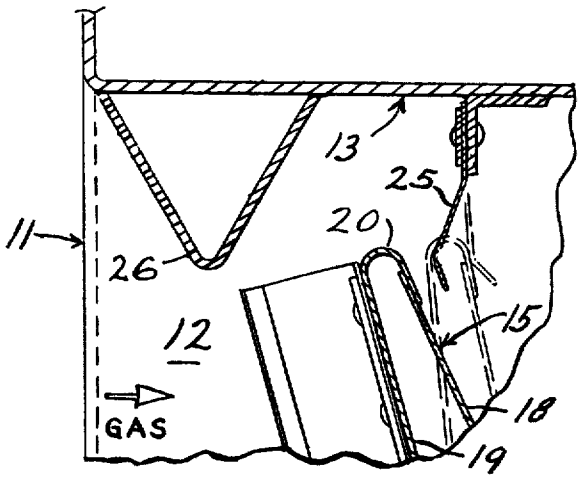


FIG. 5

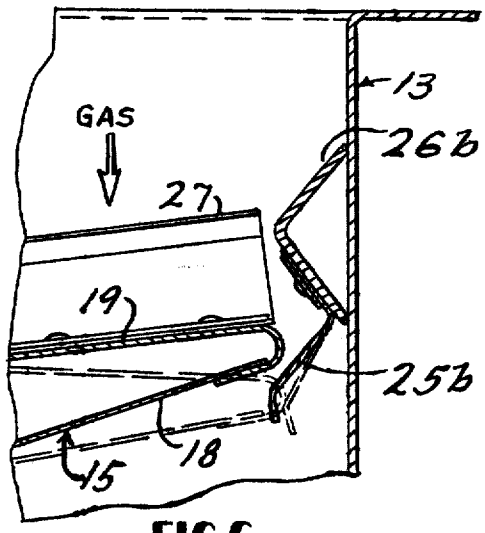


FIG. 6

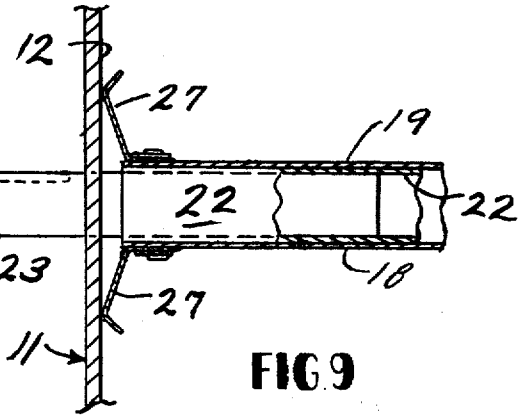


FIG. 9

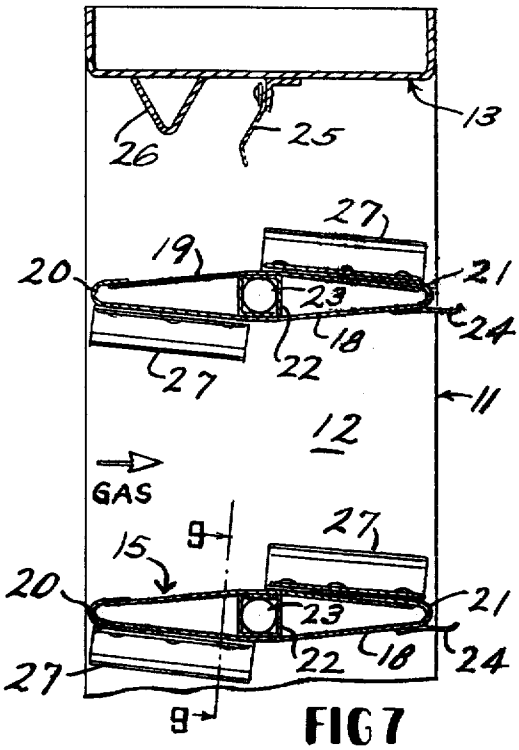


FIG 7

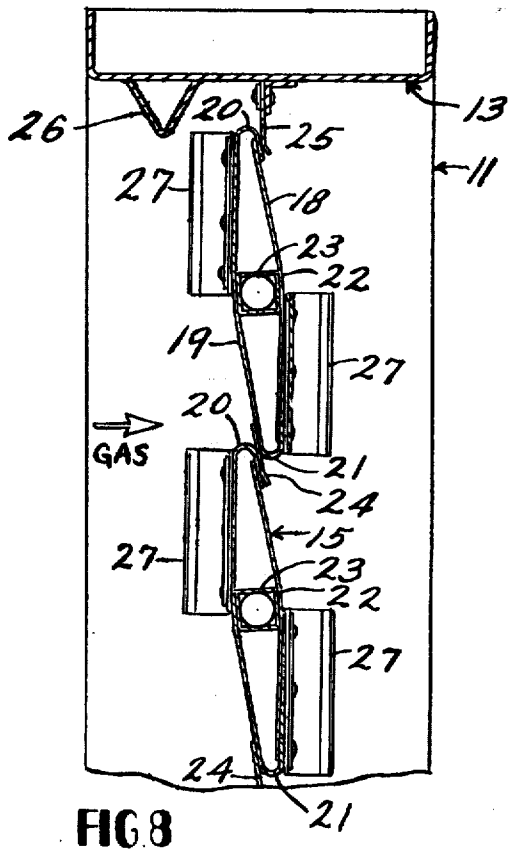


FIG. 8

MULTI-BLADE DAMPER

BACKGROUND OF THE INVENTION

Multiple blade dampers for the purpose of controlling the flow of air or other gas along a duct or through an opening in an enclosure such as a room, or the like, or in a flue of an industrial furnace, have been utilized for many years.

With the current emphasis upon control of pollution and the prevention of escape of pollutants, particularly from industrial furnace flues, the design of dampers for such flues has become more and more difficult, both to provide for the escape of gases when desired and to provide for the closure of the passageway when desired. Particular difficulties are encountered when the gases passing through the damper carry particles such as fly-ash and other materials because these materials frequently corrode and even abrade the vanes of such a damper sometimes completely destroying the seals with which the damper blades are provided so that frequent replacement of the seals is required in order to enable the gas flow to be stopped when desired.

Even greater difficulties are encountered in flue gas installation where the temperature may reach the order of 1,000° F. and even heat resistant flexible seals, such as those made from silicone rubber, break down very rapidly when exposed to temperatures of this magnitude.

It is therefore the principal object of the instant invention to provide a damper particularly designed for closing ducts through which particle bearing gases flow at elevated temperatures, say in the order of between 300° and 800° F. with the further provision that under some circumstances the damper will control the flow of gases at higher temperatures.

It is a further object of the instant invention to provide a multiple blade damper particularly designed for the control of the flow of gases bearing corrosive or abrasive particles such as fly-ash or the like.

It is yet another object of the instant invention to provide a blade for a damper which is subjected to high velocity gas or air containing contaminants and to provide sealing means for such blade or blades in a damper which will be resistant to destruction by the gas contaminants or by the temperature of the gas.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view on a small scale showing a damper embodying the invention and utilizing blades designed according to the invention;

FIG. 2 is a vertical, sectional view on a slightly enlarged scale, taken generally along the line 2—2 of FIG. 1 and illustrating a damper embodying the invention as installed to control the flow of gases in a horizontal direction, the air flow being indicated by an arrow;

FIG. 3 is a fragmentary view similar to FIG. 2 showing a damper embodying the invention as installed for the control of contaminant bearing gases through the damper in an upward direction;

FIG. 4 is a view similar to FIG. 3 but showing a damper embodying the invention as installed for the control of gases therethrough in a downward direction;

FIG. 5 is a fragmentary, vertical, sectional view further showing the uppermost blade and its sealing means when the damper is installed in the position illustrated in FIG. 2;

FIG. 6 is a view similar to FIG. 5 but showing a comparable portion of a damper according to the invention when installed in the position illustrated in FIG. 4;

FIG. 7 is a vertical, sectional view of the upper portion of a damper embodying the invention installed in the position illustrated in FIG. 2 but showing the damper blades open;

FIG. 8 is a view similar to FIG. 7 but showing the damper blades in closed position; and

FIG. 9 is a fragmentary vertical, sectional view taken along the line 9—9 of FIG. 7.

DESCRIPTION OF A PREFERRED EMBODIMENT

A damper embodying the invention has an open rectangular frame generally indicated by the reference number **10** which consists of side channels **11** having flat inner webs **12** which lie in vertical planes parallel to the direction of flow of gases through the frame **10**. The frame **10** also has a pair of end channels **13** and **14**, the end channel **13** being the upper channel when the damper frame **10** is erected vertically as illustrated in FIG. **2**.

The damper has one or a series of movable blades generally indicated by the reference number **15**, there being five of such blades shown in the damper illustrated in FIG. **1**, for example. Each of the blades **15** is substantially indentical and each of them has a generally rectangular plan configuration, being elongated transversely across the frame **10** and thus extending between the side channels **11** of the frame **10**. The width of the blade or blades **15** of an individual damper is such that when the damper is in closed position, the blade or blades **15** extend substantially vertically between the end channels **13** and **14** to interrupt the flow of gas through the frame **10**. When a multiple blade damper embodying the invention is in use, all of the blades **15** in the damper are simultaneously swung between open (FIG. **7**) and closed (FIG. **8**) positions by a suitable mechanism such as the articulated linkage generally indicated by the reference number **16** and shown in FIG. **1**. Such a linkage **16** may be actuated by rotating a shaft **17** in response to changing conditions, a signal given to an actuating device or manually.

Each of the damper blades **15** embodying the invention consists of two opposed, substantially rectangular sheets of metal **18** and **19** (see FIGS. **5–8**) which are formed with a shallow V-shaped cross section, and which are interfolded at their longitudinal edges as can best be seen, for example, in FIGS. **5** and **6**. In these two figures, the sheet **18** has a lesser width than the sheet **19** and the edges of the sheet **19** are returned upon themselves to embrace the edges of the sheet **18** to which they may then be spot welded or otherwise secured to provide a rigid hollow structure having a relatively narrow upwind edge **20** and a relatively narrow and similar downwind edge **21** (see for example FIG. **7**). Because of the shallow V-shaped cross section of the two sheets of metal **18** and **19**, they are spaced from each other along their median or central area a distance sufficient to provide for a reinforcing member **22** for example a tube, to extend along between the sheets at approximately the apices of the opposed shallow V of each sheet of metal **18** and **19**. The member is spot welded or otherwise rigidly secured to the two opposed sheets **18** and **19** to provide a structurally integral blade **15**. The reinforcing members **22** of each of the blades **15** have open ends for the reception of the ends of

mounting axles 23 (FIG. 9) which extend through the webs 12 of the side channels 11 and which are linked to each other by the linkage 16 already described, the axles 23 being welded, riveted, or otherwise secured to their respective reinforcing members 22.

Each of the blades 15 has a thin, flexible sealing strip 24 secured to and extending along and beyond its downwind edge 21, the strip 24 being also riveted or otherwise welded or secured on the same side of each of the blades 15. The sealing strips 24 have sufficient width to extend beyond the downwind edges 21 a distance such that when the blades 15 are swung to closed position in a multiple blade damper such as that illustrated in the drawings, the respective sealing strip 24 of each of the damper blades 15 is brought into flexed contact with the upwind edge 20 of the adjacent blade 15 as is illustrated in FIG. 8. It will be observed in FIG. 8 that in closed position of the blades 15 of this multiple blade damper, each of the sealing strips 24 is bent slightly beyond its normal position in order to insure tight surface contact with the adjacent blade 15 and also to insure that this tight surface contact continues after the blades have been operated a large number of times.

It has been found in the manufacture and use of dampers for installations such as those described above, that if such sealing strips are fabricated from materials which are not greatly resistant to the repeated deformation and take a permanent "set," tight sealing of the damper cannot be achieved. In contrast, by reason of the fact that in a damper according to the invention, the sealing strips are actually flexed at the time of contact, repeated closing of the damper is unlikely to so deform the sealing strips 24 as to result in leaks occurring after long usage.

When a damper embodying the invention is designed for use in a hot environment, as for example in controlling flue gas bearing corrosive and abrasive contaminants, such blades may readily be fabricated from high temperature resistant, stainless steel sheets and alloys such as nickel-chrome-molybdenum, etc. The objectives in the selection of the sheet material from which the two opposed sheets 18 and 19 are fabricated are to render the blades 15 resistant to both corrosion and abrasion as well as heat deformation throughout the temperature range to which they are subjected in any installation.

When a multiple blade damper embodying the invention is designed, or in the case of a single blade damper employing a blade according to the invention, the downwind edge of a blade such as the blade indicated by the reference number 15*a* in FIG. 2, similarly has an edge sealing strip 24*a* which functions to seal the lower edge of that blade by intimate contact with the planar web of an end channel 24. While the particular sealing strip 24*a* shown in FIG. 2 has a configuration slightly different from that of the blade sealing strips 24, it will be appreciated that this sealing strip 24*a* is bent only so that it will sweep into contact with the surface of the channel 14, being flexed at closed position of the blade, again to establish a tight seal at this margin of the damper frame 10. When a damper embodying the invention is employed in the positions illustrated in FIGS. 3 and 4, a similar edge seal 24*b* or 24*c* is similarly mounted on the downwind edge of that blade adjacent the end channel member 14 again to establish tight flexed contact with its planar surface when the damper blade adjacent thereto is swung into closed position.

At the other end of a damper embodying the invention, the upper end in FIG. 2, the left end in FIG. 3 or the right end in FIG. 4, the upwind edge 20 of the respective blade 15 does not carry a sealing strip because it would be impinged upon by particles carried by the gases and being up-wind would also generate noisy turbulence and would create resistance to gas flow.

In a damper according to the invention, a fixed sealing strip 25 (FIGS. 2 and 3) or 25*b* (FIG. 4) is employed. Each of the fixed sealing strips 25 or 25*b* is riveted, welded or otherwise rigidly connected to the end channel 13 and protrudes from its planar web into the space defined by the frame 10 a distance such that it is engaged by the respective leading or upwind edge 20 of a damper blade designed according to the invention. The sealing strip 25 or 25*b* is fabricated from a resilient material probably identical with the material from which the blade mounted seals 24 are fabricated, so that when the damper is in closed position (FIG. 8, for example) the fixed position sealing strip 25 is also slightly flexed to insure tight contact with the surface of the blade sheet 19.

Particularly when a damper embodying the invention is to be employed in a duct through which contaminant bearing gases flow, such as a furnace flue carrying fly-ash, a gas deflector 26 (FIGS. 2, 3, 5, 7 and 8) is rigidly mounted on the respective end channel 13 and extends along and at the upwind side of the fixed sealing strip 25*b*. A similar gas deflector 26*b* is similarly mounted when a damper embodying the invention is mounted in the position illustrated in FIGS. 4 and 6, its cross sectional configuration being slightly different in order to function for the deflection of gases around the inner side of the adjacent fixed position sealing strip 25*b*.

It will also be observed by comparing the cross sectional configuration of the sealing strips 25 employed in dampers installed as illustrated in FIGS. 2 and 3 with the cross sectional configuration of the sealing strip 25 employed in the damper installed as illustrated in FIG. 4 that the cross sectional shape of the respective strip 25 is such that it extends downwardly, so that contaminating particles such as fly-ash which lodge behind the upwind side of the fixed position sealing strip 25 fall therefrom by gravity when the flow of gases is terminated. The flexure of the sealing strip brought about by engagement of the adjacent edge of the blade 15 results in cracking any caked contaminants lodged behind the upwind side of the respective fixed position sealing strip and it is gravity discharged therefrom.

In a damper according to the invention and on damper blades designed according to the invention, each blade carries a pair of opposed end sealing flaps 27 which are riveted or otherwise rigidly secured at each end of the blade 15 extending longitudinally beyond the edges of the blade forming sheets 18 and 19 and into sliding surface contact with the planar webs 12 of the side channels 11. As can best be seen by reference to FIG. 9 these sealing flaps function to substantially seal the vertical space which would otherwise exist between the inner planar surfaces 12 of the side channels 11 and the ends of the particular blade or blades 15. The resiliency of the flaps 27 maintains their relatively sharp corners in close sweeping contact with the channel surfaces 12.

Having described my invention, I claim:

1. In a damper having an open retangular frame, a plurality of rectangular blades mounted on transversely extending parallel shafts, and means for simultaneously swinging said blades between open position parallel to air flow through said frame and closed position across air flow, the improvement comprising

a flexible, thin, metal sealing strip secured to and extending along and laterally beyond the down-wind edge of each of said blades and into flexed engagement with the low pressure side of an adjacent blade near its other edge when said blades are in closed position, the sealing strip on an end one of said blades adjacent a transverse frame member engaging said frame member in closed position, whereby said sealing strips are bent slightly beyond their normal positions when said blades are in closed position.

2. In a damper according to claim 1, the improvement comprising a flexible, thin metal sealing strip mounted on and extending transversely across a transverse frame member adjacent the other end one of said blades and engaged by the up-wind edge of said adjacent blade when said blades are in closed position.

3. In a damper according to claim 1, the improvement comprising sealing flaps on the ends of said blades extending into wiping contact with the side members of the damper frame.

4. A damper according to claim 2 and a gas deflector mounted on and extending along said frame member adjacent to and on the up-wind side of the frame mounted sealing strip.

5. An improved blade for a damper, said blade consisting of two shallow V-shaped, substantially rectangular sheets of metal, the longitudinal edges of one of said sheets being bent around in return lips embracing the edges of the other of said sheets and secured thereto, the two sheets being positioned on opposite sides of a mounting shaft with their edges forming parallel apices lying parallel to and evenly spaced from such shaft, a pair of thin, flexible metal sealing flaps mounted on each end of said blade for wiping sealing contact with the surface of a frame for the damper, and an elongated, thin, flexible sealing strip secured to and extending along and beyond that edge of said blade which lies on the down-wind side of said shaft when said blade is in open position generally parallel to the flow of air through the damper frame.

6. A damper comprising at least one blade according to claim 5 and an open rectangular frame having two side members and two end members, a shaft for said blade extending between said side members across the opening defined by said frame and a flexible, thin metal sealing strip mounted on and extending across one of said end members for flexed engagement with the edge of said blade when in closed position, said frame mounted sealing strip extending downwardly from said frame member.

7. A damper according to claim 6 and a gas deflector mounted on and extending along said end member adjacent to and on the up-wind side of said frame mounted sealing strip.

8. A damper having a rectangular frame consisting of two side members and two end members, said frame members having flat surfaces lying parallel to the direction of air flow through said frame, at least one rectangular damper blade mounted on a transversely extending shaft mechanism for rotating said shaft to move said blade from open to closed position, a thin, flexible sealing strip mounted on the downwind edge of said blade and engageable with another element of said damper when said blade is in closed position for sealing the space therebetween, a fixed sealing strip mounted on one of said end frame members and engageable with the opposite edge of said blade when said blade is in closed position, sealing flaps on the ends of said blade and engaged in wiping contact with the side frame members of said frame, and a gas deflector mounted on said one of said end frame members adjacent to and on the up-wind side of said fixed sealing strip.

9. A damper according to claim 8 in which the fixed sealing strip extends inwardly into the space defined by the frame in a downward direction whereby gas born particles are carried away therefrom by gravity.

10. A damper having a rectangular frame consisting of two side members and two end members, said frame members having flat surfaces lying parallel to the direction of air flow through said frame, a plurality of evenly spaced, parallel shafts journalled in said side frame members and extending across said frame, a damper blade mounted on and rotatable with each of said shafts, mechanism for rotating all of said shafts simultaneously to move said blades from open to closed position, a thin, flexible sealing strip mounted on the downwind edge of each of said blades and engageable with the opposite edge of an adjacent blade when said blades are in closed position for sealing the space therebetween, a fixed sealing strip mounted on one of said end frame members and engageable with the opposite edge of the adjacent one of said blades when said blades are in closed position, sealing flaps on the ends of said blades and engaged in wiping contact with the side frame members of said frame, and a gas deflector mounted on said one of said end frame members adjacent to and on the up-wind side of said fixed sealing strip.

11. A damper according to claim 10 in which the fixed sealing strip extends inwardly into the space defined by the frame in a downward direction whereby gas born particles are carried away therefrom by gravity.

12. A reinforced blade for a damper, said blade consisting of a pair of rectangular sheets of metal bent to form opposed, shallow V-shaped blade surfaces, the longitudinal edges of said surface sheets being interfolded and secured to each other and a reinforcing channel secured to and lying between the opposed apices of said surface sheets and extending longitudinally thereof, the ends of said channel being open and adapted to receive mounting axles.

* * * * *