United States Patent [19]

Hagar

[11] 3,847,373

[45] Nov. 12, 1974

[54] LOUVER VALVE

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[73] Assignee: **Mosser Industries, Incorporated**, Allentown, Pa.

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[52] **U.S. Cl.** **251/298**, 251/213

[51] **Int. Cl.** **F16k 31/52**

[58] **Field of Search** 251/298, 299, 300, 301, 251/302, 303, 304, 228, 229, 230, 213; 137/601, 527

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Assistant Examiner—Ira S. Lazarus

[57] **ABSTRACT**

A louver valve comprising a casing, a seat within the casing, a drive shaft in the casing, a driven shaft in the casing on the opposite side of the seat from the drive shaft, a louver for opening and closing the valve cooperatively with said seat, said drive shaft being connected to the louver, and said driven shaft being connected to the louver so that rotation of the drive shaft in one direction causes rotation of the driven shaft in an opposite direction, thereby positioning the louver between the valve open and valve closed positions.

11 Claims, 7 Drawing Figures

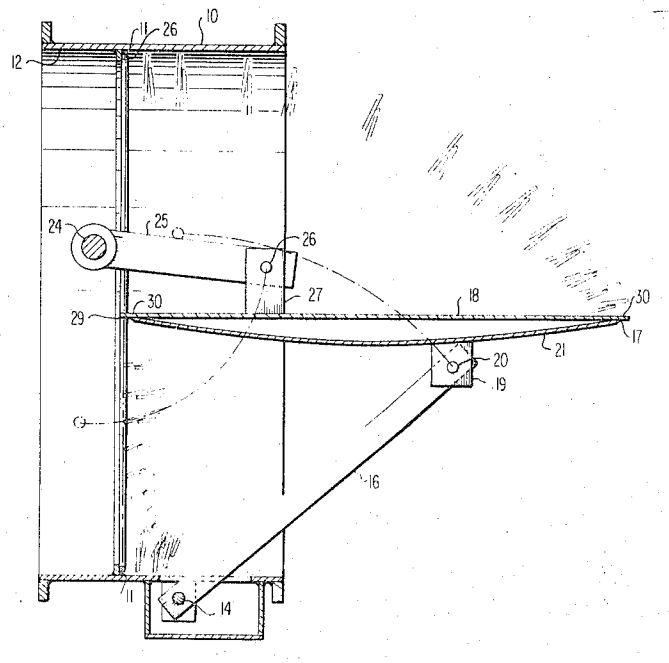


FIG. 1

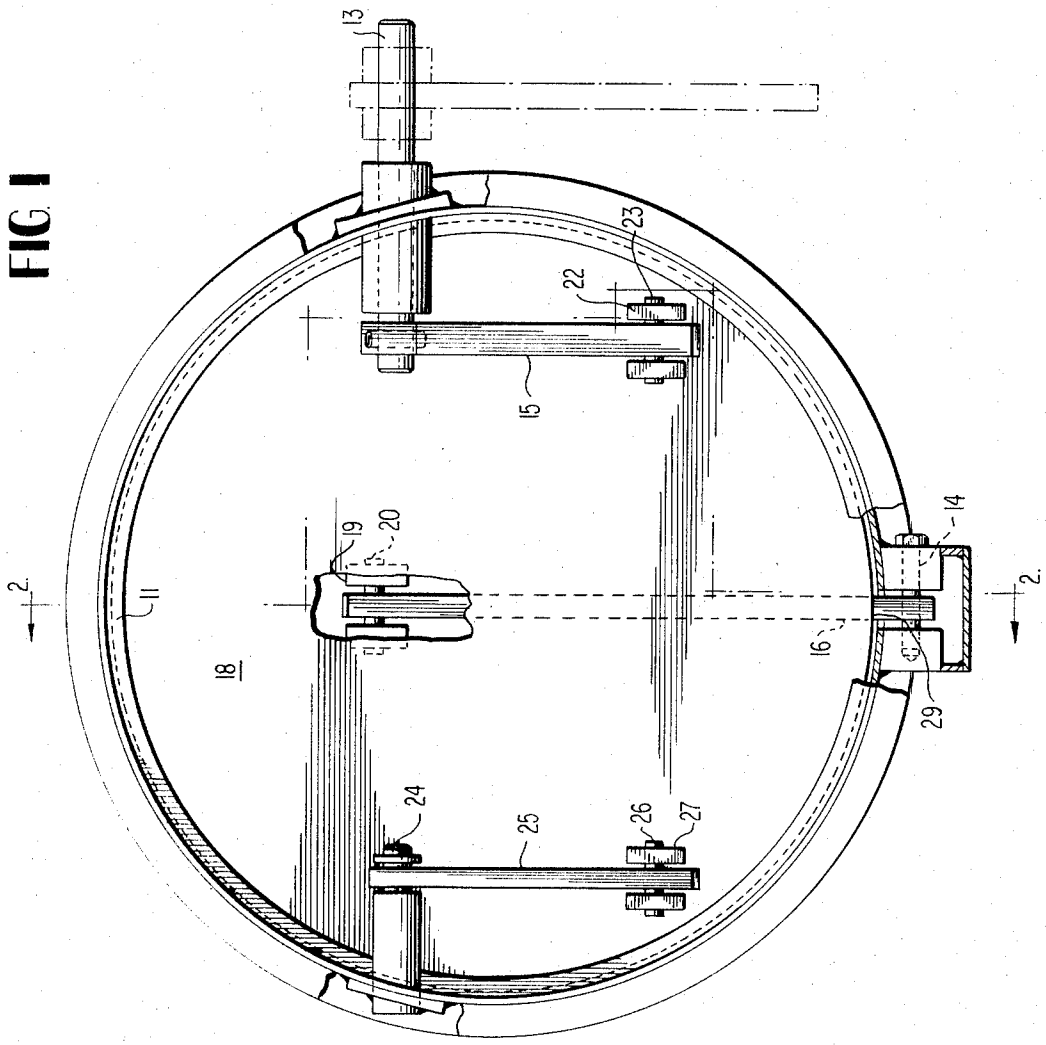

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FIG. 2

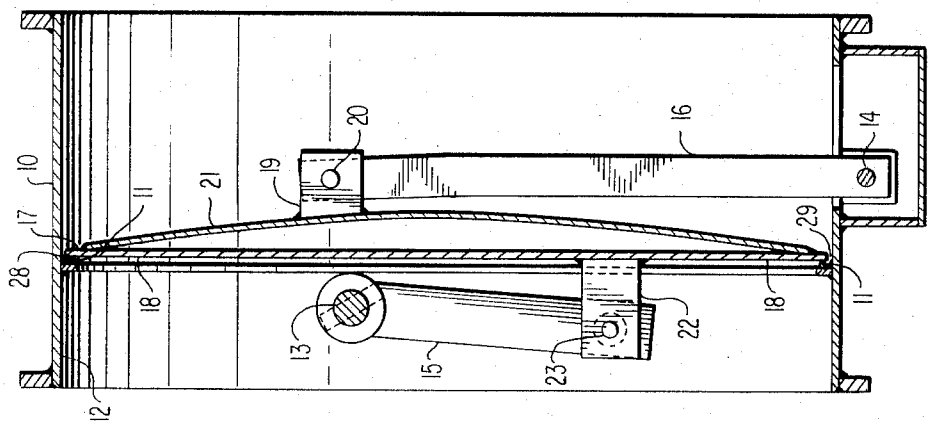

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FIG 4

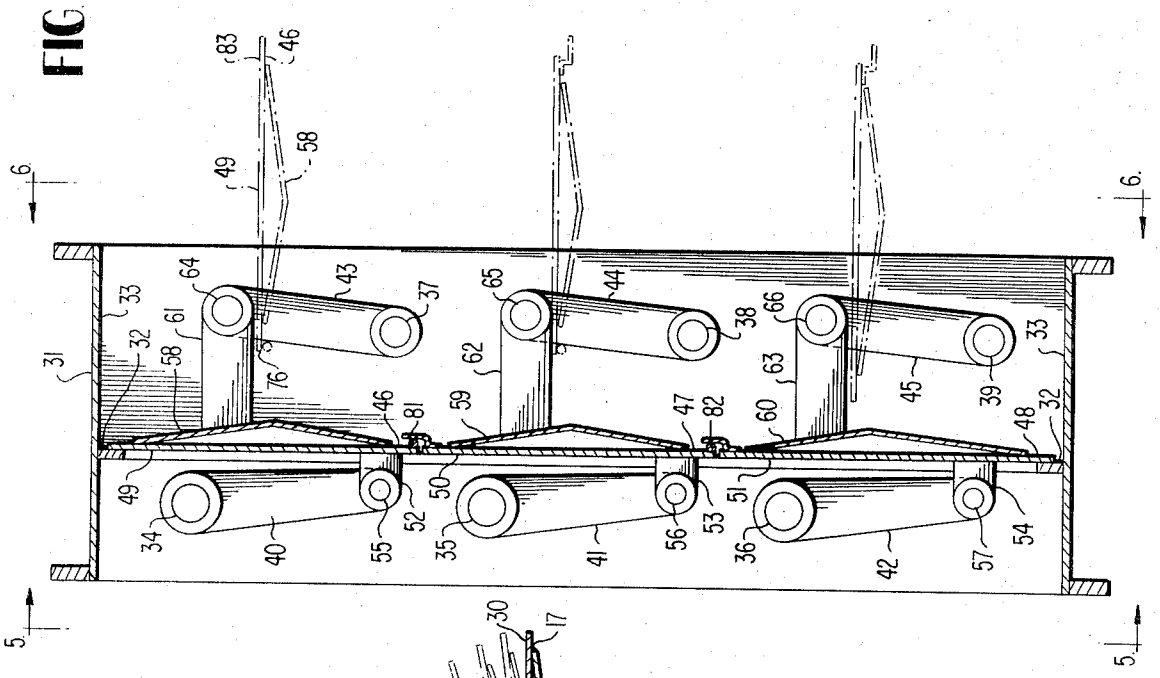


FIG 3

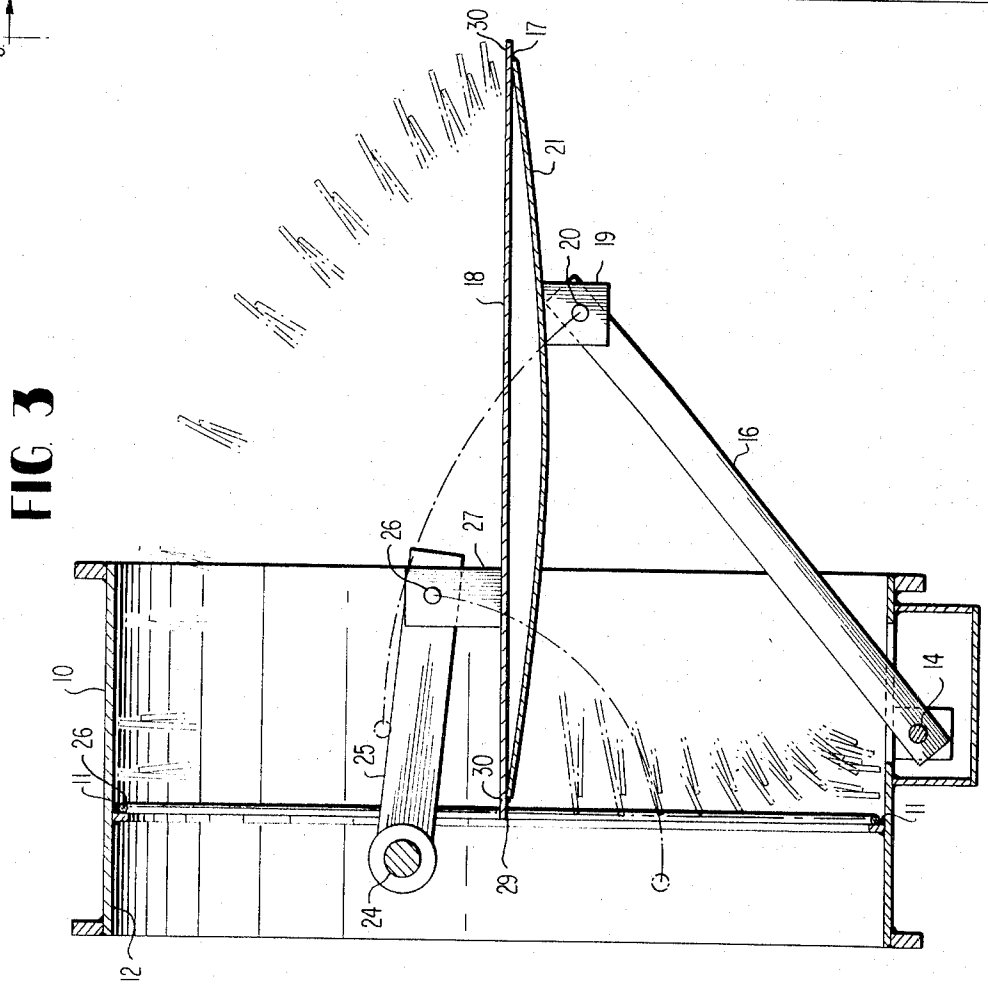


FIG 6

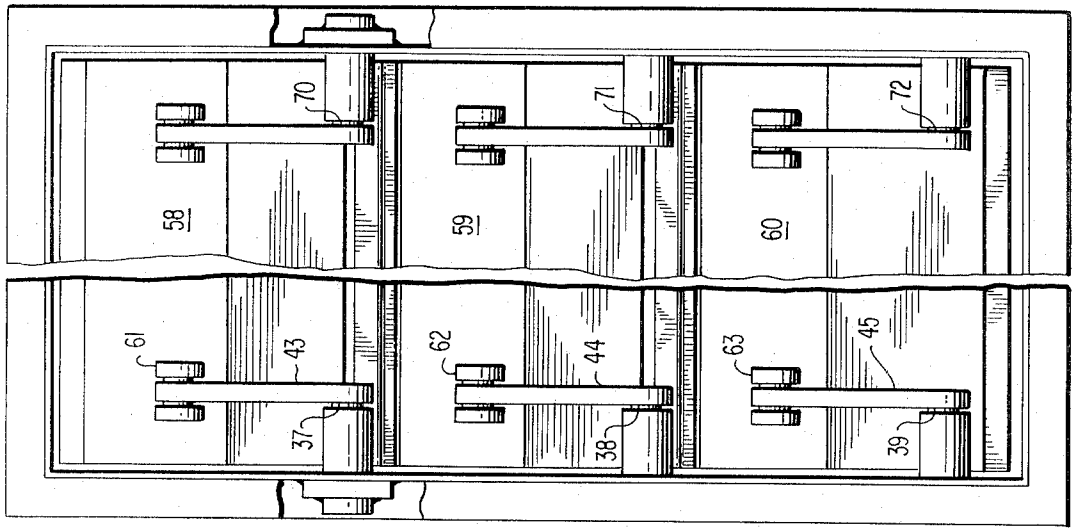


FIG 7

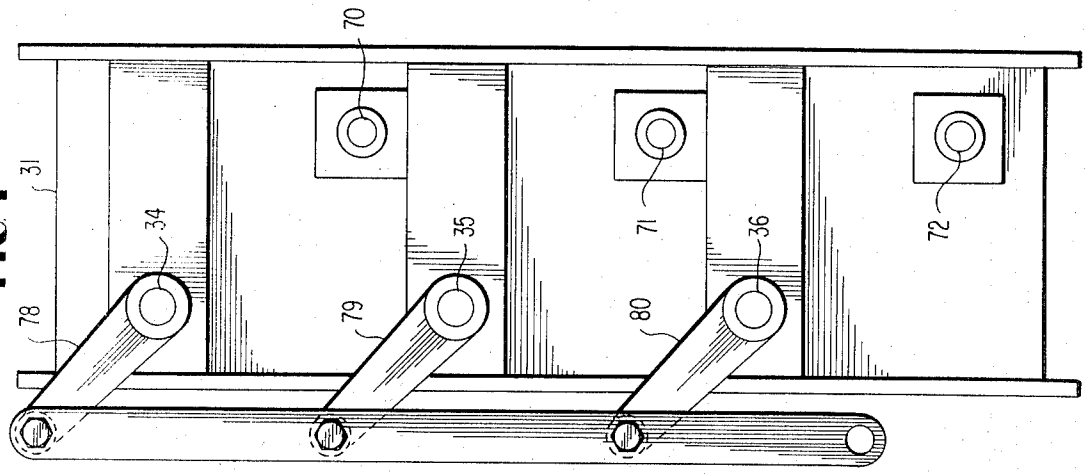
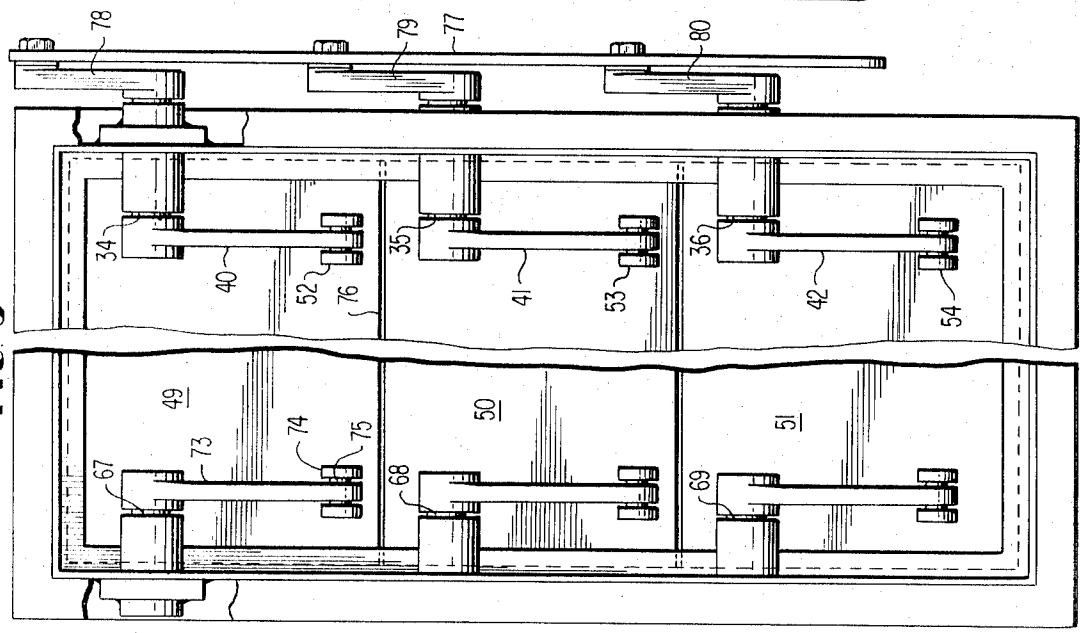


FIG 5



LOUVER VALVE

This invention relates to an improved louver valve.

Louver valves are commonly utilized to control the flow of low velocity fluids in situations which do not require an exceptionally tight seal. For example, they may be used in suspended hot gas ducts from furnace plenums.

By the present invention is provided a type of louver valve that can effect a relatively tight seal when in its closed position and a relatively low pressure drop when in its fully open position.

The louver valve of the present invention comprises a casing, a seat within the casing, a drive shaft in the casing, a driven shaft in the casing on the opposite side of the valve seat from the drive shaft, and a louver for opening and closing the valve cooperatively with the seat. The drive shaft and driven shaft are connected to the louver in such a manner that rotation of the drive shaft in one direction causes rotation of the driven shaft in the opposite direction, thereby positioning the louver between the valve open and valve closed positions.

The invention will be better understood by considering the accompanying drawings, which are presented for the purpose of illustrating two ways of practicing the present invention.

Referring now to the drawings,

FIG. 1 is a front view, with portions cut away, of a round, single louver valve of the present invention in closed position;

FIG. 2 is a sectional view along the line 2—2 of FIG. 1;

FIG. 3 is the same section as FIG. 2, but showing the valve in fully open position, with intermediate positions between closed and fully open being indicated also;

FIG. 4 is a top sectional view of a rectangular, three louver valve of the present invention in closed position, with the fully open positions of the louvers being indicated with broken lines;

FIG. 5 is the view along line 5—5 of FIG. 4, with portions cut away;

FIG. 6 is the view along line 6—6 of FIG. 4, with portions cut away; and

FIG. 7 is the top view of the valve of FIG. 4.

The round, single louver valve of FIGS. 1–3 comprises a valve casing 10 having an axis in the direction of the flow of fluid through the valve, and a circuitous valve seat 11 protruding from the inner wall 12 of casing 10. The plane of seat 11 is substantially perpendicular to the axis of casing 10.

A drive shaft 13 is journaled in the interior of casing 10 to one side of the plane of seat 11. A driven shaft 14 is journaled in the interior of casing 10 on the opposite side of the plane of seat 11 from drive shaft 13. The line of centers between the axis of drive shaft 13 and the axis of driven shaft 14 is diagonal to the axis of casing 10. A drive arm 15 extends radially from drive shaft 13. A slave arm 16 extends radially from driven shaft 14. Driven shaft 14 is illustrated as a stationary stud around which slave arm 16 pivots. Obviously, it could as well be a rotatable pin with slave arm 16 rigidly attached to it. Louver 17 is positioned within casing 10 to one side of the plane of seat 11; in the drawings louver 17 is positioned on the same side of seat 11 as driven shaft 14. The front surface 18 of louver 17 faces seat 11 when the valve is in its closed position. A gasket

28 may be used, if desired, to provide a better seal between seat 11 and front surface 18 of the louver when the valve is closed.

Front surface 18 of the louver is pivotally connected by clevis 22 and pivot pin 23 to drive arm 15, while the rear surface 21 of louver 17 is connected by clevis 19 and pivot pin 20 to slave arm 16. To lend more stability to the apparatus a second slave shaft 24 is journaled in casing 10 coaxially with drive shaft 13. (Alternatively, if desired, drive shaft 13 could extend clear across casing 10, in which case it would be unified with slave shaft 24.) Extending radially from slave shaft 24 is slave drive lever 25, which is pivotally connected to front surface 18 of louver 17 by clevis 27 and pivot pin 16, the latter being coaxial with pivot pin 23.

The axes of drive shaft 13, driven shaft 14, front surface pivot pin 23, and rear surface pivot pin 20 are all substantially parallel to one another and to the plane of the valve seat 11, and the interconnection of drive shaft 13, driven shaft 14, drive arm 15, driven arm 16, and louver 17 constitutes a four bar linkage that is so arranged that when the drive shaft 13 is rotated in one direction, the driven shaft 14 rotates in the opposite direction.

Each of the axes of drive shaft 13, driven shaft 14, front surface pivot pin 23, and rear surface pivot pin 20 lies, quite obviously, in an infinite number of different planes. Only one of those planes is longitudinal, however, by which is meant parallel to the axis of casing 10. The relative positions of these shafts and pivots may in part be described, then, by reference to the relative locations of the longitudinal planes of the axes of those parts when the valve is in the closed position (see FIG. 2). In that regard, then, when the valve is in the closed position (a) the longitudinal plane of the axis of the front surface pivot pin 23 lies in the space between (b) the longitudinal plane of the axis of the rear surface pivot pin 20 and (c) the longitudinal plane of the axis of driven shaft 14. The significant point of this arrangement of shafts and pivot pins is that (a) lies in the space between (b) and the longitudinal plane of the axis of whichever shaft it is (drive or driven) that is positioned on the same side of seat 11 as is louver 17. The last-mentioned shaft can conveniently be referred to as the "louver side shaft." As illustrated in FIGS. 1–3, then, the driven shaft 14 happens to be the louver side shaft.

The above-mentioned (a), the longitudinal plane of the axis of front surface pivot pin 23, also lies in the space between (c), the above-mentioned longitudinal plane of the axis of the louver side shaft 14, and (d) the longitudinal plane of the axis of the non-louver side shaft 20, when the valve is closed. By "non-louver side shaft" is meant whichever shaft (drive or driven) that is positioned on the opposite side of seat 11 from the louver 17. In FIGS. 1–3, then, the non-louver side shaft happens to be drive shaft 13.

The distance between the axis of the non-louver side shaft (drive shaft 13) and the axis of the front surface pivot pin 23 is equal to or greater than the sum of (e) the distance between the axis of the non-louver side shaft (drive shaft 13) and the plane of the valve seat 11 and (f) the distance between the axis on the front surface pivot pin 23 and that edge 29 of louver 17 which is closest to the plane of seat 11 when louver 17 is in the open position. The length of the arm of the non-louver side shaft (as illustrated in FIGS. 1–3 the arm re-

ferred to is drive arm 15) is sufficiently shorter than the distance between the axes of drive shaft 13 and driven shaft 14 so that by rotating drive shaft 13 the louver 17 can be moved from its closed position (see FIG. 2) to an open position (see FIG. 3) where louver 17 is substantially parallel to the axis of casing 10.

In a preferred embodiment of the present invention, as illustrated in FIGS. 1 and 2, the axis of the louver side shaft (driven shaft 14) is spaced farther away from the plane of valve seat 11 than the distance between the axis of the non-louver side shaft (drive shaft 13) and the plane of valve seat 11.

Another preferred feature, also illustrated in FIGS. 1 and 2, is the axis of the non-louver side shaft (drive shaft 13) being spaced closer to the plane of valve seat 11 than the distance between the axis of the front surface pivot pin 23 and the plane of the seating surface 30 of louver 17.

Also embodied in the valve that is illustrated in FIGS. 1 and 2 is an advantageous arrangement of elements whereby the sum of (g) the distance between (i) the axis of the non-louver side shaft (drive shaft 13) and (ii) the axis of the front surface pivot pin 23 plus (h) the distance between said (ii) and (iii) the plane of the seating surface 30 of louver 17, is less than the sum of (j) the distance between (iv) the axis of the louver side shaft (driven shaft 14) and (v) the axis of the rear surface pivot pin 20 plus (k) the distance between said (v) and said (iii).

Also preferred, and illustrated in FIGS. 1 and 2, is the arrangement of the four bar linkage so that (1) the line of centers between the front surface pivot pin 23 and the rear surface pivot pin 20 is diagonal to the plane of the seating surface 30 of louver 17, and (2) the seating surface 30 of louver 17 remains entirely to one side of the plane of valve seat 11 during opening and closing of the valve.

The rectangular, three louver valve of FIGS. 4–7 likewise comprises a valve casing 31 having an axis in the direction of the flow of fluid through the valve, and a circuitous valve seat 32 protruding from the inner wall 33 of casing 31. The plane of seat 32 is substantially perpendicular to the axis of casing 31.

Drive shafts 34, 35 and 36 are journaled in the interior of casing 31 to one side of the plane of seat 32. Driven shafts 37, 38 and 39 are journaled in the interior of casing 31 on the opposite side of the plane is seat 32 from drive shafts 34, 35 and 36. The line of centers between the axis of drive shaft 34 and the axis of driven shaft 37 is diagonal to the axis of casing 31. The same is true, of course, with respect to the shafts which operate the other two louvers. Drive arms 40, 41 and 42 extend radially from drive shafts 34, 35, and 36, respectively. Slave arms 43, 44, and 45 extend radially from driven shafts 37, 38, and 39. Louvers 46, 47, and 48 are positioned within casing 31 to one side of the plane of seat 32; in the drawings, louvers 46, 47, and 48 are positioned on the same side of seat 32 as driven shafts 37, 38, and 39. The front surfaces 49, 50, and 51 of louvers 46, 47, and 48, respectively, face seat 32 when the valve is in its closed position.

Front surfaces 49, 50, and 51 of louvers 46, 47, and 48 are pivotally connected by clevises 52, 53, and 54 and pivot pins 55, 56, and 57 to drive arms 40, 41, and 42, respectively, while the rear surfaces 58, 59, and 60 of louvers 46, 47, and 48 are connected by clevises 61, 62, and 63 and pivot pins 64, 65, and 66 to slave arms 43, 44, and 45, respectively. To lend more stability to the apparatus each drive shaft and driven shaft has a coaxial slave shaft (i.e., slave shafts 67, 68, 69, 70, 71, and 72) which is also pivotally connected, via a slave lever, to the louver. Thus, for example, drive shaft 34 is journaled in casing 31 in a coaxial relationship with slave shaft 67, and slave drive lever 73 extends radially from slave shaft 67 and is pivotally connected to the front surface 49 of louver 46 via clevis 74 and pivot pin 75.

The axes of drive shaft 34, driven shaft 37, front surface pivot pin 55, and rear surface pivot pin 64 are all substantially parallel to one another and to the plane of the valve seat 32. The interconnection of drive shaft 34, driven shaft 37, drive arm 40, driven arm 43, and louver 46 constitutes a four bar linkage that is so arranged that when the drive shaft 34 is rotated in one direction, the driven shaft 37 rotates in the opposite direction. When the valve is in the closed position (see FIG. 4), the longitudinal plane (a) of the axis of the front surface pivot pin 55 lies in the space between (b) the longitudinal plane of the axis of the rear surface pivot pin 64 and (c) the longitudinal plane of the axis of the louver side shaft (driven shaft 37).

The longitudinal plane (a) of the axis of front surface pivot pin 55 also lies in the space between (c) the above-mentioned longitudinal plane of the axis of the louver side shaft 37 and (d) the longitudinal plane of the axis of the non-louver side shaft (drive shaft 34), when the valve is closed.

The distance between the axis of the non-louver side shaft (drive shaft 34) and the axis of the front surface pivot pin 55 is equal to or greater than the sum of (e) the distance between the axis of the non-louver side shaft (drive shaft 34) and the plane of the valve seat 32 and (f) the distance between the axis of the front surface pivot pin 55 and that edge 76 of louver 46 which is closest to the plane of seat 32 when louver 46 is in the open position. The length of the arm of the non-louver side shaft (as illustrated in FIGS. 4 and 5 the arm referred to is drive arm 40) is sufficiently shorter than the distance between the axes of drive shaft 34 and driven shaft 37 so that by rotating drive shaft 34 the louver 46 can be moved from its closed position to an open position (see FIG. 4) where louver 46 is substantially parallel to the axis of casing 31.

The above-described arrangement and relative positions of the elements that enable movement of louver 46 are repeated with respect to the other two louvers, 47 and 48. Movement of all three louvers in unison is provided by moving common operating rod 71, shown in FIGS. 5 and 7. Operating rod 77 is linked to crank arms 78, 79, and 80, which are operatively connected to drive shafts 34, 35, and 36, respectively.

Adjacent edges of louvers 46, 47, and 48 overlap one another in a sealing engagement when the valve is in its closed position. To effect a better seal in these overlapped regions, gaskets 81 and 82 are positioned there.

A preferred feature of the apparatus illustrated in FIGS. 4–6 is that the axis of the rear surface pivot pin 64 is spaced farther away from the plane of the seating surface 83 of the louver 46 than the distance between the axis of the front surface pivot pin 55 and the plane of the seating surface 83 of the louver 46.

As indicated hereinabove, the louver valve of the present invention, because of its unique design, can be

arranged so that the louver never swings through the plane of the valve seat when it is being opened or closed, thus greatly simplifying the effectuating of an unbroken seal when the valve is in its closed position. The valve can, if desired, be used as a control valve, since it is stable at intermediate positions between closed and fully open. As compared to prior art louver valves wherein the drive shaft and driven shaft are on the same side of the louver, the valve of the present invention has the advantage that it can employ relatively shorter drive arms, and therefore requires relatively less torque to operate it.

I claim:

1. A louver valve comprising a valve casing having an axis in the direction of the flow of fluid through the valve; a circuitous valve seat protruding from the inner wall of the casing, said seat lying in a plane that is substantially perpendicular to the axis of the casing; a drive shaft journaled in the interior of the casing to one side of the plane of the valve seat; a second shaft journaled in the interior of the casing on the opposite side of said plane of the valve seat from the drive shaft, the line of centers between the axis of said drive shaft and the axis of said second shaft being diagonal to the axis of the casing; a drive arm extending radially from said drive shaft; a slave arm extending radially from said second shaft; a louver positioned within the casing to one side of the plane of the valve seat for opening and closing the valve cooperatively with said seat said louver having a front surface which faces the seat when in closed position, and a rear surface which is opposite the front surface, said front surface of said louver being pivotally connected to the arm of the shaft which is on the opposite side of the plane of the valve seat from the louver, said rear surface of said louver being pivotally connected to the arm of the other shaft; the axes of said drive shaft, said second shaft, said front surface pivot, and said rear surface pivot being substantially parallel to one another and to the plane of the valve seat, said axes lying in longitudinal planes that are substantially parallel to the axis of the casing, said interconnection of said shafts, arms, and louver constituting a four bar linkage that is so arranged that when the drive shaft is rotated in one direction the slave arm rotates in the opposite direction, and that when the valve is in the closed position said longitudinal plane (a) of the axis of the front surface pivot lies in the space between (b) said longitudinal plane of the axis of the rear surface pivot and (c) said longitudinal plane of the axis of that shaft which is positioned on the same side of the valve seat as the louver (hereinafter the "louver side shaft"), said (a) also lying in the space between said (c) and (d) said longitudinal plane of the axis of the shaft that is positioned on the opposite side of the seat from the louver (hereinafter the "non-louver side shaft"), the distance between the axis of the non-louver side shaft and the axis of the front surface pivot being equal to or greater than the sum of (e) the distance between the axis of the non-louver side shaft and the plane of the valve seat and (f) the distance between the axis of the front surface pivot and that edge of the louver which is closest to the plane of the valve seat when the louver is in the open position; the length of the arm of the non-louver side shaft being sufficiently shorter than the distance between the axes of the two said shafts that the louver can be moved from its closed position to an open position where the louver is substantially parallel to the axis of the casing by rotating the drive shaft.

2. The valve of claim 1 wherein the drive shaft is the non-louver side shaft.

3. The valve of claim 1 wherein the axis of the rear surface pivot is spaced farther away from the plane of the seating surface of the louver than the distance between the axis of the front surface pivot and said plane of the seating surface of the louver.

4. The valve of claim 1 wherein a plurality of such four bar linkages are present in the casing in a side-by-side relationship so that adjacent edges of the louvers overlap one another in a sealing engagement when the valve is in its closed position.

5. The valve of claim 2 wherein the axis of the second shaft is spaced farther away from the plane of the valve seat than the distance between the axis of the drive shaft and the plane of the valve seat.

6. The valve of claim 2 wherein the axis of the drive shaft is spaced closer to the plane of the valve seat than the distance between the axis of the front surface pivot and the plane of the seating surface of the louver.

7. The valve of claim 2 wherein the sum of (g) the distance between (i) the axis of the drive shaft and (ii) the axis of the front surface pivot plus (h) the distance between said (ii) and (iii) the plane of the seating surface of the louver, is less than the sum of (j) the distance between (iv) the axis of the second shaft and (v) the axis of the reat surface pivot plus (k) the distance between said (v) and said (iii).

8. The valve of claim 1 wherein the cross-section of the casing is rectangular.

9. The valve of claim 1 wherein the perimeter of the louver is rectangular.

10. The valve of claim 1 wherein the line of centers between the front surface pivot and the rear surface pivot is diagonal to the plane of the seating surface of the louver.

11. The valve of claim 1 wherein said four bar linkage is so arranged that the seating surface of the louver remains entirely to one side of the plane of the valve seat during opening and closing of the valve.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,847,373 Dated November 12, 1974

Inventor(s) Donald K. Hagar

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

Column 2, line 14, "pivot pin 16" should read --pivot pin 26--.
Column 3, line 47, "is" should read --of--.
Column 4. line 51, "operating rod 71" should read --operating rod 77 --.
Column 5, line 29, "said seat said louver" should read --said seat, said louver--.
Column 6, line 40, "reat" should read --rear--.

Signed and sealed this 11th day of March 1975.

(SEAL)
Attest:

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Attesting Officer

C. MARSHALL DANN
Commissioner of Patents
and Trademarks