

- [54] **BACKDRAFT DAMPER**
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Related U.S. Application Data

- [63] Continuation-in-part of Ser. No. 354,680, April 26, 1973, Pat. No. 3,833,989.
- [52] U.S. Cl. **98/110; 98/40 VM; 98/119; 98/121 A**
- [51] Int. Cl.² **F24F 13/08**
- [58] Field of Search **98/110, 121 R, 121 A, 98/40 VM, 107, 119; 308/2 R, 2 A, 237 R, 308/237 A, 238, 239; 220/340**

References Cited

UNITED STATES PATENTS

345,689	7/1886	Hayes	98/121 A
2,296,599	9/1942	Costello	220/340
3,374,576	3/1968	Duclon et al.	98/121 R
3,581,650	6/1971	McCabe	98/110

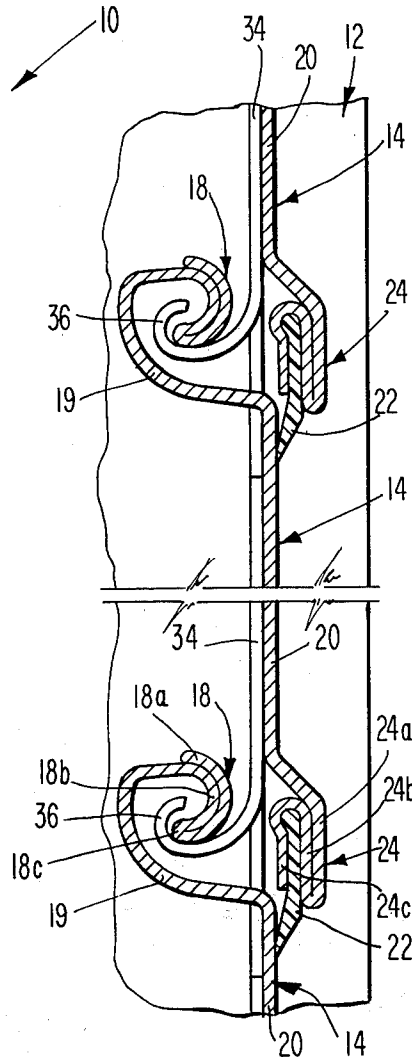
3,584,566	6/1971	McCabe	98/110
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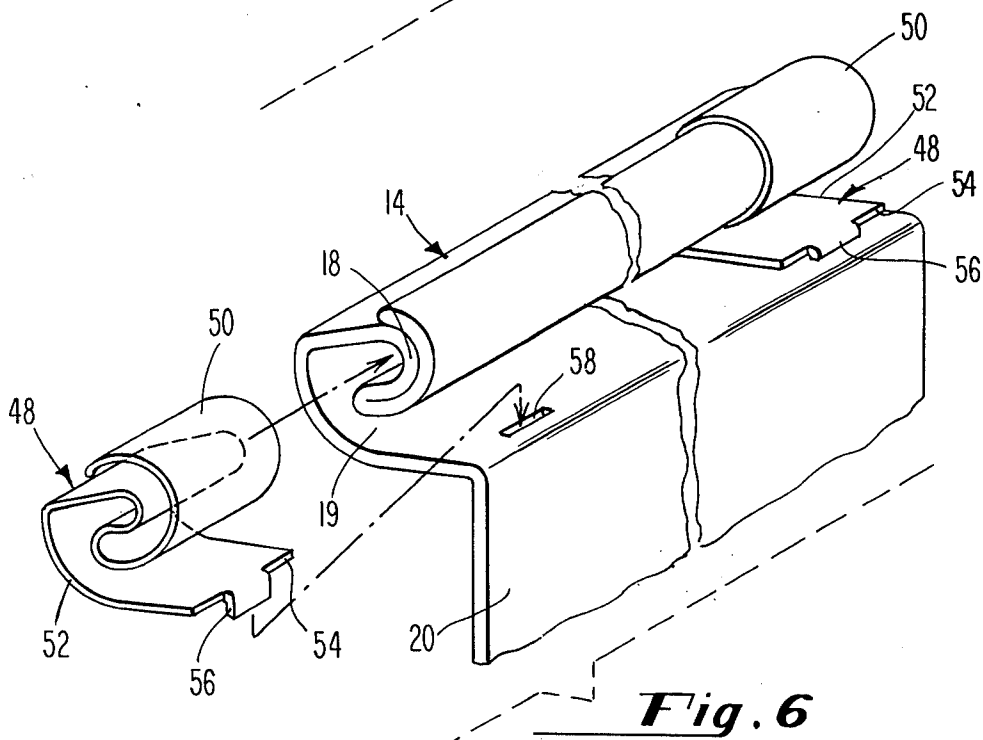
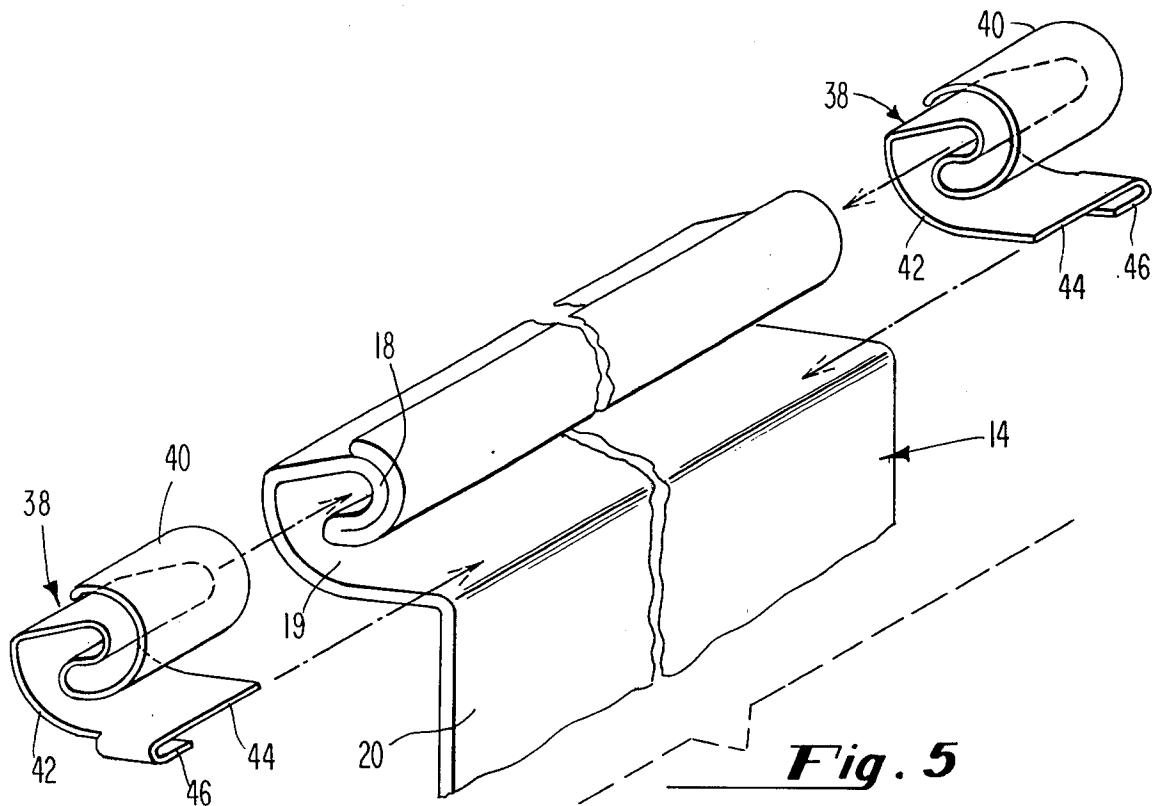
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[57] **ABSTRACT**

The present invention provides a backdraft damper which is constructed of essentially two integral elements. A damper frame and blades are so formed as to eliminate the necessity of separate hinging elements while providing for pivotal movement of the blades with respect to the damper frame. This pivotal hinging action is free from binding, provides positive sealing in the closed position, and limits the arc of pivotal displacement of the blades to an acute angle. The present invention also provides two novel bearings which may be utilized in combination with the damper to ensure smooth operation in extreme temperature and weather conditions, and to facilitate assembly of the damper frame and blades from non-critical materials.

6 Claims, 6 Drawing Figures





BACKDRAFT DAMPER RELATED APPLICATION

This is a continuation-in-part of my co-pending application Ser. No. 354,680 now U.S. Pat. No. 3,833,989, filed Apr. 26, 1973, entitled "Method of Fabricating and Assembling a Damper". This referenced application is specifically incorporated as part of this application as if specifically set forth herein.

BACKGROUND OF THE INVENTION

This invention relates to air dampers and, in particular, to dampers permitting air flow in one direction only, commonly referred to as backdraft dampers. More particularly, the present invention relates to a novel pivot means for allowing arcuate movement of the blades with respect to the frame.

Designers of prior art dampers have long sought to provide a device in which the blades may be easily moved to an open position to allow unimpeded air flow through the device while creating an effective air seal when the blades are closed. A backdraft damper is designed to allow air to pass from the interior of a building to the environment, while precluding wind, backdraft, rain, dust, smoke or obnoxious fumes from entering through the damper. Backdraft dampers are commonly operated by the differential pressure across the damper. To perform effectively, such dampers must have efficient seals to prevent passage of air, in the wrong direction, between the blades and between the blades and the frame. One such backdraft damper is disclosed in my U.S. Pat. No. 3,381,601.

Many different types of pivot means for allowing pivotal displacement of the blades of a backdraft damper with respect to the frame are known in the art. Several of these types are represented in my U.S. Pat. Nos. 3,327,764, 3,381,601, 3,581,650 and 3,605,603. Generally, these prior art devices employ pivot pins, bearings, hinges or other separate elements which are expensive to fabricate and install.

SUMMARY OF THE INVENTION

The present invention improves upon prior art dampers by providing a new damper consisting essentially of only two elements, that is, the damper blade and the damper frame. These elements are articulated with respect to one another by means of hinge portions formed in each element. The backdraft damper disclosed in the present application is efficient, economical, easy to fabricate, and reduces the number of moving parts and resultant maintenance to a minimum, while achieving the desired backdraft damper characteristics of efficient sealing, smooth operation, and limited blade travel.

In addition to the above, the present application teaches the use of two novel bearings which may be used in combination with the device of the present invention to effect smooth operation in extreme temperature and weather conditions. These bearings also facilitate construction of the device from inexpensive materials heretofore unsuited to damper construction.

Accordingly, it is an object of this invention to provide a new two element damper which overcomes the deficiencies of the prior art. This and other objects of the invention will become apparent from the following description with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top view showing the basic assembly of the damper frame in accordance with the preferred embodiment of my invention;

FIG. 2 is a front view on a smaller scale partially broken away, of the assembly shown in FIG. 1;

FIG. 3 is an enlarged foreshortened cross section, taken as indicated by the lines and arrows 3—3 in FIG. 2;

FIG. 4 is an enlarged cross section showing the pivot detail of a first alternate embodiment in which the blade is positioned to demonstrate its maximum arcuate displacement with respect to the frame;

FIG. 5 is an enlarged exploded perspective view of a foreshortened blade and the bearings of the first alternate embodiment of the present invention; and

FIG. 6 is an enlarged perspective of a foreshortened blade showing the bearings of the second alternate embodiment of the present invention, a first bearing shown exploded from the blade and a second bearing shown in its operating position.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Although specific forms of the invention have been selected for illustration in the drawings, and the following description is drawn in specific terms for the purpose of describing these forms of the invention, this description is not intended to limit the scope of the invention which is defined in the appended claims.

Referring now to FIG. 2, the damper assembly designated generally 10 comprises a frame designated generally 12 and a plurality of standard blades 14 and a similarly shaped bottom blade 16. As seen in FIG. 3, the blade construction comprises a hook-shaped upper portion designated generally 18 connected by a curved offsetting portion 19 to a flat intermediate blade portion 20 and seal member 22, preferably made of felt or vinyl or similar material, which is retained in a longitudinally extending slot formed by folding the lower edge portion of the blade, designated generally 24, over on itself to form layers 24a, 24b and 24c and to pinch the seal member 22 between layers 24b and 24c.

The hook-shaped upper portion 18 is formed by folding the blade material back on itself to form double layers 18a and 18b and a rounded blade tip 18c. This upper portion 18 and the curved offsetting portion 19 comprise the hinge portion of the blade. As seen in FIG. 3, this hinge portion is complementally configured and in articulated relationship with the hook-shaped hinge elements 36 of the frame. The blade may be constructed of any suitable material known to the art, however lightweight aluminum is preferred due to its excellent strength and wear characteristics. The unique formation of the hinge portion, and particularly the rounded blade tip 18c, allows non-critical material to be used in the construction of a suitable damper. The blade tip 18c reduces the friction between the blade and the hinge elements 36 thereby ensuring smooth pivotal operation of the damper.

The damper frame is formed of lightweight aluminum, which is fabricated preferably by roll forming to provide a plurality of flanges in the assembled box shape. As illustrated, the exterior flange 26 is reinforced by angle brackets 28 which are fastened to the

exterior flange by rivets 30. The purpose of the exterior flange 26 is to add strength to the damper and to engage the surface through which the damper is mounted. The shape and position of the external flange on the frame may vary, depending upon the mounting position required for a particular installation. The body of the frame 32 generally extends in a plane perpendicular to the plane of the blades 14 and is integrally formed with the aforementioned exterior flange 26, and an interior flange 34 which is disposed substantially parallel to the plane of the blades. The interior flange 34 is notched during construction at spaced intervals to provide a plurality of hook-shaped hinge elements 36 which are formed from the interior flange 34 by notching and bending portions of the flange 34. The spacing of these hook-shaped hinge elements 36 is such that the blades 14 will be disposed along parallel lines when engaging the hook-shaped hinge elements 36 on opposed sides of the frame, as shown in FIG. 2. Consequently, two such hook-shaped hinge elements 36 are required to engage each hinge portion of each blade.

It is anticipated that dampers of varying width and height may be constructed from standard blade stock. As shown in FIG. 2, the bottom blade 16 has been cut off thereby allowing the fabrication of an "odd size" damper without altering the stock blade width. Likewise, as shown in FIG. 3, each blade 14 is uniform along its length, thereby allowing the blade stock to be cut in accordance with the desired opening width. The present invention therefore provides a damper well suited for installation in "odd size" openings.

Referring now to FIG. 3, the invention is shown to provide a novel interengagement of the blades 14 with the frame portions 32, 34 and 36. As described in my co-pending application Ser. No. 354,680 now U.S. Pat. No. 3,833,989, the blades are attached within the frame by folding the frame around the blades in such a way as to interlock the blade and frame in an articulated pivotal relationship. The hook-shaped upper portion of the blade 18 is shown in FIG. 3 in interengagement with the hook-shaped hinge elements 36 of the interior flange portion 34 of the frame 12. This hook-shaped upper portion 18 is spaced from the intermediate portion of the blade 20 by the offsetting portion 19. In the closed position, the edges of the offsetting portion 19 extend through the notched openings defined in the interior flange 34. In this position the edges of the intermediate portions 20 of the blade form a seal with the flat surfaces of the interior flange 34. The lower edge of the blade 24 and the seal member 22 act to seal the recess created by the hook-shaped hinge element and the offsetting portion 19. The bottom blade 16 will form a seal along its sides and lower edge with the interior flange 34. Thus, in the closed position the damper is effective in sealing out rain, dust, wind, and other foreign materials.

Referring now to FIGS. 3 and 4, it can be seen that the blades are allowed to pivot with respect to the plane of the damper frame 12. The offset of the hook-shaped end 18 from the intermediate portion of the blade 20 results in a gravitational torque on the blade which helps to create a seal between the blade and its contiguous surfaces, particularly between sealing material 22 and its contiguous blade. Differential pressure will cause the various blades to pivot to the position shown in FIG. 4. It can be seen in FIG. 4 that the interengagement of the hook-shaped hinge elements 36 and the

hook-shaped hinge portion 18 of the blade is such that the arc of displacement of the blade with respect to the interior flange 34 is limited to an acute angle. The device of the present invention is useful not only for vertical mountings but also may be used in a variety of positions, including horizontal mountings since limitation of the arc of displacement of the blades will result in the blades falling shut in the absence of differential air pressure.

As shown in FIG. 4, for certain extreme environmental conditions, it may be desirable to improve the sliding frictional characteristics of the blade-frame interconnection. A first alternate embodiment comprising bearings designated generally 38 is shown in FIG. 4 for the purpose of facilitating a smooth action of the blades with respect to the frame. These bearings are formed from substantially planar material and are shaped to conform to the contours of the interior surfaces of the offsetting portion 19 and are designed to envelop the contours of the hook-shaped upper portion 18. FIG. 5 shows these bearings in an exploded perspective view illustrating the method of insertion and positioning of the bearing with respect to an unassembled blade. As seen in FIG. 5, these bearings comprise a first end portion 40 which is formed to create a hook-shaped slot and a mid-section of the bearing 42 which is formed to conform to the interior surface of the hook-shaped end portion 18 of the blade. A second end portion 44 of the bearing comprises a U-shaped member 46 which prevents the longitudinal movement of the bearings towards the center of the blade by engaging the edge and two surfaces of the offsetting portion 19 of the blade. The U-shaped member 46 abuts the intermediate portion 20 of the blade, thereby facilitating a force fit of the bearing and ensuring that the bearing will not slide relative to the blade. In order to fit the blade with the bearings 38, the bearings are pre-formed and then slipped onto the end of the blade as shown by the arrows of FIG. 5. The interarrangement of the blade with the body portion 32 of the frame prevents the bearings from slipping off the end of the blade, and the U-shaped portion 46 prevents the bearings 38 from moving towards the center of the blade. Consequently, the bearings need only be slipped onto the blade, and no additional fastening is necessary.

FIG. 6 shows a second alternate embodiment bearing 48 which may be used for dampers in which the body portion 32 does not naturally prevent the bearing from slipping off the end of the blade. This bearing 48 also defines a hook-shaped slot with its first end portion 50, and has a mid-portion 52 formed to correspond to the interior surface of the hook-shaped end portion of the blade 18. The second end portion 54 comprises a substantially perpendicular tab 56 which mates with a slot 58 in the blade, thereby securely positioning the bearing with respect to the blade. Insertion of the bearing 48 is accomplished by sliding it onto the end of the blade as shown in the arrows in FIG. 6 and forcing the tab 56 into slot 58. Both bearings 38 and 48 should be constructed to ensure a snug fit of the bearing against the interior surface of the hook-shaped end of the blade.

These bearings may be constructed of high quality stainless steel, low friction plastic materials, or any of a number of other bearing materials well known in the art. It should be emphasized that these bearing surfaces are unnecessary unless either low quality materials are

used to fabricate the damper or unless the damper is to be installed for use in the most extreme conditions.

It will be understood that various changes in the details, materials and arrangement of parts which have been herein described and illustrated in order to explain the nature of this invention may be made by those skilled in the art within the principle and scope of the invention as expressed in the following claims.

It will further be understood that the "Abstract of the Disclosure" set forth above is intended to provide a nonlegal technical statement of the contents of the disclosure in compliance with the Rules of Practice of the United States Patent Office, and is not intended to limit the scope of the invention described and claimed herein.

What is claimed is:

1. In a backdraft damper having a frame, at least one blade, and pivot means for allowing arcuate displacement of said blade with respect to said frame, the improvement wherein said pivot means comprises at least two hook-shaped hinge elements formed in said frame, said hinge elements defining a surface having a hook-shaped cross-section and at least one hook-shaped hinge portion formed in said blade, said hinge portion complementally configured to said hook-shaped hinge elements and slidably engaging said hinge elements, and wherein said pivot means further comprises bearing means disposed between said hinge elements and said hinge portion.

2. The invention of claim 1, wherein said bearing means comprises at least two bearings which engage the hinge portion of the blade.

3. The invention of claim 2, wherein said bearings conform to the interior surfaces of said hook-shaped

hinge portion.

4. The invention of claim 3, wherein said bearings further comprise a U-shaped portion which engages one edge and two surfaces of said hinge portion.

5. The invention of claim 3, wherein each of said bearings further comprise a tab, said tab mating with a slot in said hinge portion, thereby fixing said bearing to said hinge portion.

6. A backdraft damper comprising a frame, at least one blade, and pivot means for allowing arcuate displacement of said blade between a closed and an open position with respect to said frame, wherein said frame is box shaped and is comprised of a plurality of flanges, at least one of which is an inwardly depending interior flange disposed within a plane which is parallel to and contiguous with a first side of the plane of said blade in said closed position, said interior flange being notched to form at least two hook shaped hinge elements which project generally away from the plane of said blade on said first side and are disposed on opposite sides of said frame, said hinge elements defining a surface having a hook shaped cross section; and wherein said pivot means comprises a hook shaped hinge portion formed in said blade and offset from the plane of said blade, and said hinge elements; said hinge portion being complementally configured to said hook shaped hinge elements and slidably engaging said hinge elements, said hook shaped hinge elements and said hook shaped hinge portion being so articulated as to limit the arc of displacement of said blade with respect to said frame, whereby a seal is formed between said frame and said blade in the closed position.

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