

[54] **AIR CONTROL DEVICE**

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[58] **Field of Search:** 137/607; 251/305, 6; 93/38 B, 93/38, 110, 102; 165/103, 48

[56] **References Cited**

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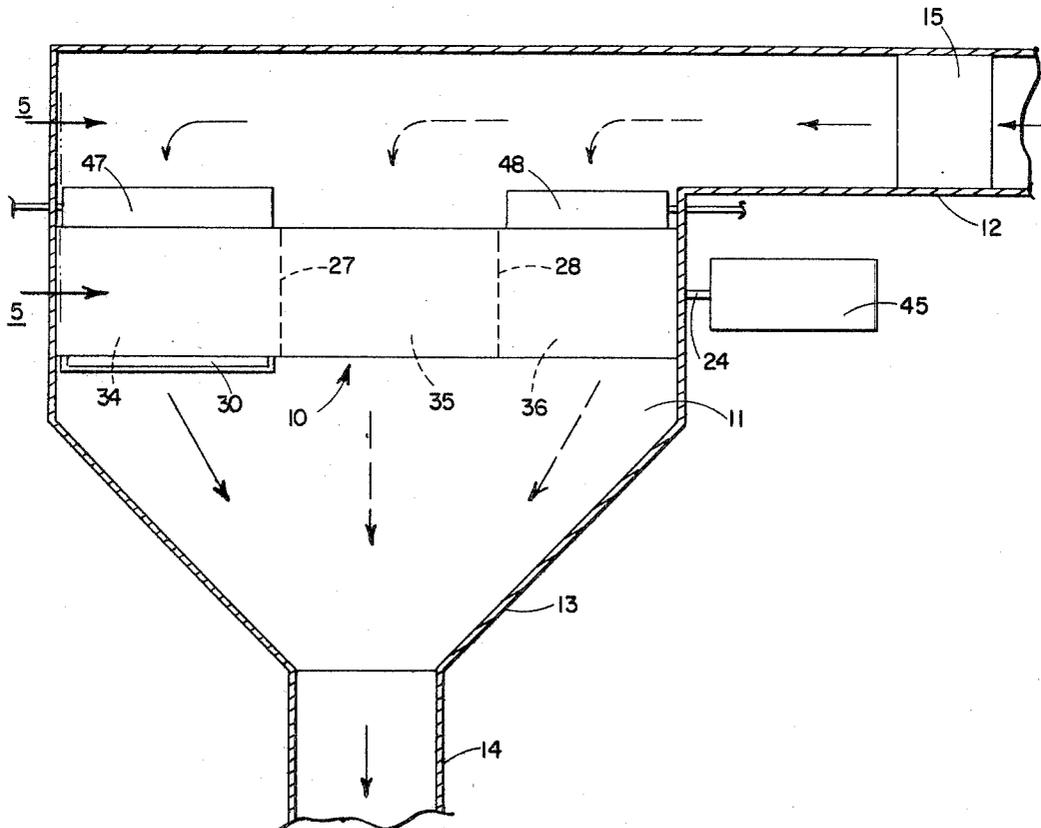
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[57] **ABSTRACT**

A damper control for an air-conditioning system including opposed walls defined by concentric, cylindrical segments divided transversely into three passageways in each of which is a vane, the vanes being on a shaft concentric with the opposed walls, the vanes also being angularly displaced relative to each other so that, when each vane is positioned intermediate the walls so as to open its passageway, the other two vanes engage the opposed walls to close their passageways, with a heating unit being positioned adjacent one of the passageways to heat the air flowing through it, and a cooling unit being positioned adjacent another of the passageways for cooling the air flowing through that passageway.

5 Claims, 8 Drawing Figures



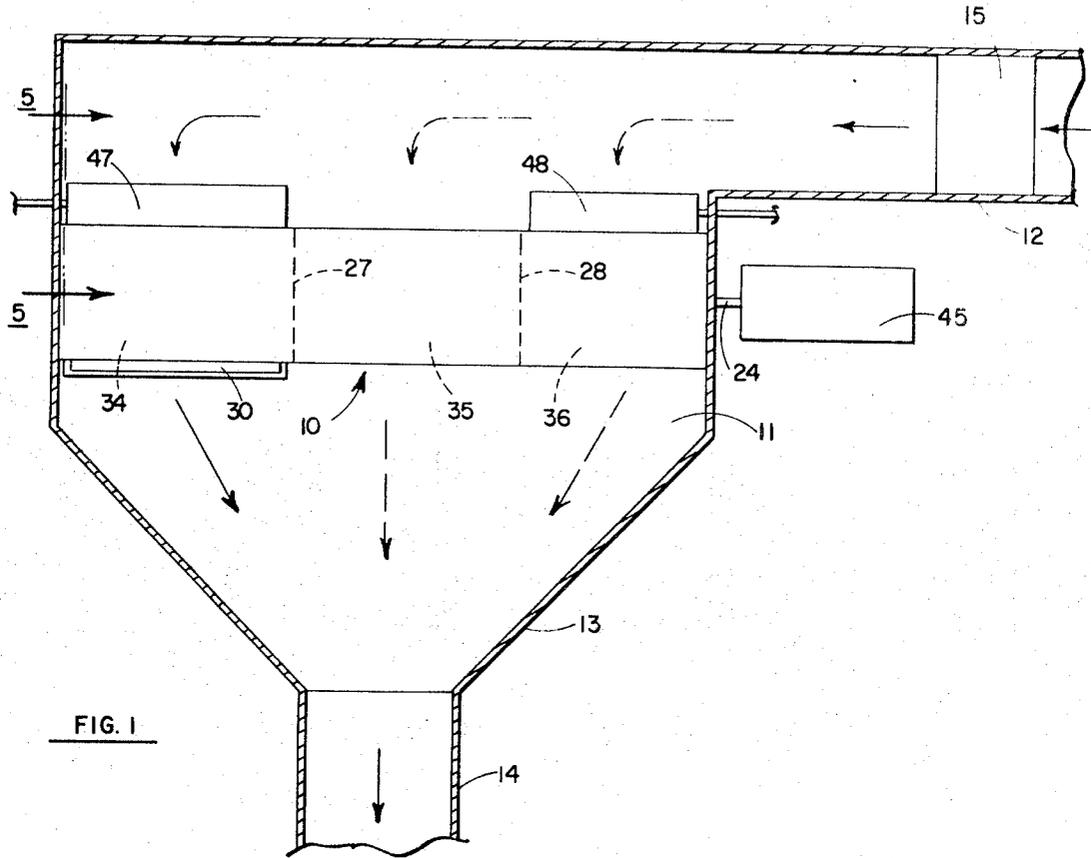


FIG. 1

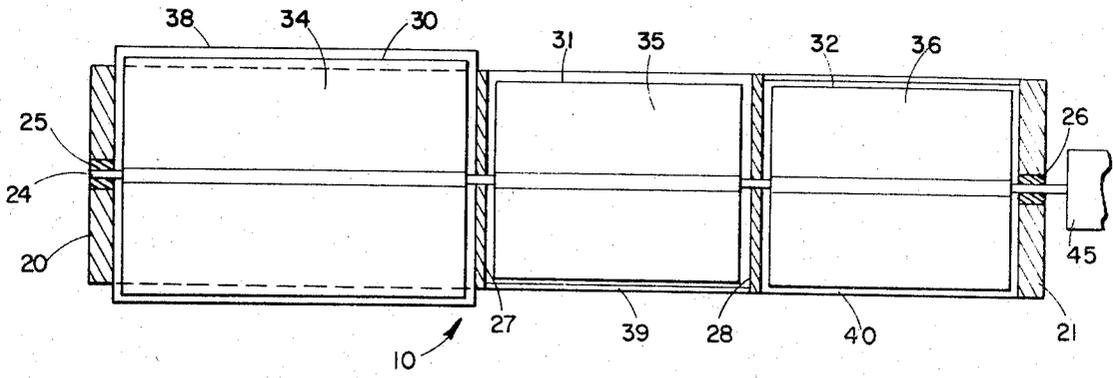
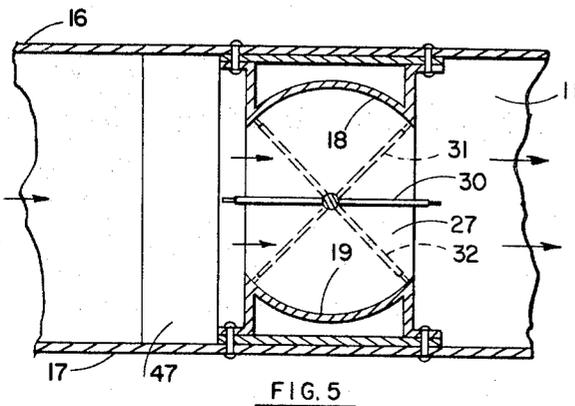
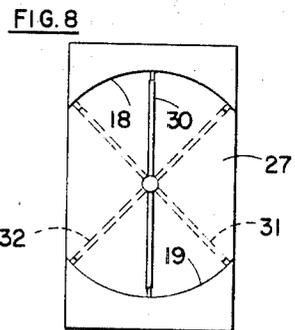
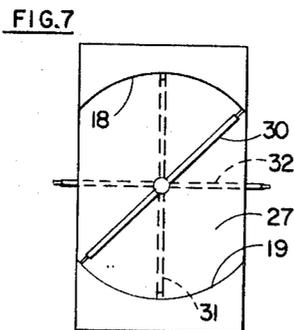
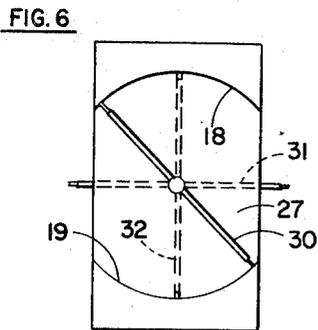
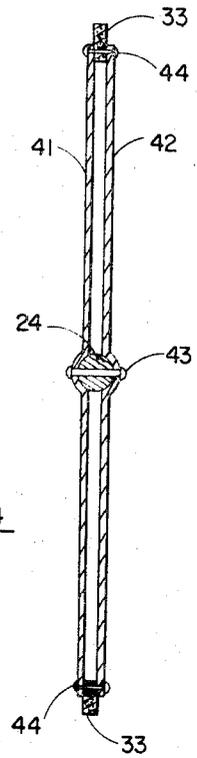
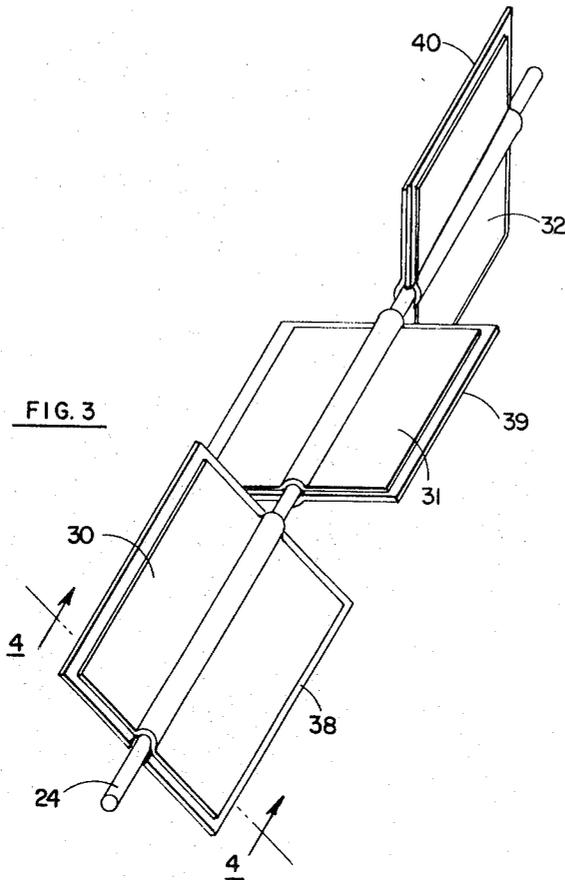


FIG. 2

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AIR CONTROL DEVICE

BACKGROUND OF THE INVENTION

1. The Field of the Invention

This invention relates to a damper for an air-conditioning system.

2. The Prior Art

Normally, in air-conditioning systems, dampers are used for regulating the flow of air. These dampers generally are pivotal members, hinged to some support to rotate before an opening as a door. In this manner, the flow of air through the heat exchangers of the air-conditioning system is controlled so that hot and cold air may be obtained when required. Linkages may be employed in effecting simultaneous rotation of different damper vanes. However, these mechanisms normally are complex and subject to malfunction, so that there is no assurance of synchronization of the movements of the vanes. Consequently, needed results are not always obtained, as hot and cold air may be caused to flow at inappropriate times or mixed together undesirably. These hinged vanes also do not provide a positive shutoff, so that leakage has occurred even when the vanes are in their seated positions. Therefore, precise control of temperatures has been made more difficult to obtain, and the efficiencies of the air-conditioning systems have been adversely affected.

SUMMARY OF THE INVENTION

The present invention provides an improved damper assembly overcoming the difficulties encountered with prior designs. It includes a pair of opposed walls which are defined by coaxial cylindrical segments. In addition, there are transverse walls extending between the opposed walls, typically providing three passageways therethrough. A shaft coaxial with the opposed walls extends through the unit and carries a rectangular vane in each of the passageways. When a vane is horizontally positioned in the passageway, full flow is permitted. However, the vane may be rotated by the shaft to position its edges adjacent the opposed walls, which then shuts off the passageway. The vanes are angularly displaced relative to each other so that they may be individually placed in the full open position. When a vane is so positioned, the other two vanes extend to the opposed walls and block the flow through their passages. Rotation of the shaft, therefore, effects the opening and closing of the three passages, with a complete and positive shutoff being provided when the vanes are appropriately positioned. Heat exchangers are positioned at the entrances to two of the passages for providing heating and cooling of the air. Therefore, when air flows through one of the passages, heat is transferred to it and its temperature is increased, while, when air flows through another of the passages, it loses heat and becomes refrigerated. The third passage provides for the circulation of air that is neither heater nor cooled.

BRIEF DESCRIPTION OF THE DRAWING:

FIG. 1 is a top plan view, partially in section, illustrating an air-conditioning system embodying the present invention;

FIG. 2 is a longitudinal sectional view of the damper unit as viewed from above;

FIG. 3 is a perspective view of the vane assembly removed from the other components of the damper unit;

FIG. 4 is an enlarged fragmentary sectional view of one of the vanes, taken along line 4—4 of FIG. 3;

FIG. 5 is a transverse sectional view taken along line 5—5 of FIG. 1, illustrating the vane assembly in one relative rotational position in which one passage through the damper assembly is open, while the other passages are closed;

FIGS. 6 and 7 are views similar to FIG. 5, showing the vane assembly in other rotational positions for opening the other two passages; and

FIG. 8 is a view similar to FIGS. 5, 6 and 7, showing the vane assembly positioned so as to close all passages through the damper unit.

DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in FIG. 1 of the drawing, the damper unit 10 of this invention is positioned in a chamber 11 provided in the air flow passage of an air-conditioning system. In the example illustrated, there is an inlet duct 12 leading to the chamber 11 which, through a convergent portion 13, connects to a discharge duct 14. A blower 15 is appropriately positioned in the duct 12 to pump the air from the inlet 12 to the outlet 14. The inlet 12 may include outside air, return air or a combination of the two, depending upon the system with which the air-conditioning unit is associated. The discharge duct 14 leads to the rooms which are to be heated and cooled by the circulation of the air.

The damper unit 10 fits between the top and bottom walls 16 and 17 of the chamber 11. It is provided with arcuate top and bottom walls 18 and 19 that extend longitudinally of the unit 10 between end walls 20 and 21 (see FIGS. 2 and 5). The top and bottom walls 18 and 19 are defined by cylindrical segments having a common axis at the longitudinal center of the unit 10. Each of the walls 18 and 19 describes an arc of 90° or slightly more.

Extending the length of the unit 10 along its axis is a shaft 24 mounted in bearings 25 and 26 in the end walls 20 and 21. The shaft 24 also passes through spaced transverse walls 27 and 28 which extend between the top and bottom walls 18 and 19. The shaft 24 carries three flat, rectangular vanes or blades 30, 31 and 32. These are angularly displaced relative to each other, as illustrated in FIG. 3. In this illustration, the blade 31 is rotationally displaced in the counterclockwise direction 45° from the adjacent blade 30. The next vane 32, which is at the end of the shaft 24 opposite from the vane 30, is rotationally displaced 45° in the clockwise direction from vane 30. This means that the vanes 31 and 32 are 90° from each other.

The vanes 30, 31 and 32 fit in separate sections in the damper unit 10, as defined by the end walls 20 and 21 and the transverse walls 27 and 28. This locates the vane 30 between the walls 20 and 27 in a passageway 34 through the damper unit 10. The vane 31 is positioned in a passageway 35 between the walls 27 and 28, and the third vane 32 is in a passageway 36 between the walls 28 and 21.

The vanes are designed to seal against the top and bottom walls 18 and 19 as well as the transverse walls adjacent to them. For this reason, they are provided with strips of felt of other suitable material 38, 39 and 40 that extend around the edges of the vanes 30, 31 and 32, respectively. The vanes are constructed in a similar manner, with the arrangement for the vane 30 being shown in FIG. 4. This vane is made up of flat, opposed, parallel, sheet metal pieces 41 and 42, which have arcuate central portions that fit around the shaft 24. Suitable means, such as bolts 43, attach the sheet metal pieces 41 and 42 to the shaft 24 so that they rotate with the shaft. The felt strip 38 is received between the outer edges of the sheets 41 and 42, being secured by fasteners 44 or other appropriate means. As a result of this construction, the felt strip 38 projects outwardly beyond the edges of the metal sheets 41 and 42, engaging the top and bottom walls 18 and 19, when the vane 30 is appropriately positioned rotationally, as well as the transverse walls 20 and 27. This provides a seal with respect to those walls.

Similarly, the felt strip 39 of the vane 31 seals against the transverse walls 27 and 28 and also may seal at the top and bottom walls 18 and 19. The felt strip 40 of the vane 32 engages the transverse wall 28 and the end wall 21, while the longitudinal portions of the strip 40 may seal against the walls 18 and 19.

As a result of this construction, the vane assembly can be positioned to selectively and individually close off the passageways through the damper unit 10. This is accomplished through rotation of the shaft 24 by means of a control motor 45 positioned outside the chamber 11. When the shaft 24 is rotated by the motor 45 so as to position the vane 30 in a horizontal attitude, the passageway 34 between the walls 20 and 27 is unobstructed. In this position, as seen in FIG. 5, the

parallel longitudinal edges of the vane 30 are spaced a maximum distance from the top and bottom walls 18 and 19 of the damper unit 10. Simultaneously, however, the vanes 31 and 32 extend between the walls 18 and 19 so as to close off the other passages through the damper unit. While the vane 30 is horizontal, both the vanes 31 and 32 are at an angle of 45° relative to the horizontal, so that their felt sealing strips engage the side edges of the top and bottom walls 18 and 19 which closes off the passageways 35 and 36 through the damper unit 10. Therefore, in the position of FIG. 5, air may flow from the inlet 12 through the passageway 34 at the vane 30, but is prevented from flowing through the passageways 35 and 36.

Rotation of the shaft 24 through an arc of 45° clockwise from the position of FIG. 5 to that of FIG. 6 opens the passageway 35, while closing the passageway 34. The passageway 36 at the vane 32 remains in the closed position. As can be seen from FIG. 6, the vane 31 then is positioned in a horizontal attitude, so that its longitudinal edges are intermediate the top and bottom walls 18 and 19 and the vane 31 does not obstruct the flow of air through the passageway 35. However, the vane 30, by the rotation, has been brought to a position where it extends outwardly at an angle of 45° relative to the horizontal, so that its felt strip 38 seals against the walls 18 and 19. The vane 32 has been moved from an angle of 45° to the horizontal to a vertical position, so that it remains sealed against the walls 18 and 19.

Rotation in the other direction through an arc of 45° from the position of FIG. 5 opens the passageway 36 at the vane 32. As can be seen in FIG. 7, the shaft 24 has been rotated in the clockwise direction from the position of FIG. 5, so that the vane 32 is horizontal and no longer blocks the passageway 36. The vane 31, being vertical, seals against the top and bottom walls 18 and 19. Similarly, the vane 30, which is at a 45° angle, seals against the edges of the walls 18 and 19, blocking the passageway 34.

A fourth position is shown in FIG. 8, in which the vanes 30, 31 and 32 all engage the top and bottom walls 18 and 19, so that all three passageways 34, 35 and 36 are closed. Normally, this position will not be used in the operation of the air-conditioning system. By positioning the shaft so as to cause the vanes to assume positions intermediate those shown in FIGS. 5, 6 and 7, it is possible to provide for flow through more than one passage at the same time.

To complete the system for obtaining desired temperatures in the discharge duct 14, a cold deck 47 and a hot deck 48 are positioned in front of the entrances to the passageways 34 and 36, respectively. These units are arranged so that all the air entering the passageway 34 flows through the cold deck 47, and all the air for the passageway 36 passes through the hot deck 48. Therefore, when air is allowed to flow through the passageway 34, it becomes refrigerated. The hot deck 48 adds heat to the air passing through it, so that the temperature of the air through the passageway 36 will be increased. No heat exchanger is provided at the central passageway 35, allowing air to enter the discharge duct 14 without having been either heated or cooled.

In a typical air-conditioning system, the cold and hot decks 47 and 48 will be in operation continually, but they will affect the temperature of the air only when the damper vanes are positioned for permitting air to flow through their adjacent passageways. Thus, when cooler air is needed, the control motor 45 positions the vane 30 in the horizontal position shown in FIG. 5, so that air then can flow through the cold deck 47, the passageway 34 and into the discharge duct 14. With the other vanes closing the passageways 35 and 36, only refrigerated air will be transmitted through the unit, so that a rapid cooling effect will be obtained. Similarly, when the vane assembly is positioned as shown in FIG. 7, with the vane 32 in

the horizontal position, the passageway 36 is open and the passageways 34 and 35 are closed. Therefore, only heated air will be obtained at the outlet duct 14. Of course, in the position of FIG. 6, where the passageways 34 and 36 are closed, the air will flow through neither the hot deck nor the cold deck and will be unaffected in temperature.

The result is a very simple damper arrangement which allows precise control of the discharge air to obtain exactly the heating or cooling effects that are required. Through the rotation of a single shaft, positive changes of air flow through the damper unit are obtained, permitting sensitive and exact temperature control.

Air-conditioning control can be obtained by a damper unit having only two passageways which may provide, for example, heating or cooling for all the air being circulated. Greater efficiency and better results, however, are obtained when the damper unit includes the three paths for the flow of air as in the example illustrated.

I claim:

1. A damper assembly comprising a duality of opposed spaced walls, said walls being defined by coaxial cylindrical segments, transverse walls extending between said opposed walls to define a plurality of passageways between said opposed walls, each of said vanes being dimensioned to fit diametrically between said opposed walls and having outer edges in juxtaposition with said opposed walls when said vane is so fitted between said opposed walls, and means for rotating said vanes about an axis, said axis of rotation being coincident with the axis of said opposed walls, said vanes being angularly displaced from each other so that when said outer edges of one of said vanes are in juxtaposition with said opposed walls said outer edges of a second of said vanes are remote from said opposed walls, each of said vanes when so fitted diametrically between said opposed walls substantially precluding flow of fluid through the passageway in which it is located at all rotational positions of said vane in which said outer edges thereof are in juxtaposition with said opposed walls,
2. A device as recited in claim 1 including in addition whereby said one vane obstructs the flow of fluid through the passageway in which it is located while said second vane allows the flow of fluid through the passageway in which it is located.
3. A device as recited in claim 1 in which said vanes are of substantially flat rectangular configuration.
4. A device as recited in claim 1 including in addition sealing means on said outer edges of said vanes, said sealing means being engageable with said opposed walls when said outer edges are in juxtaposition with said opposed walls.
5. A device as recited in claim 1 including in addition sealing means on said outer edges of said vanes for engaging said opposed walls when said outer edges are so in juxtaposition with said opposed walls, said vanes having additional opposite edges adjacent said transverse walls, and including further sealing means on said additional opposite edges engaging said transverse walls for effecting a seal therewith.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,635,245 Dated Jan. 18, 1972

Inventor(s) John L. Canfield

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, between lines 25 and 26, insert ---a vane in each of said passageways; line 31, "axis" (second occurrence) should read ---axes---; lines 44 through 48 should read:

--- whereby said one vane obstructs the flow of fluid through the passageway in which it is located while said second vane allows the flow of fluid through the passageway in which it is located.

2. A device as recited in claim 1 including in addition---

Signed and sealed this 26th day of September 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents