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McGough, Jr.

[11] **3,889,552**

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[54] **ACTUATING DEVICE FOR MULTIPLE DAMPERS**

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[73] Assignee: **Combustion Engineering, Inc.,** Windsor, Conn.

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[52] **U.S. Cl.** ..... **74/519;** 49/77; 98/121 A

[51] **Int. Cl.** **G05g 1/04**

[58] **Field of Search** ..... 74/519, 521, 25, 99 R; 49/80, 77, 78, 103; 98/88 L, 110, 121 A, 40 VM

[56] **References Cited**

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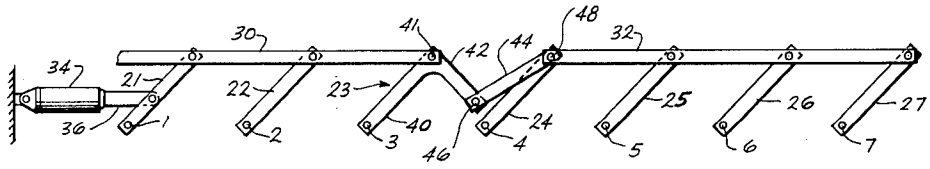
Assistant Examiner—Frank H. McKenzie, Jr.
Attorney, Agent, or Firm—Robert L. Olson

[57] **ABSTRACT**

An actuating device for two or more flow control dampers, utilizing a linkage arrangement which permits one or more of the dampers to be initially opened while the others remain closed, and which also rotates all of the dampers 90° to a fully open position simultaneously.

3 Claims, 4 Drawing Figures



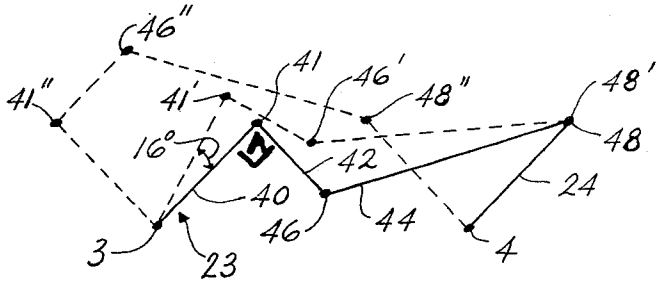


FIG-3

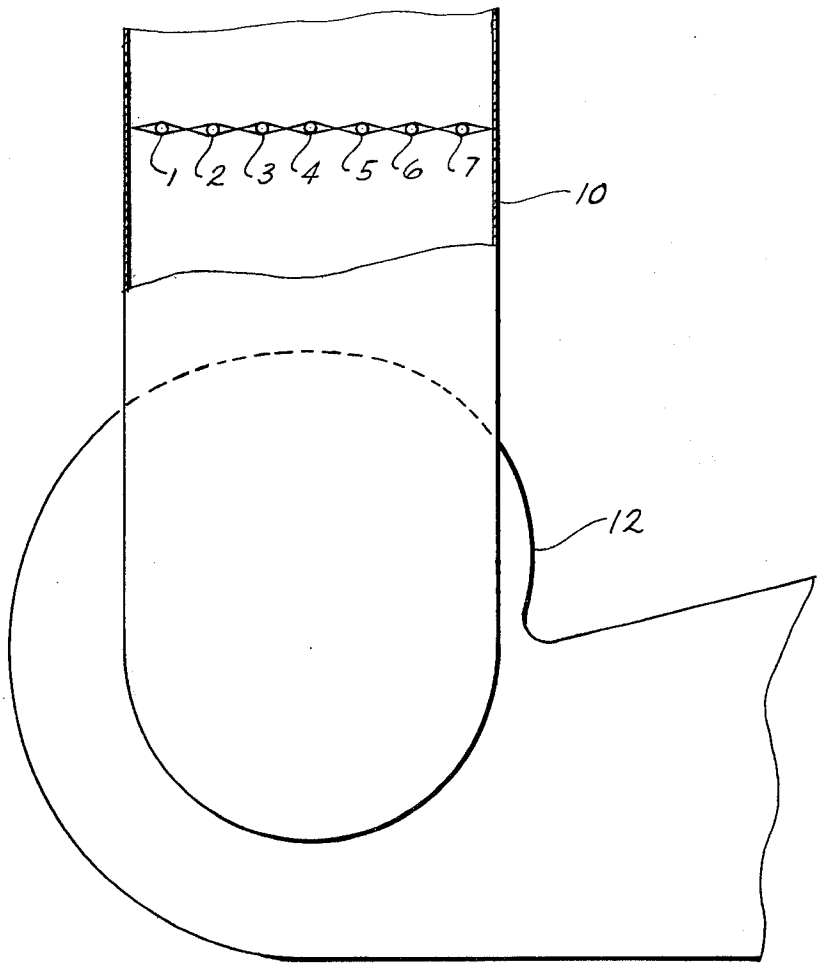


FIG-1

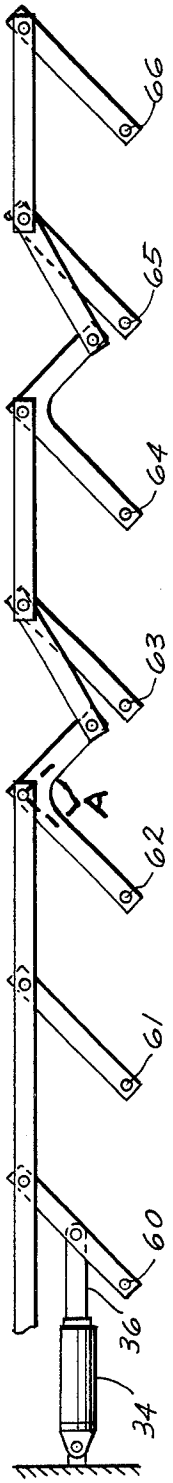

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FIG-4

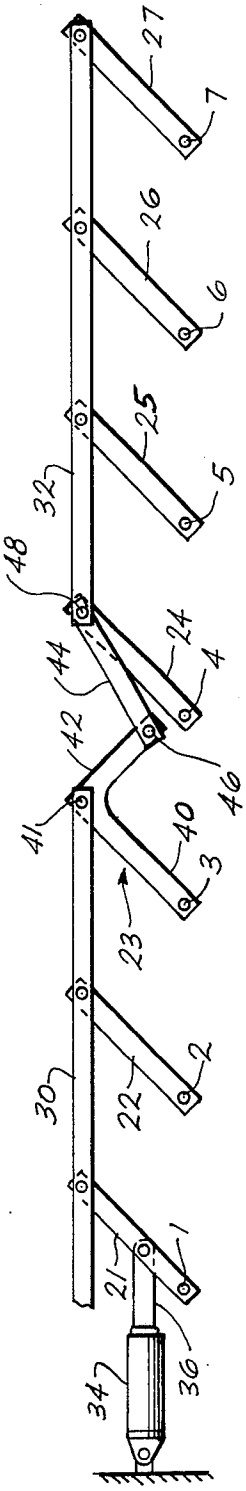
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FIG-2

ACTUATING DEVICE FOR MULTIPLE DAMPERS

BACKGROUND OF THE INVENTION

During low load operation of large steam generators, vibration of the induced draft fan or gas recirculation fan is sometimes encountered. The inlets to these fans are controlled by a multitude of small coacting dampers extending across the width of the inlet ducts. It has been determined that one way of reducing fan vibration problems is to have a fine control over the damper positions during low load operation, and to allow flow through only selective dampers.

SUMMARY OF THE INVENTION

In accordance with the invention a single actuating device is provided which permits initial opening of one or more of a plurality of dampers, while the other dampers remain in their closed position. The actuating device further accomplishes full opening of all of the dampers simultaneously. The actuating device comprises a linkage arrangement having a dogleg link therein for accomplishing the above.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a sectional side view of a plurality of damper valves to be actuated in accordance with the invention;

FIG. 2 is a side view of the actuating mechanism for the dampers shown in FIG. 1;

FIG. 3 is a schematic showing the relative positions in dotted lines of the linkage arrangement; and

FIG. 4 is an alternative embodiment of an actuating device.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. **1**, a gas inlet duct **10** for fan **12** is shown. Flow to the fan is controlled by a plurality of coacting dampers rotatable about pivot points **1–7**. In some installations, such as the induced draft fan or gas recirculation fan of a steam generator, it has been found that the fan is subjected to severe vibration problems when the unit is first started up, and during low load operation. One way of minimizing the vibration problem during these operation conditions is to initially open only selective dampers, keeping the remaining dampers closed during low load operation. It is still desirable to have all of the dampers in a fully opened position when the unit is operating at full capacity. Also, it is desirable to be able to actuate all of the dampers by means of a single actuating device.

FIG. **2** shows the linkage arrangement located outside of the duct **10** for causing the desired rotation of the dampers. As shown, each damper pivot pin **1–7** has an associated link **21–27**, respectively, attached to it. Links **21, 22** and **23** are attached to a first drive rod **30**, and links **24, 25, 26** and **27** are attached to a second rod **32**. The linkage arrangement is shown in the position it is in when all of the dampers are in their fully closed position. A fluid motor **34** is used to rotate pivot pin **1** through piston rod **36**. By means of the linkage, the motor thus actuates all of the dampers.

In order to allow some of the dampers, mounted on pivot pins **1, 2** and **3** to intially start opening while the other dampers remain closed, link **23** is in the configuration of a dogleg, having two leg portions **40** and **42**. The outer end of leg **42** is pivotally connected at point **46** to link **44**. The other end of link **44** is pivotally connected to rod **32** by means of the same pin pivotally connecting link **24** to rod **32**. When motor **34** is initially started, it rotates pivot pin **1** along with the damper and its associated link **21** counterclockwise. This causes simultaneous rotation of pivot pins **2** and **3**, and their associated dampers because of the connections of links **22** and **23** to drive rod **30**. The dampers mounted on pivot pins **4–7** remain in their closed positions during this initial rotation, since this initial rotation of dogleg **23** merely causes movement of its leg **42**, and the link **44** connected to it. The second drive rod **32** will initially move to the right (in the close direction), causing links **24, 25, 26** and **27** to rock while the dampers associated with pivot pins **1–3** initially open. With the linkage illustrated, the first set of dampers will rotate approximately 16° before the second set of dampers start to open. At this point further movement of drive rod **30** to the left also causes movement of the second drive rod **32** to the left causing opening of the dampers associated with pivot pins **4–7**. Further movement of drive rod **30** then causes further opening of the first dampers, and also causes opening of dampers **4–7** at a faster rate, so that after 90° rotation of the first set of dampers **1–3**, the second set **4–7** also will have rotated 90°, so they are all in their fully open position. This is accomplished by the proper size of the included angle A between the two leg portions of the dogleg, in combination with the proper lengths of **42** and **44**.

In order to have the second set of dampers rotate 90°, the distance between pivot points **41** and **48** must be the same after 90° rotation as it was when all of the dampers were in the closed position. In the linkage arrangement shown in FIG. **2**, this is done by making the included angle A of the dogleg 90°. The leg **40** of the dogleg forms a 45° angle to a vertical passing through pin **3**. Thus after the dogleg link rotates 90°, leg **40** will again be at a 45° angle to a vertical passing through pin **3**, and thus the distance between pivot points **41** and **48** is the same after 90° as it was when all of the dampers were fully closed.

The positions of the solid lines links during rotation is shown in FIG. **3**. The solidlines indicate the respective link positions when all of the dampers are fully closed. The positions shown by the numbers with a prime affixation shows the relative positions after approximately 16° rotation of the first set of dampers, with the second set of dampers still closed. As can be seen, at this point the leg **42** and link **44** lie almost in a straight line, so that any further rotation of the first set of dampers also causes rotation of the second set too. The numbers with the double prime affixation shows the relative positions after 90° rotation, with all of the dampers in their fully open positions.

By using a 90° included angle A, the degree of rotation of the first set of dampers before there is any rotation of the second set of dampers is determined by the lengths of leg **42** and link **44**. The shorter the length of **40**, the lesser the amount of rotation of the first set of dampers before there is any movement of the second set of dampers. The relative lengths of the links shown in FIG. **2** to allow 16° rotation of the first set of dampers before the second set started moving are: leg **40** is 6 inches long; leg **42** is 5.375 inches long; and link **44** is 17.75 inches long. In an actual working model, the second set of dampers started opening slightly before the leg **40** and link **44** were in a straight line position. As mentioned previously, the included angle A of the

dogleg is 90°, and the leg **40** initially lies at a 45° angle to a vertical passing through pin **3.**

FIG. **4** shows an alternative arrangement of an actuating device having two doglegs in a linkage arrangement, with all other parts being identical to that shown in FIG. **2.** In this arrangement, the first set of dampers **60, 61** and **62** would be rotated 16° before there is any movement of the second and third set of dampers. Further rotation would then cause the second set of dampers **63** and **64** to start rotating. After these dampers have been rotated 16°, the third set of dampers **65** and **66** will start opening. The third set of dampers **65** and **66** will start opening after something slightly less than 32° rotation of the first set of dampers **60, 61** and **62,** since the second set of dampers will be rotating at a slightly faster rate than the first set of dampers during the second 16° rotation period. As was the case with the FIG. **2** embodiment, all of the dampers **60–66** will have rotated 90° at the same time, placing all of the dampers in their fully open positions simultaneously.

What is claimed is:

1. An actuating device for causing rotation of first and second members about first and second stationary pivot points, respectively, between first and second positions, the second positions being 90° from the first positions, said actuating device including a first link of dogleg configuration, a second link, a third link, a first leg of the first link being integral with the first member, and being rotatable about the first stationary pivot point at its outer end, the second leg of the dogleg being connected to one end of the second link by means of a first movable pivot point, the other end of the second link being connected to one end of the third link by means of a second movable pivot point, the other end of the third link being integral with the second member, and being rotatable about the second stationary pivot point, the first leg of the dogleg being parallel with the third link when the first and second members are in their first positions, means for causing 90° rotation of the first member, the length of the second leg of the dogleg, the length of the second link, and the angle included between the first and second legs of the dogleg, being so proportioned that the first leg of the dogleg and the third link will be parallel after 90° rotation of the first member, whereby during initial rotation of the first member no rotation of the second member occurs, but after 90° of rotation of the first member, the second member will also have rotated 90°.

2. The actuating device of claim **1,** whereby the angle included between the first and second legs of the dogleg is 90°.

3. The actuating device of claim **2,** whereby the length of the second leg of the dogleg and the length of the second link is so proportioned that the first member is rotated through approximately 15° before any rotation of the second member occurs.

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