United States Patent [19]

McCabe

[11] **3,866,656**

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[54] **FOLDING BLADE FIRE DAMPER**

[76] Inventor: **Francis J. McCabe,** P. O. Box 181, Buckingham, Pa. 18912

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 293,460, Sept. 29, 1972, Pat. No. 3,796,249.

[52] **U.S. Cl.** **160/84,** 160/1, 160/9, 160/188

[51] **Int. Cl.** **E05f 15/20,** E06b 9/204

[58] **Field of Search** ..... 160/1, 9, 84, 35, 23, 36, 160/331, 310, 311; 49/189, 188, 379, 110; 242/107 R

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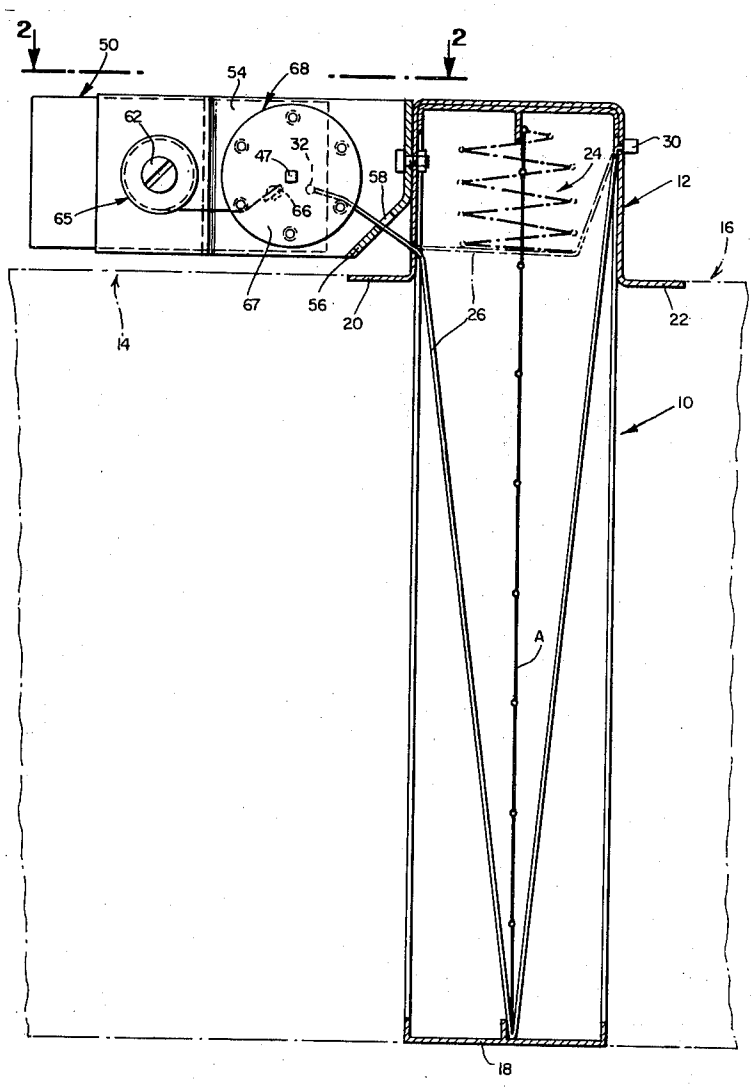
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Primary Examiner—Philip C. Kannan
Attorney, Agent, or Firm—Paul & Paul

[57] **ABSTRACT**

A motor operated geared pulley system is provided for retracting the blades of a folding blade fire damper. Drive means are provided attached to the motor operated system to counteract the frictional forces in the system by driving a portion of it in reverse, thereby allowing the retracted blades to fully extend when the motor is shut off.

5 Claims, 4 Drawing Figures



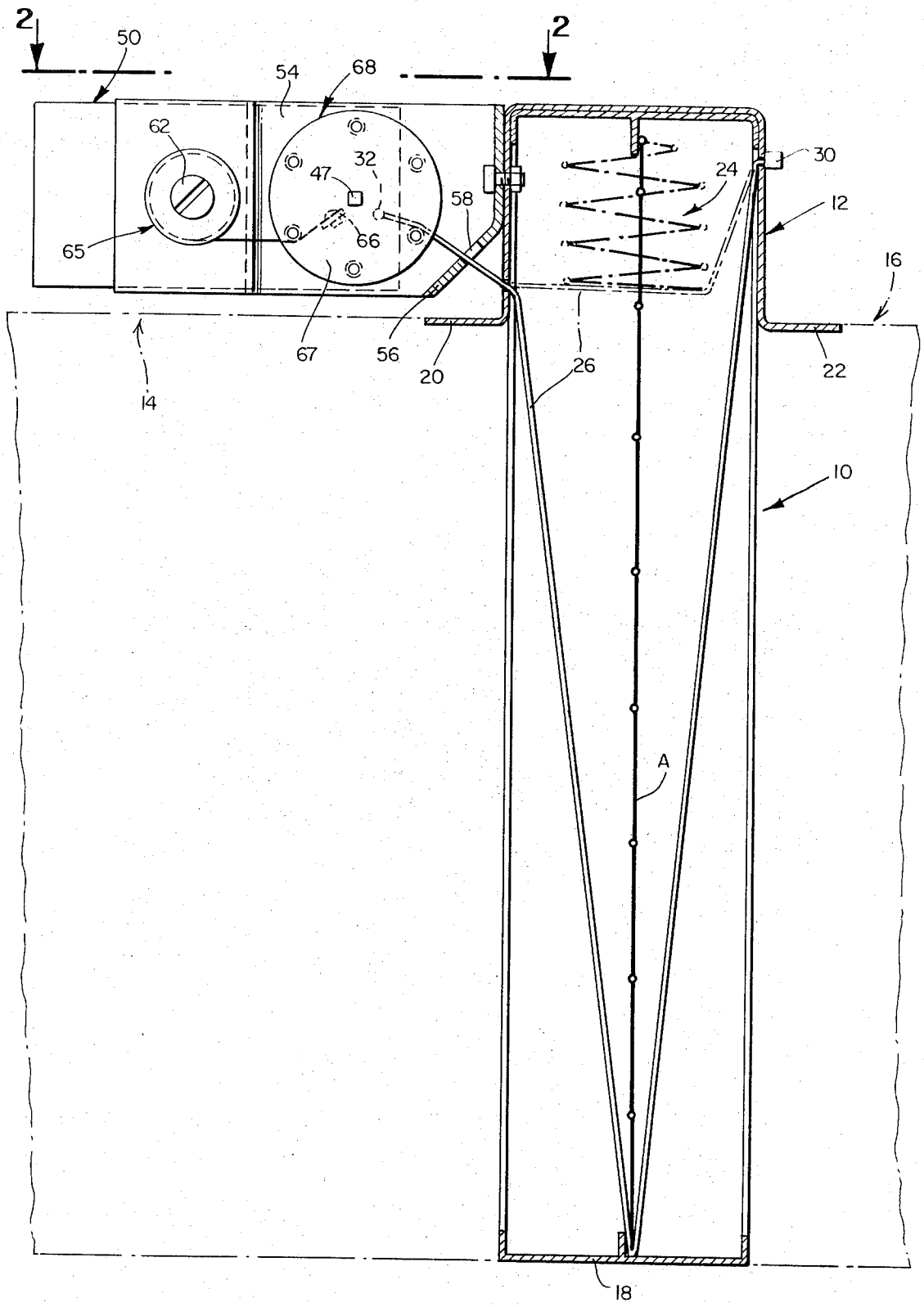


Fig. 1

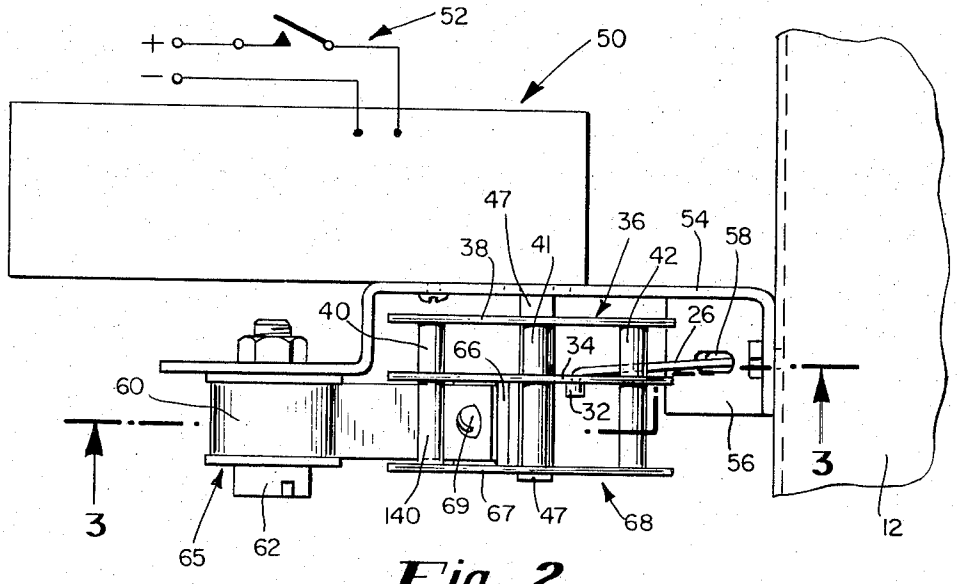


Fig. 2

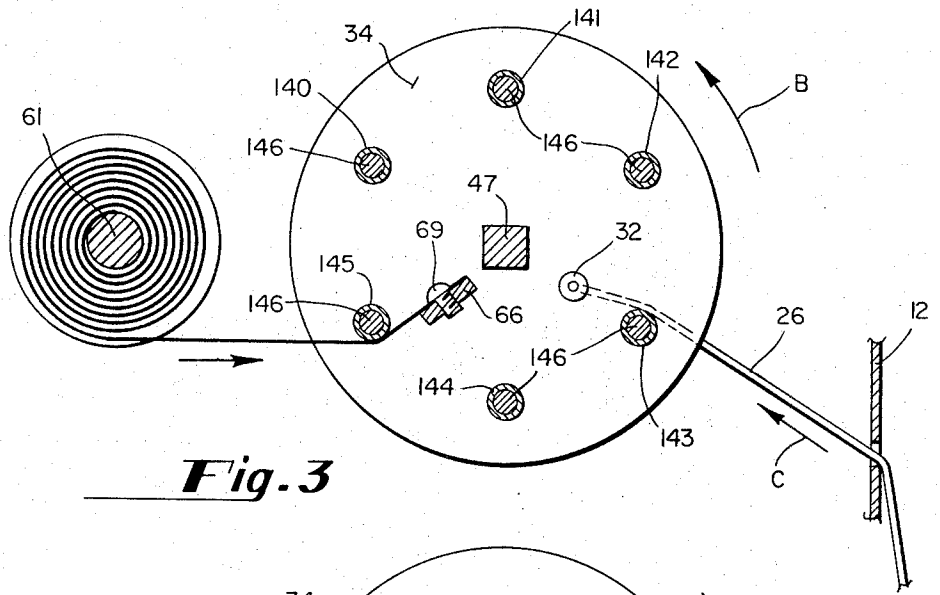


Fig. 3

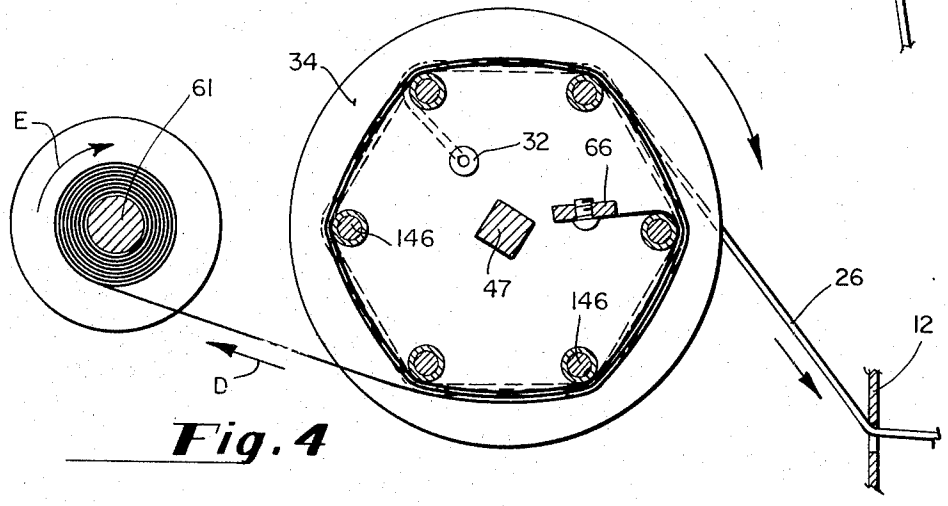


Fig. 4

FOLDING BLADE FIRE DAMPER

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of my prior copending application Ser. No. 293,460, filed Sept. 29, 1972, now U.S. Pat. No. 3,796,249, for a Resettable Fire Damper, and incorporates said application herein by reference.

BACKGROUND OF THE INVENTION

This invention relates to folding blade fire dampers for use in air ducts, and more particularly, to motor operated retraction devices which are designed to hold the damper in the open position under normal usage and release the damper by remote control so that it will close under fire and smoke conditions.

In the prior art, folding blade fire dampers, such as those shown in my U.S. Pat. Nos. 3,273,632 and 3,401,734, comprise a frame retaining a plurality of blades hinged along their longitudinal edges and normally retained in a folded or retracted condition. It is known to retain the blades out of the flow path in an air duct by forming the frames with a header to embrace the mass of folded blades. Alternatively, the blades can be retained within the flow path in the air duct. In either event, the blades are normally released by the heat destruction of a fusible link which releases the blades and allows them to fall of their own weight to a fully extended position, closing the air duct. In certain installations, a spring is attached to the bottom blade to aid in fully extending the blades.

In my prior copending application referenced above, I disclose means of resetting the blades in their folded condition; which means is operative from outside the fire duct. I also disclosed a non-destructible release means.

It is now known to reset a fire damper of the type described from outside the fire duct by means of a motor operated pulley system. Typically, the motor retracts a cable which is passed about the blades of the fire damper and retained at one end in the frame of the fire damper. As the cable is wound on a pulley, the blades are folded and retracted. The motor is a "stall" motor; that is, once it has retracted all the cable possible, it maintains a power-on stalled condition without being burnt out. Such motors employ gear trains for use in winding the pulleys. The motors are actuated by remotely controlled electrical means. When the power is cut off, the motor and part of the gear train are cut out of the system, that is, disconnected, thereby allowing the damper to open of its own weight, at times aided by means of a spring attached to the bottom blade of the damper.

I have found that such motors are not entirely satisfactory because of the frictional forces in the gear train which is still connected to the pulley after the electricity to the motors has been shut off. The object in fire dampers is to fully close the damper to prevent smoke and fire from continuing to move through the air ducts. If the damper cannot be fully closed because of the retarding effects of the pulley and gear train, the whole system becomes less efficient, and indeed, hazardous.

SUMMARY OF THE INVENTION

In the present invention, I provide a means for counteracting the frictional forces in the pulley and gear train, thereby allowing the damper to fully close of its own weight. In the preferred embodiment, this means comprises a spring motor attached to the spool or pulley in such a way as to be set by the electric motor when the power is on. The spring motor drives the spool or pulley and gear train in reverse, thereby acting as a compensator to allow the cable which is passed about the damper blades to fully unwind.

Accordingly, it is an object of my invention to improve upon the existing motor operating retracting systems for folding blade fire dampers by providing a means for nullifying the retarding effects of said systems and allowing the dampers to fully close. This and other objects of my invention will become apparent from the following description with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an elevational view, partly in section, of a motor operated fire damper shown in its environmental condition mounted in a duct with a blade shown schematically and alternate positions shown in phantom lines;

FIG. **2** is a slightly enlarged view taken as indicated by the lines and arrows **2—2** in FIG. **1** with electrical circuitry shown schematically;

FIG. **3** is a further enlarged view of a portion of the apparatus taken as indicated by the lines and arrows **3—3** in FIG. **2**; and

FIG. **4** is a view similar to FIG. **3** with parts shown in alternate positions.

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.

A folding blade fire damper is shown in elevational view in FIG. **1** and designated generally **10.** In the type of damper shown, a header section, designated generally **12,** is provided. The damper is mounted in its environmental condition so that the air ducts shown in phantom lines, designated generally **14** and **16,** are connected to the damper, or a sleeve, at the bottom **18** and to the flanges **20** and **22** at the top.

The damper comprises a plurality of blades shown schematically and designated generally **24.** The header retains the blades in the folded condition shown in phantom lines so that the blades are out of the flow path of the air through the ducts. In this folded or retracted condition the blades are held by a flexible member or cable or wire **26.** The wire is connected at one end by passing it through a hole in the header portion **12** and attaching a metallic clip **30** to the end as by crimping. The metallic clip is of such a diameter that it will not pass through the holes. When the flexible member **26** is released, the blades will descend by the force of gravity to their unfolded or fully extended condition shown in full lines "A" in FIG. **1.**

The other end of the cable **26** is attached by means of a similar spring clip **32,** FIG. **2,** through a hole in a plate **34** which forms one side of a spool or pulley designated generally **36.** The spool is formed by the plates **34** and **38,** which are spaced from one another by a plurality of spacers, such as at **40, 41** and **42,** and retained

in the spaced relation by any suitable means, such as by bolts or rivets passing therethrough, and fixed at their ends in any suitable fashion (not shown). A square shank **47** passes through an axially disposed hole in each of the plates **34** and **38.** The shank **47** is connected internally to the drive gear train of the stall motor retraction system, designated generally **50.** This motor is actuated by remote electrical means, as shown schematically at **52.** The motor is not shown in greater detail since it is known in the art and has been described functionally in the description of prior art above. Suffice it to say for present purposes that the shank **47** can be connected readily to the gear train so that upon appropriate electrical impulse to the motor the shank **47** can be made to turn in the direction of the arrow "B" shown in FIG. **3** to retract the cable **26** in the direction indicated by the arrow "C" by winding it about the spacers. As previously stated, when the cable **26** is fully withdrawn, as shown in phantom lines in FIG. **1,** the motor will stall out and retain the cable in that position until the electrical current is shut off.

The motor and spool are mounted to the damper by means of a bracket **54,** which has an angled member **56** with a slot **58** therein forming a cable guide. It will be understood that it is within the scope of this invention to mount the motor and spool within the duct, such as by means of the bracket **54.**

An extension of the bracket **54** serves to mount the power drive means for offsetting the frictional forces in the motor gear system **50** when the motor is shut off. In accordance with the preferred embodiment of this invention, the power drive means comprises a coiled spring **60** of a type known in the art. Such springs are usually mounted on the bottom portion of the frame of the fire damper and have one end attached to the lower blade in the damper. When the damper is released, the spring pulls the blades down to their fully extended condition. These springs are made so that even though they may be almost fully extended or rewound after forming, they tend to return to their original wound condition.

In accordance with this invention, the spring is shown in its rest or normal wound condition in the first three figures; with the exception of a small portion which has been unwound in order to be attached to an extension of the spool **36.** As shown in the figures, the spring is disposed about a shaft **61** which is part of a bolt **62** attached to the bracket **54.** The spring is retained axially by the sides of the spool, designated generally **65,** and can rotate about the shaft **61.** The other end of the spring is attached to a strut **66** disposed between the plate **67** and the plate **34.** The plates **34** and **67** form a spool designated generally **68,** which is constructed similar to the spool **36** and has a plurality of spacers **141, 142, 143, 144, 145** and **140** to retain the plates in spaced relationship in cooperation with the bolts or rivets **146.** Both the bolts or rivets **146** and the shaft **47** pass through the spools **36** and **68,** so that the spools rotate together with the shaft. The strut **66** is fixed to the plates and the end of the spring is fixed to the strut as by means of a screw **69.**

The positioning of the shafts **61** and **47,** the strut **66,** and the bolt and spacer **146, 145,** respectively, is important to the functioning of this device. I have found that in the last stages of unwinding, when the force due to the weight of the blades is approaching its lowest value, there is need to increase the speed of unwinding so that the blades can close fully by their own weight. By mounting the spring and spool in the position shown and offsetting the end of the spring with respect to the last spacer, I have found that the spring speeds up, thereby perhaps more than offsetting the frictional forces of the motor gear train and allowing the damper blades to fully extend.

In operation, with the arrangement just described and the damper in the closed position (that is, with the blades extended as at "A"), the electric power is turned on starting the motor. As the motor winds the spools in the direction shown by the arrow "B" in FIG. **3,** the cable **26** wraps about the spacer elements on the spool **36** and the spring **60** is simultaneously unwound from the position shown in FIG. **3** and rewound on a greater diameter about the spacer elements on the spool **68.** The motor retracts the cable **26** fully to the position shown in FIG. **1** and then stalls. When it is desired to release the damper, the electricity is cut off to the motor and the damper blades fall of their own weight. However, they are retarded by the cable **26** which is wound on the spool **36** and must unwind from the spool thereby reversing the gears to which the spool is connected. The frictional forces in these gears are overcome by the spring **60** which forceably returns to its original condition having a lesser diameter, moving in the direction of the arrows "D" and "E" shown in FIG. **4.** This drives the gear train in reverse.

The effects of this device are even more pronounced in dampers which are mounted horizontally, that is, with blades that are horizontal in their fully extended condition. Such dampers are activated by springs, as previously described, attached generally to the end blade. While these springs act in place of the gravitational forces in a vertically mounted damper, the construction of the dampers are such that their action in fully closing the damper against the effects of frictional forces in the gear train would be inhibited without the use of the power drive means in accordance with my invention.

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 non-legal 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 damper having blades movable between a folded and unfolded condition and having a motor operated means connected thereto to move said blades to said folded condition, the improvement comprising: drive means directly connected to the motor operated means to drive said motor operated means in a reverse direction to the movement of said means when folding said blades, said motor operated means comprising a motor and gear train system, said drive means being directly connected to said gear train system to overcome the frictional resistance of that gear train system to allowing the blades to move to an unfolded condition, said motor operated means having a spool connected

to a flexible member disposed about said blades to move said blades to a folded condition upon rotation of said spool in one direction, said drive means being directly connected to said spool to rotate said spool in the opposite direction, and wherein the blades create a tension in said flexible member which is resisted by the frictional forces of said gear train system, and wherein said drive means rotates said spool to reduce the tension in said flexible member to thereby allow said blades to move to an unfolded condition.

2. The invention of claim **1** wherein said drive means comprises a spring.

3. The invention of claim **2** wherein said spring is a coiled spring disposed about a shaft remote from said spool and having one end connected to said spool.

4. The invention of claim **3** wherein said spool has a larger diameter than the coil of said spring to wind said spring thereon as said motor operated means moves said blades to a folded condition.

5. The invention of claim **4** wherein the end of said spring connected to said spool is offset internally of the spool from the periphery of the spool about which the spring is wound as the motor operated means moves the blades to a folded condition.

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