United States Patent

Neece

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[54] **LOUVER WITH A REDUCED TURNING RADIUS**

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[52] **U.S. Cl.**.....**98/110**, 49/77, 98/121 A

[51] **Int. Cl.**.....**F24f 13/00**

[58] **Field of Search**..98/40 UM, 110, 112, 114, 121; 137/601; 49/77, 78, 82, 88

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[57] **ABSTRACT**

A louver having a frame and a set of vanes mounted for pivotal movement about axes of rotation characterized by a rack and pinion operating the vanes, the rack being affixed to a plurality of co-engaging members that snap together to encompass a horizontal vane in the louver to facilitate assembly. In another aspect, the louver is characterized by the vanes having pins, or stub shafts, disposed in notches along at least one side of the frame and a snap-on strip for that side of the frame to hold the vanes in place. Moreover, the vanes overlap so that they can completely block flow of a fluid through the louver. Specific structural features such as the protrusions of the snap-on strip engaging apertures in the frame, are also disclosed.

12 Claims, 5 Drawing Figures

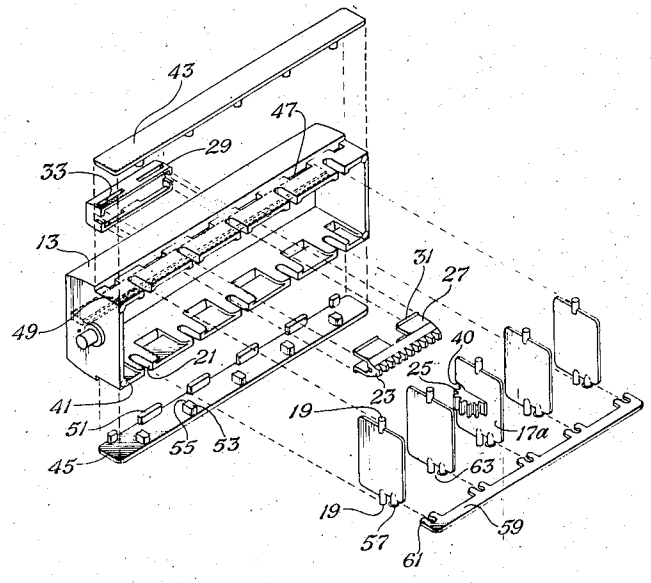


Fig. 1

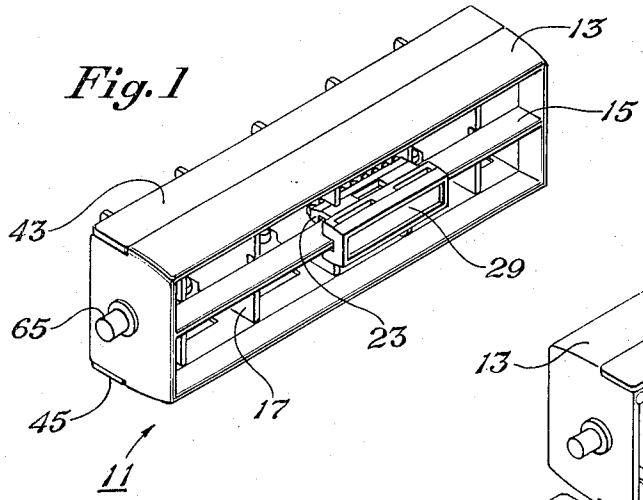
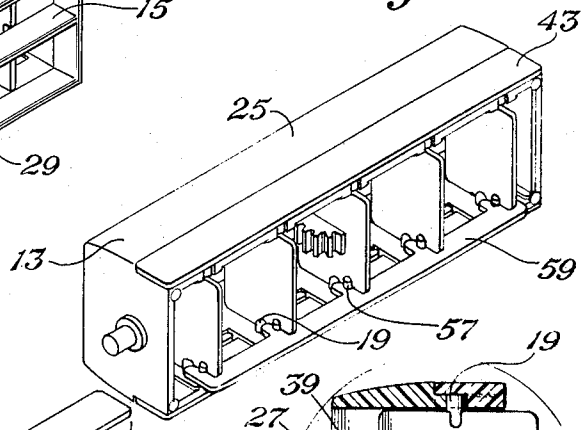


Fig. 2



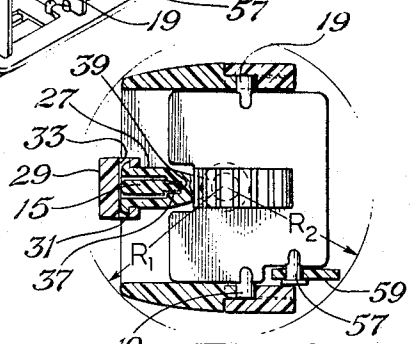


Fig. 4

Fig. 3

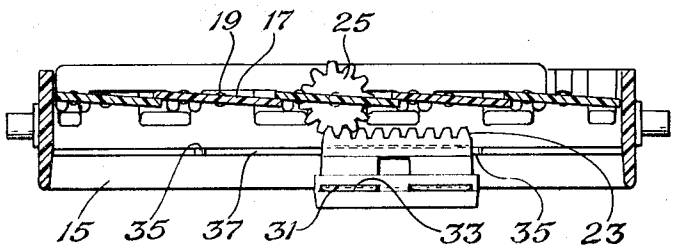


Fig. 5

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LOUVER WITH A REDUCED TURNING RADIUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to louvers such as are employed to effect a direction of flow of a fluid flowing therethrough.

2. Description of the Prior Art

It is well known in the prior art to have a set of vanes formed integrally with the frame and a set of adjustable vanes. In this way, the vanes having a fixed relationship with the frame may be tilted as the frame is pivotally moved about its mounting means to effect a directional flow of fluid at an angle with respect to one plane such as a horizontal plane. The adjustable vanes are movable to effect the flow of the fluid at an angle with respect to a transverse plane. Individually adjustable vanes have been employed. Also, adjustable vanes having a protrusion to extend through the front of a louver frame are known. It is also known to employ a connector link at the rear of adjacent vanes to translate the movement of one of the vanes to the remainder of the vanes in a given row.

In general, the louvers of the prior art employed a multiplicity of elements such as screws and the like for assembly and were expensive to assemble. In special applications such as in automotive air conditioning systems, the louvers needed, but did not have, a small radius of rotation so as to be operable in a relatively small space. Moreover, the louvers did not ordinarily have the capability of blocking the flow of fluids therethrough and separate valves had to be installed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view from the front of a louver in accordance with one embodiment of this invention.

FIG. 2 is an isometric view from the rear of the louver of FIG. 1.

FIG. 3 is an exploded isometric view of component parts of the louver of FIG. 1.

FIG. 4 is a simplified side view, partly in section, illustrating a central vane and operating mechanism and the radii of the louver of FIG. 1.

FIG. 5 is a top plan view of the vanes and operating mechanism of the louver of FIG. 1.

DESCRIPTION OF PREFERRED EMBODIMENTS

It is a primary object of this invention to provide a louver structure that alleviates the disadvantages of the prior art louvers.

The louver structure of this invention may be employed in effecting a direction of flow of any fluid. Ordinarily, it will be employed in directing the flow of a gas such as air in a conditioned air distribution system. It has particular utility in automotive air conditioning distribution systems where the space that is available for equipment is restricted. Accordingly, the following descriptive matter will be given with respect to the use of the louver in an automotive air conditioning equipment distribution system.

Referring to FIG. 1, louver **11** has a frame **13** and at least one vane **15** that is parallel with one of the major axes of the frame **13** and is connected with the frame. For example, the vane **15** may be substantially horizontal so as to effect a direction of air flow with respect to a horizontal plane as the frame **13** is tilted about its mounting means.

Louver **11** also has adjustable vanes **17** for effecting a desired flow of air with respect to another axis of the louver **11**. For example, the adjustable vanes **17** may be mounted transversely to vane **15** for pivotal movement about their respective axes of rotation to effect a desired direction of air flow with respect to a vertical plane. The adjustable vanes **17** are mounted for pivotal movement about their axes of rotation by a pair of pin means such as pins, or stub shafts, **19**, FIGS. **2** and **3**. The pins **19** are located in notches **21** disposed along at least one side; and, preferably, on two opposite sides of the frame **13**.

Control of the adjustable vanes is effected by a rack **23** and a pinion **25**. The rack **23** is attached to one of a plurality of co-engaging members **27** and **29**. The co-engaging members **27** and **29** encompass the vane **15** such that the member **29** forms a slide bar means at the front of the louver. The co-engaging members are movable reciprocally and longitudinally of vane **15**. They have mating fastening means such as respective mating protrusion means **31** and slot means **33** that may be disengageably snapped together to encompass the vane **15** and retain the rack in place. The vane **15** has limit means such as knobs **35**, FIG. **5**, for preventing movement of the rack **23** out of engagement with the pinion **25**. Specifically, the vane **15** has an inner guide rail **37** that conformingly fits within a slot **39** of the inner member **27**, FIG. **4**, to facilitate longitudinal movement of the rack along vane **15**. The inner guide rail **37** has knobs **35** located on either side of the region that will be traversed by the rack **23**, FIG. **5**. Thus, once correct correlative positioning of the rack and pinion is established, it is maintained until a new correlative position is established through disassembly and reassembly.

The pinion **25** is connected with one of the adjustable vanes **17**; for example, the center vane **17***a*; so as to have its center aligned with the axis of rotation of the center vane **17***a*. With this construction, rotation of pinion **25** effects rotation, or pivotal movement, of the central vane **17***a* about its pair of pin means **19** in the notches **21**. The pinion **25** engages the rack **23** such that the pinion **25** is rotated when the rack **23** is moved laterally. Consequently, the central vane **17***a* is moved pivotally by lateral movement of the rack **23**. In my copending application entitled LOUVER APPARATUS, Ser. No. 32,115, filed Apr. 27, 1970, I described alternative structures in which the pinion **25** and central vane **17***a* may be (1) manufactured separately and appropriately connected together, or (2) injection molded together to form an integral structure. That descriptive matter is embodied herein by reference. As noted therein, the central vane **17***a* has a cut away portion **40**. The cut away portion **40** allows the pinion **25** to have its center aligned with the axis of rotation, and engage rack **23**, yet have central vane **17***a* large enough to overlap adjacent vanes for blocking flow.

While the members **27** and **29**, rack **23**, and pinion **25** may be located at any point on the louver, it is preferable to locate them in the central portion to allow maximum flexibility in positioning the adjustable vanes **17**.

As indicated hereinbefore, the adjustable vanes each have a pair of pin means such as upper and lower pins **19**, FIG. **3**, that are emplaced in upper and lower notches **21** for pivotal movement of the vanes. The notches **21** traverse from the inner edge **41** of frame **13** toward the front of the louver. A pair of snap-on strips **43** and **45** are provided for retaining the pins **19** in the notches **21**, once emplaced therein. The frame **13** has a plurality of separate first positions of holding means; such as, aperture means **47** disposed along its inner portion **49** adjacent the inner edge **41**. The aperture means **47** will ordinarily penetrate completely through the side, since a complete aperture is readily molded; but it is only necessary that the aperture means **47** comprise an appropriate indentation for receiving a mating protrusion means on the snap-on strips for retaining the snap-on strips in place. The snap-on strips **43** and **45** have a plurality of mating separate second portions of holding means such as protrusion means **51** disposed at correlative intervals along their length. The protrusion means **51** are removably snapped into engagement with the aperture means **47** and conformingly engage the aperture means on at least two sides so as to be frictionally retained in place. The protrusion means are illustrated as having rectangular cross section. They may have any other cross section appropriate to the cross sectional shape of the aperture means **47**. Any other mating separate first and second portions of holding means may be employed, but the respective aperture means and protrusion means form a preferred embodiment, since the lateral dimensions may be kept small to prevent enlarging the radii, R_1 and R_2, FIG. **4**; and, consequently, the radius of rotation. The significance of a small radius of rotation is referred to hereinbefore and discussed in more detail hereinafter.

The snap-on strips **43** and **45** also have protruding blocking means **53** disposed along their length in the notches **21** and retaining the set of adjustable vanes **17** in place. The snap-on strips have the protruding blocking means so positioned that the blocking means bear against the respective pin means **19** with sufficient forces to retain the adjustable vanes in any set position. Specifically, the arcuate internal surface **55** of blocking means **53** bears frictionally against the respective pin means **19**, forcing it frictionally into engagement with the inner arcuate portion of notch **21** so that the respective vane means are frictionally retained in any set position.

To enable the adjustable vanes **17** to be moved in unison to a respective set position, each vane has a third pin means **57**, FIGS. **2** and **3**, eccentrically disposed with respect to its axis of rotation. The third pin means **57** of the respective vanes are interconnected with each other via a connector link **59**. The connector link **59** has a plurality of bifurcated ends **61** adapted for snapping over and for engaging the respective third pin means **57**. The bifurcated ends **61** are disposed along the connector link **59** the same distance vanes **17** are disposed apart by respective pairs of pin means **19** in notches **21**. The third pin means **57** may be located at either the top or bottom of the adjustable vanes **17** or at any intermediate position. An opening, or second aperture means, **63** of a predetermined width sufficient to allow the bifurcated end **61** of the connector link **59** to move freely therewithin is provided around each respective third pin means **57**, regardless of where it is positioned. In this way, interference between the respective adjustable vane **17** and the bifurcated end **61** is avoided, regardless of the angle at which the adjustable vane is disposed, or set.

In my copending application Ser. No. 32,115, referenced hereinbefore, there was described a plurality of types of mounting means; such as, apertures in the respective ends of frame **13** for receiving separate mounting pins, or shafts, and a mounting shaft **65** directly carried by the frame **13** at opposite ends to effect the desired pivotal mounting. That descriptive matter is incorporated herein by reference. Briefly, it described the use of a shaft of a plastic material for conformably fitting with contiguous parts such as an aperture with sufficient frictional forces to retain the louver **11** in any set position, in terms of its angle with respect to a horizontal plane. A suitable plastic material comprises nylon or other suitable plastics delineated hereinafter.

If desired, the adjustable vanes **17** may have an identical structure such as typified by the central vane **17***a*. In this way, a single mold can be employed to form the respective vanes. Preferably, however, the exact structure of the central vane and the remainder of the vanes varies to effect overlap and enable blocking the flow of fluids therepast, as illustrated in FIG. **5**. That is, the vanes **17** extend radially from their respective pin means **19** for a distance sufficient to overlap with the adjacent vane such that when moved into a closed position, they completely block the flow of fluids therepast, whereas center vane **17***a* has a cut away portion **40**, described hereinbefore.

Despite the relatively long radial distance the vanes **17** extend, it is desirable that the louver have a small radius of rotation and small radii, R_1 and R_2, referred to hereinbefore and illustrated in FIG. **4**. Accordingly, the upper and lower pin means **19** and the third pin means **57** with its attached connector link **59**, are so positioned as to form a minimal radius R_2. The illustrated louver construction enables forming a louver that can be rotated, or pivoted, within an opening having a radius less than one inch radius of rotation. Such a preferred compact structure is particularly advantageous in automotive air conditioning distribution systems.

The assembly and operation of the louver may be understood by referring to FIG. **3**. Therein, pinion **25** in emplaced on central vane **17***a* is not already integrally formed therewith. The co-engaging members **27** and **29** are emplaced about vane **15** intermediate the limit knobs **35**, and their mating fastening means **31** and **33** snapped together. The rack and pinion are then correlatively positioned in accordance with the position-of the central vane **17***a* as its pin means **19** are inserted into its respective notch **21**. For example, the central vane **17***a* may be disposed substantially perpendicular, or normal, to vane **15** when the rack **23** is disposed at about the midpoint of the vane **15**. On the other hand, the correlative positioning may be with the adjustable vanes in a closed position as illustrated in FIG. **5** and the rack positioned at its extreme position toward that end, abutting the respective knob **35** on vane **15**. The remainder of the adjustable vanes **17** are emplaced by their respective upper and lower pins **19** being inserted

into their respective notches **21**. The snap-on strips **43** and **45** are snapped into position with the respective first and second portions of holding means co-engaging. Their blocking means **53** are disposed in the respective notches **21** and engage the respective pin means **19**, as described hereinbefore. Thus, the vanes are retained in place in the frame **13**.

The respective adjustable vanes **17** are positioned at about the same angle and the bifurcated ends **61** of the connector link **59** are snapped into place about the respective third pin means **57** at the rear of the respective adjustable vanes **17**, as illustrated in FIG. **2**.

After louver **11** is assembled, it is mounted in its appropriate aperture or plenum by appropriate mounting means and suitable bezel. Suitable bezel structures facilitating assembly of the louvers are described in copending applications entitled BEZEL LOUVER SUPPORT STRUCTURE, Inventor Frank S. Dennis, Ser. No. 66,362, filed Aug. 24, 1970, and now U.S. Pat. No. 3,641,913; and BEZEL INNER GUIDE FRAME, Inventor Randall W. Johnson, Ser. No. 66,221, filed Aug. 24, 1970; both assigned to the assignee of this invention. The particular snap-on structure described therein is appropriate to the use of mounting shafts such as mounting shaft **65** illustrated herein.

Once emplaced, the desired direction of flow of conditioned air is effected by simply tilting louver **11** about its respective mounting means **65** to effect the desired angle via vane **15** and frame **31**; by moving slide bar **29** and, consequently, rack **23** to effect the desired angle of pivot of the adjustable vanes **17**; or both.

In the manufacturing of the louver or constituents thereof, any appropriate materials of construction may be employed. It is preferable, however, to employ corrosion resistant materials when certain fluids flow therepast and, by one process or another, induce corrosion between contiguous elements of the louver. For example, cold air cools the elements of the louver and causes a condensation of moisture between contiguous elements. Where these elements are constructed of metal that corrodes in such an environment, there is a reaction such as rusting that impedes free operability of the respective elements. Any corrosion resistant material may be employed depending upon the nature of the gas flowing therepast. Either a thermosetting plastic material or a thermoplastic material may be employed as long as it has a sufficiently high melting point and resists deformation such as warping. Typical of satisfactory thermosetting plastic materials are the phenol-formaldehyde copolymers and the melamine-formaldehyde copolymers. Typical of satisfactory thermoplastic materials are the acrylonitrile-butadiene-styrene copolymers, commonly referred to as ABS, and the polycarbonate plastic. Appearance and customer satisfaction is improved if the plastic elements that are exposed to view are coated with a thin coating of decorative metal such as aluminum.

The respective pin means may be formed separately and connected with the respective vanes if desired. Preferably, however, the pin means are integrally formed with the vanes as illustrated in the respective figures. A particularly preferred structure is effected when both vanes and pin means are formed of the indicated plastic as by injection molding, since in this way the proper positioning of the pins of the vanes is effected with no problems in assembly.

Thus, it can be seen that the invention provides an improved louver structure that alleviates the disadvantages of the prior art louvers. Specifically, the invention provides a louver structure wherein the elements may be snapped into position, without employing bolts, screws or additional tools such as screw drivers, pliers and the like, to facilitate and economize assembly. That is, the rack is readily snapped into place about horizontal vane **15**, the adjustable vanes inserted in notches and the snap-on strips snapped into place to retain them there. Additionally, the invention provides a louver that has the snap-on strips contributing minimally to the dimensions of the louver such that a very small radius of rotation is effected, yet that has vanes that overlap to enable completely blocking the flow of fluid therepast.

Although the invention has been described with a certain degree of particularlity, it is understood that the present disclosure has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention.

What is claimed is:

1. In a louver having a frame and a set of vanes mounted for pivotal movement about respective axes of rotation and engaging oppositely disposed sides of said frame, the improvement comprising:

a. a normal vane carried in the front of said frame, fixedly connected to said frame, and disposed at an angle that is substantially normal with respect to said axes of rotation; said normal vane defining a fixed, substantially lineal track for movement of a rack therealong;

b. a plurality of co-engaging members encompassing said normal vane and including an exterior member that forms a slide bar means at the front of said louver and an interior member that carries a lineal rack; said co-engaging members being movable reciprocally and longitudinally of said normal vane by movement of said slide bar means such that said rack is operable from the front of said louver; said co-engaging members having mating fastening means reversibly engaging each other, said mating fastening means comprising structure that can be disengagably snapped together to facilitate assembly and disassembly;

c. a pinion connected with one of said vanes so as to have its center aligned with said axis of rotation of said one of said vanes whereby rotation of said pinion effects rotation of said vane, said pinion engaging said rack such that lateral movement of said rack longitudinally of said normal vane effects rotation of said pinion;

d. a pin means connected with each vane of said set of vanes, eccentric with respect to said axis of rotation thereof, and an aperture means of a predetermined width surrounding said pin means; and

e. a connector link having a plurality of bifurcated ends removably snapped over and engaging respective said pins and interconnecting said vanes of said set of vanes with each other via said pin means, said bifurcated ends being adapted to move within said aperture means and being disposed along said connector link the same distance said vanes are disposed apart by respective means defining said axes of rotation.

2. The louver of claim 1 wherein said co-engaging members have respective mating protrusion means and slot means that may be disengagably snapped together to encompass said normal vane and retain said rack in place.

3. The louver of claim 1 wherein said rack is integrally formed with an interior one of said plurality of co-engaging members.

4. The louver of claim 1 wherein said normal vane has limit means for preventing movement of said rack out of engagement with said pinion.

5. The louver of claim 1 wherein said pinion is integrally formed with said one of said vanes.

6. The louver of claim 1 wherein said pinion is formed with a slot means therein for conformingly engaging said one of said vanes, said one vane has a cut away portion for receiving said pinion, and said pinion and said one of said vanes are assembled after manufacture.

7. The louver of claim 1 wherein elements of said louver are formed of acrylonitrile-butadiene-styrene copolymer.

8. The louver of claim 1 wherein said vanes in said set of vanes extend on both sides of said respective axes of rotation so as to enable blocking the flow of a fluid through said louver when said vanes are closed.

9. The louver of claim 1 having a small radius of rotation, wherein said means defining said axes of rotation are located in notches disposed along at least one side of said louver frame, said notches being open toward the inner edge of said louver frame and wherein there is provided:

a. a plurality of separate first portions of holding means disposed along the inner edge of said at least one side of said louver frame for retaining a strip in place; and

b. a snap-on strip disposed along said at least one side and bearing against said respective means defining said axes of rotation; said snap-on strip having interiorly protruding blocking means disposed along its length in said notches and retaining said vanes of said set of vanes in place; said snap-on strip having a plurality of mating separate second portions of holding means disengagably snapped into engagement with said first portions of holding means; said first and second portions of holding means comprising a plurality of respective aperture means for receiving protrusions snapped thereinto and protrusion means for conformingly and frictionally engaging said aperture means on at least two sides thereof; said aperture means and said protrusion means being disposed at correlative intervals along the lengths of said snap-on strip and said at least one side of said louver frame such that said protrusion means can be snapped into said aperture means and hold said snap-on strip positively against lateral and longitudinal movement, and yet allow radial movement against only snap-in friction such that said snap-on strip is readily removable to facilitate disassembly and readily snapped into place to facilitate assembly.

10. The louver of claim 9 wherein said snap-on strip bears against said means defining said axes of rotation with sufficient force to retain said vanes in any set position; and wherein said frame carries mounting means at oppositely disposed ends thereof for pivotal mounting and said frame has a radius of rotation of less than 1 inch about said mounting means, said radius of rotation being measured from the axis of said mounting means to the extremities of said louver in a direction perpendicular to said axis.

11. In a louver having a small radius of rotation and having a frame and a set of vanes mounted for pivotal movement about respective means defining axes of rotation and located in notches disposed along two oppositely disposed sides of the louver frame, the notches being open toward the inner edge of said louver frame, the improvement comprising:

a. a plurality of separate first portions of holding means disposed along an inner portion adjacent the inner edge of each of said sides of said louver frame for retaining a strip in place; and

b. a snap-on strip disposed along each of said sides and bearing against said respective means defining said axes of rotation; said snap-on strip having interiorly protruding blocking means disposed along its length in said notches and retaining said vanes of said set of vanes in place; each snap-on strip having a plurality of mating separate second portions of holding means disengagably snapped into engagement with first portions of holding means; said first and second portions of holding means comprising a plurality of respective aperture means for receiving protrusions snapped thereinto and protrusion means for conformingly and frictionally engaging said aperture means on at least two sides thereof; said aperture means and said protrusion means being disposed at correlative intervals along the length of said sides and said snap-on strip such that said protrusion means can be snapped into said aperture means and hold said snap-on strip positively against lateral and longitudinal movement, and yet allow radial movement against only snap-in friction such that said snap-on strip is readily removable to facilitate disassembly and readily snapped into place to facilitate assembly.

12. The louver of claim 11 wherein said frame has as said first portion of said holding means a plurality of longitudinally extending aperture means and a plurality of laterally extending aperture means disposed along its length and conformingly engaging mating protrusion means on said snap-on strip and wherein said snap-on strip bears against said means defining said axes of rotation with sufficient force to retain said vanes in any set position.

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