

Nov. 4, 1952

H. H. McCABE ET AL  
ADJUSTABLE VENTILATOR

2,616,355

Filed March 25, 1950

3 Sheets-Sheet 1

Fig. 1

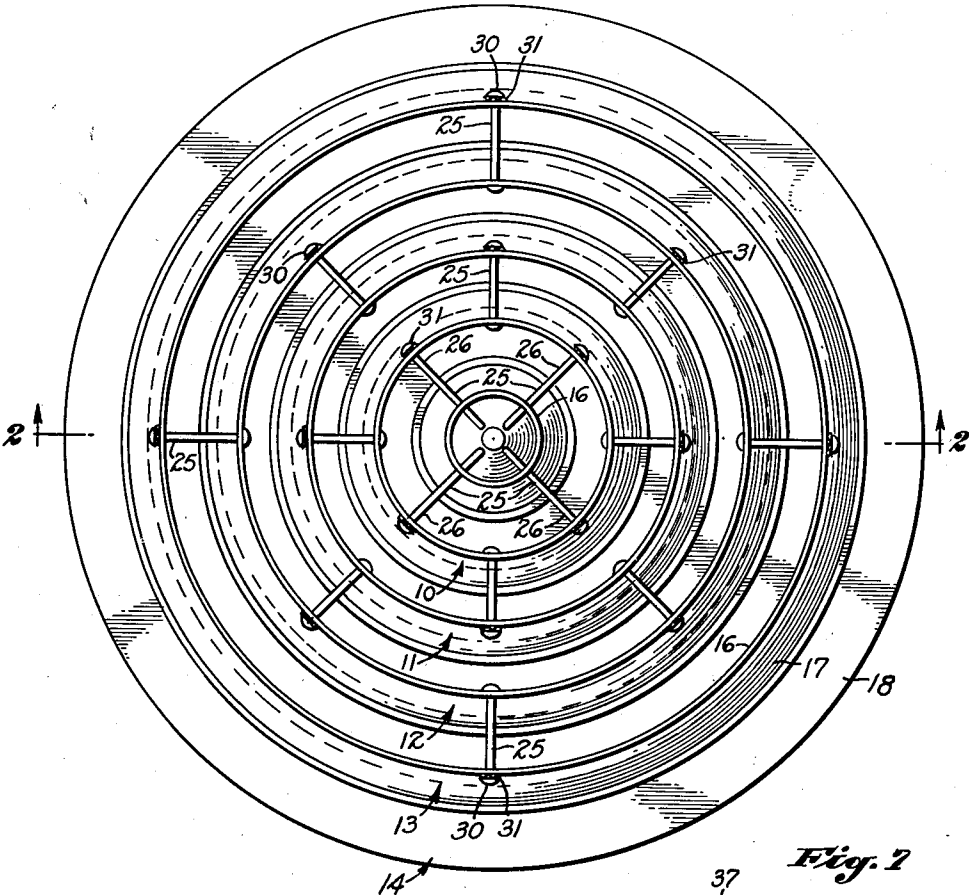


Fig. 7

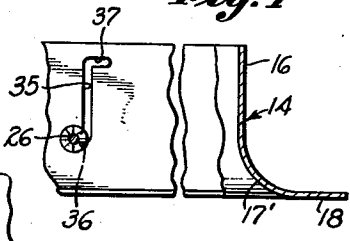


Fig. 5

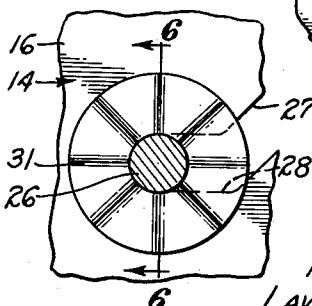
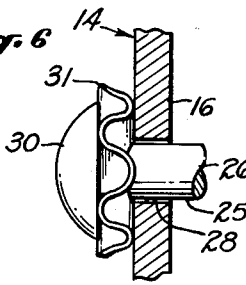


Fig. 6



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*Fig. 2*

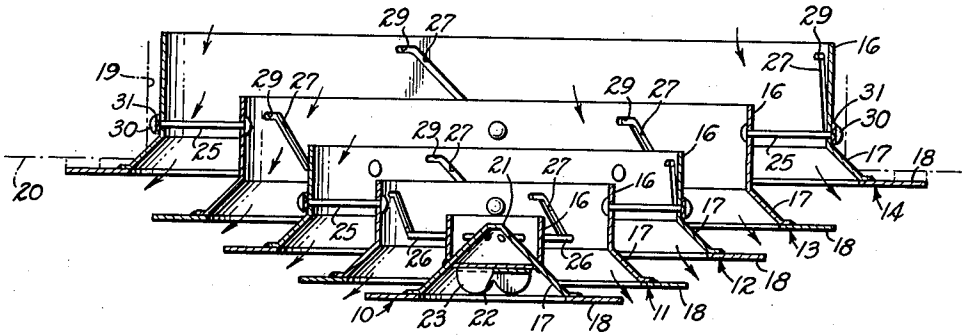


*Fig. 3*

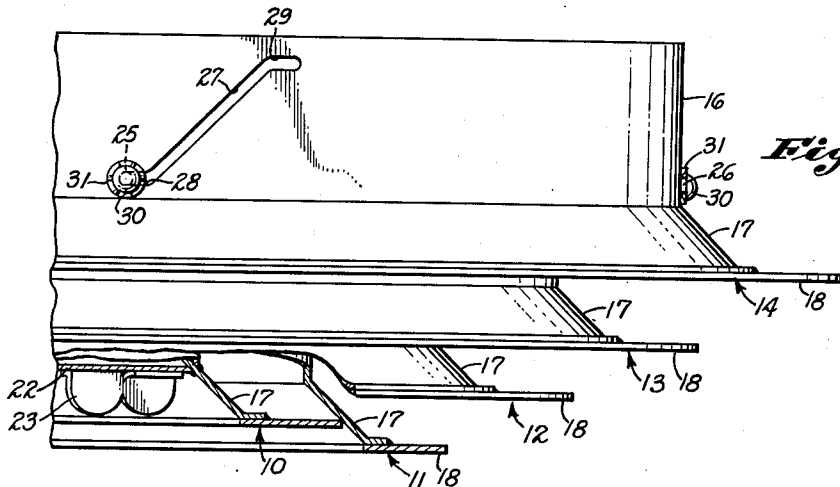
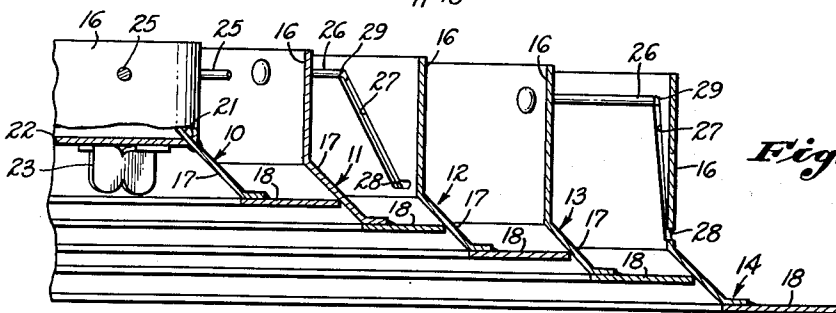


*Fig. 4*



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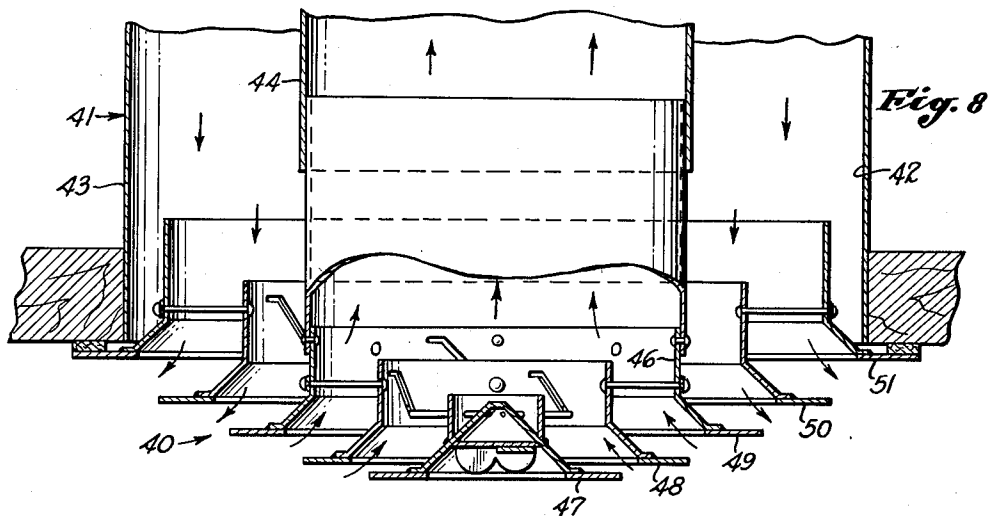


Fig. 9

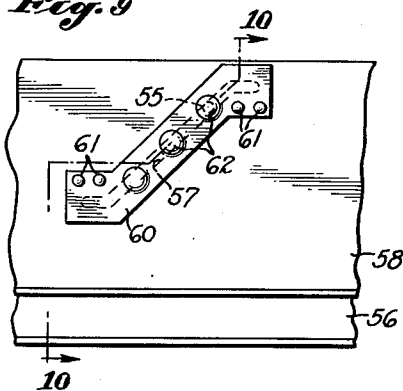


Fig. 10

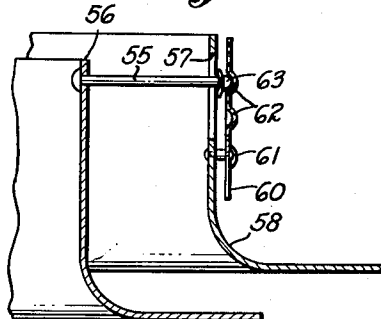


Fig. 12

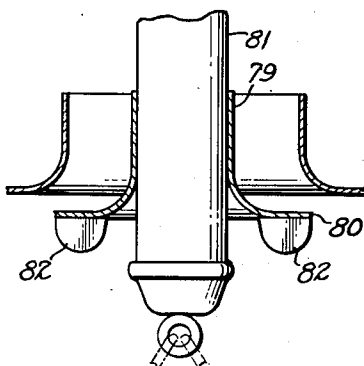
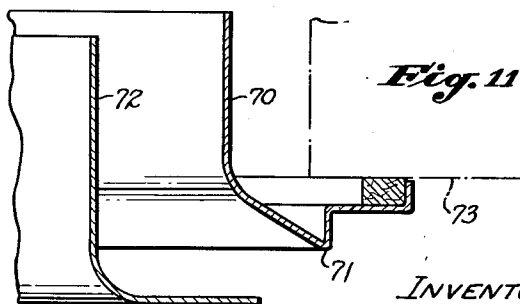


Fig. 11



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## UNITED STATES PATENT OFFICE

2,616,355

## ADJUSTABLE VENTILATOR

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Application March 25, 1950, Serial No. 151,946

7 Claims. (Cl. 98—40)

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This invention relates to improvements in gas distributing devices or diffusers employed in connection with ventilating or air conditioning systems and particularly to a damper or like control device for regulating the flow of air from one area to another.

One object of the invention is to provide an air distributing device, of the character referred to, which, when used in connection with an air distributing system of a building, provides an accurate and variable control for the distribution of air to rooms of various sizes; provides a "balancing" medium when employed in connection with heating and cooling systems; provides a damper means for closing a cooling system so as to prevent the escape of heat from the inside to the outside of a building through the cooling ducts when the cooling system is inoperative; provides an effective control means for varying the volume of heating or cooling air introduced into a room or other area of a building so as to distribute the air in desired volumes throughout the building; provides a means for varying the volume of either hot or cold air which may pass through a single duct; provides a ventilating means by which the desired volume of the air conditioning medium can be accurately controlled; and provides a simple, yet highly efficient, volume control means which is adapted for convenient manual adjustment.

Another object of the invention is to provide a damper or like control device which includes a plurality of concentric annular vanes or louvers which are interconnected to provide a unitary structure, the outermost vane being adapted for installation within an opening in the ceiling or wall of a room or within an air duct or within a side opening of such a duct.

Another object is to provide a device of the type indicated in which each annular vane is supported by the next outer vane of the series and adapted for simultaneous rotation with its supporting vane and for independent rotation with respect to its supporting vane.

Another object is to provide a device, of the class referred to, in which the means for rotatably supporting a vane from the next outer vane comprises cam followers, in the form of pins, carried by each vane and engageable in inclined cam slots of the next outer vane of the series of vanes, this connection adapting each vane to rotate and move axially with respect to the next outer vane.

Another object is to provide a device of the type specified in which the cam slot of each

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vane has end portions or lands which form rests for the cam followers of the next inner vane so as to retain said next inner vane in open and closed positions. A further object in this respect is to provide friction means on each cam follower which are engageable with the next outer vane of the series to frictionally resist rotation of each vane so as to avoid accidental or unwarranted opening or closing of the vanes. A related object is to provide spring detent means which is operative to retain each vane in various positions intermediate its open and closed positions, this means consisting of a resilient element having spaced depressions into which the end of a cam follower may snap.

Another object is to provide a ventilator, of the class referred to, in which one of the vanes may carry a sleeve which is slidable within the inner tube of a two-part concentric duct through which air may flow in two directions, the air entering a space through the annular space surrounding the inner tube and discharging from said space through the inner tube, or vice versa.

Another object is to provide a ventilator, or the like, in which the outermost vane of the series has an annular deflector portion which serves to direct air flowing from the outer portion of the ventilator radially outwardly and in a plane spaced from the peripheral flange of the outer vane. By this means, the air entering a room through the ventilator, which is installed in the ceiling or wall thereof, is directed away from the ceiling so as to avoid soiling the ceiling or wall.

Another object is to provide a ventilator of the type indicated in which the innermost vane may surround the tubular support for a suspended lighting fixture so that the ventilator and lighting fixture are combined in a unitary structure.

Another object is to provide a ventilator or like device which is economical to manufacture, the several annular vanes being particularly adapted for mass production as sheet metal stampings.

A further object is to provide a device of the character specified which is light in weight, convenient to install and operate, and one which is highly efficient in performing its intended function.

Further objects of the invention will appear from the following specification and from the drawings, which are intended for the purpose of illustration only, and in which:

Fig. 1 is a plan view of our improved gas distributing device;

Fig. 2 is a cross-sectional view of the device taken on line 2—2 of Fig. 1, the several annular vanes being shown in open position;

Fig. 3 is an enlarged, fragmentary elevational view of the device, the inner vanes being shown in section to illustrate the innermost vane in closed position;

Fig. 4 is an enlarged cross-sectional view of the portion of the device illustrated in Fig. 3, showing the several vanes in closed relationship;

Fig. 5 is an enlarged, fragmentary side view of one of the cam followers and the friction means employed in connection therewith;

Fig. 6 is a view, partially in cross section, taken on line 6—6 of Fig. 5;

Fig. 7 is a fragmentary elevational view of a portion of one of an alternative annular vane showing slight variations in the cross-sectional shape and in the contour of the operating slots thereof;

Fig. 8 is a cross-sectional view similar to Fig. 2, showing a modified form of the ventilator which is particularly adapted for use in connection with a duct having a two-way flow of air;

Fig. 9 is a fragmentary side view of a pair of the vanes, showing a modified type of friction and detent means for retaining one of the vanes in different positions of adjustment;

Fig. 10 is a cross-sectional view, taken on line 10—10 of Fig. 9;

Fig. 11 is a fragmentary cross-sectional view through a modified form of outermost vane; and

Fig. 12 is a fragmentary sectional view of the central portion of a ventilator in which is embodied the supporting tube of a lighting fixture.

Referring to the drawings in detail, our improved damper or ventilator device comprises a plurality of concentric, annular louvers or vanes 10, 11, 12, 13 and 14. The vanes 11, 12, 13 and 14 are similar in cross-sectional shape, each vane having a tubular inner portion 16, a conical portion providing a tapered seat 17, and an outer, annular, plate-like rim portion 18.

In other instances, the intersection of the tubular and rim portions may be curved to provide a part-spherical seat 17'. The several vanes are supported from the outermost vane 14 of the series of vanes by means to be presently described. The outermost vane 14 is adapted to be installed in an opening 19 of a building wall, such as the ceiling 20 of a room, or to be mounted in an air conditioning duct or in a side opening of such a duct. As shown in Fig. 2, the tubular portion 16 of the outermost vane may be disposed within the opening 19, the outer rim portion 18 being suitably secured to the portion of the ceiling surrounding the opening. The innermost vane 10 is similar to the vanes 11 to 14 but its central portion is closed by a cone 21 and a plate 22 (Fig. 2). The plate 22 carries a transverse finger piece 23 by means of which the vane 10 can be rotated.

The innermost vane 10 is provided with a plurality of transversely extending pins 25, the outer ends of which provide cam followers 26. The cam followers 26 project radially outwardly through inclined cam slots 27 provided in the tubular portion 16 of the next outer annular vane 11. Each cam slot 27 is inclined at an angle of approximately 45° with respect to the plane of the rim portion 18. The lower end of the cam slot 27 terminates in a relatively short hori-

zontal portion or land 28, the upper end of the slot having a similar straight portion or land 29, the closed ends of the straight portions 28 and 29 providing abutments. The outer ends of the cam followers 26 have heads 30 and disposed between these heads and the periphery of the tubular portion 16 are resilient means, herein illustrated by way of example as spring washers 31 (Figs. 5 and 6), which frictionally engage the tubular portion 16 to frictionally resist movement of the cam followers in the cam slots 27 and their lands 28 and 29. As shown in Figs. 5 and 6, the washers may have a wavy configuration to adapt them to be compressed slightly in an axial direction between the heads 30 and the tubular portions 16 so as to effect frictional resistance to relative rotation between the vanes 10 and 11.

The vane 11 is rotatably connected to the next outer vane 12 by similar pins 25 and cam slots 27. In a like manner, the vanes 12 and 13 are connected for limited rotation and axial movement within the respective vanes 13 and 14, and since the outermost vane 14 is stationary, the vanes 10, 11, 12 and 13 are adapted to rotate and move axially with respect to the vane 14 and with respect to one another.

Assuming that the device is installed, for example, within the opening 19 of the ceiling of a room, and that the vanes 10 to 13 assume their open positions as shown in Fig. 2, the greatest effective area of the opening 19 is utilized so that maximum volumetric flow of air therethrough is permitted. The air entering the room by way of the opening 19 may be used to replace air which is consumed by persons breathing the same. In other instances, the air entering the room may be utilized as a medium for "balancing" the temperature of the air in the room so as to maintain a substantially even room temperature. In this respect, it is to be noted that the device may be installed within a duct or within a side opening thereof when the duct supplies either heated or cooled air to a space. That is to say, the device may be advantageously employed as a means for mixing cool and warm air to maintain a substantially uniform temperature within a room or other space which is air conditioned. The device may also be installed in an opening of a partition between rooms for proportioning the cooling or heating medium introduced into the rooms. Thus, a series of the devices may be employed for accurately controlling the flow of air between a number of rooms and for completely shutting off the flow of air through certain of the wall openings. The device may be employed as a damper for closing a cooling system to prevent the escape of heat therethrough during the winter when the rooms are heated. Conversely, the damper device may effectively prevent the escape of cool air from rooms, through the heating ducts, during the summer season. As will be next shown, the effective cross-sectional area of the device may be adjusted with precision so as to accurately vary the volumetric flow of air therethrough.

When it is desired that the effective area of the opening 19, or the area of a duct within which the device is installed, be reduced, the innermost vane 10 is rotated in clockwise direction and this operation is facilitated by the finger piece 23 which is grasped between the fingers of the operator. During the initial rotation of the vane 10, its followers 25 slide in the straight portions 28 of the cam slots 27 of the vane 11 and as the ro-

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tation is continued the followers ride upwardly in the inclined cam slots. Thus, the central vane 10 is moved upwardly within the vane 11 to close the annular opening between these two vanes. As the followers 26 reach the upper ends of the cam slots 27, the periphery of the flange 18 of the vane 10 engages the conical seat 17 of the vane 11, as shown in Fig. 3, so as to seal the opening between the vanes 10 and 11 and thus reduce the over-all effective cross-sectional area of the device. As rotation of the vane 10 is continued, its followers 26 enter the straight portions or lands 29 of the slots 27 and engage the closed ends or abutments thereof.

If further closing of the ventilator is desired, rotation of the vane 10 is continued. Engagement of the followers 26 of the vane 10 against the closed ends of the lands 29 of the vane 11 causes the latter to also rotate in clockwise direction with its followers 26 riding in the cam slots 27 of the next outer vane 12. Eventually the followers 26 of the vane 11 come to rest within the straight portions 29 of the cam slots 27 of the vane 12, at which time the rim portion or flange 18 of the vane 11 engages the seat 17 of the vane 12 to close the annular opening between these two vanes.

By continuing the rotation of the vanes 10 and 11, the vanes 12 and 13 are successively rotated and moved axially in the manner explained above so that eventually each vane disposed inwardly from the outermost vane 14 is engaged with an outer vane and the vanes 10, 11, 12 and 13 which, during the last part of the clockwise rotation, move as a unit, are brought into sealing engagement with the outermost vane 14 (Fig. 4). At this stage, all the followers 26 are disposed within the straight portions 29 of the several cam slots 27 and thus the vanes are held in closed relationship.

In some installations, it is desirable that a partial flow of air through the ventilator be effected at all times. This result may be attained with the present ventilator by so locating the upper ends 29 of the cam slots 27 with respect to the flange 18 that when each cam follower 26 reaches the upper extremity of a cam slot, the flange 18 of the vane carrying this follower is spaced slightly from the next outer vane of the series of vanes.

In order to positively retain the vanes in closed position, the friction washers 31 are employed, these washers resiliently engaging the vanes to resist rotation thereof and this is important when the damper or ventilator is installed in a wall or duct which is subject to vibration. It is to be noted that in addition to providing the cam followers 26, the pins 25 also serve as the sole mounting means by which each vane is supported from the adjacent, next outer vane.

When it is desired to open the fully closed damper or ventilator, the operation explained above is reversed. That is to say, the central vane 10 is rotated in counterclockwise direction (clockwise as viewed in Fig. 1). Since only the resistance offered by the washers 31 of the followers 26 of the vane 10 must be overcome to permit rotation of the latter, the vane 10 opens before the other vanes rotate. Thus, the vanes 10, 11, 12 and 13 are opened in succession as rotation of the central vane 10 is continued. Upon rotation of the innermost vane 10, its followers 26 slide down the inclined cam slots 27 of the next outer vane 11 and enter the lower straight portions 28 thereof. If this partial opening of the ventilator is insufficient to establish the de-

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sired passage of air therethrough, the vane 10 is rotated further in the same direction so that its followers 26 engage the closed ends or abutments of the straight portions 28 of the vane 11 to rotate the latter with respect to the next outer vane 12. In this manner, the vane 11 is also opened and if the opening of additional outer vanes is necessary to obtain the desired effective cross-sectional area, the rotation of the inner vanes is continued. When a fully open condition is necessary, the rotation is continued until the cam followers 26 of the vane 13 enter the straight lands 28 of the outermost, fixed vane 14.

It is thus seen from the foregoing that each vane is, in effect, screwed into the next outer vane of the series to close the ventilator or damper device, and unscrewed therefrom to open the device. The operation of opening and closing the vanes in succession is readily accomplished by simply rotating a single finger piece. It is apparent that by the present improved damper construction the size of the air passage or opening can be adjusted with precision and in this respect it will be understood that the vanes employed may vary in number; the invention not being limited to the exact number of vanes disclosed in the drawings. It will also be apparent from the foregoing that the present device is adapted for installation in openings in walls, air ducts, etc., in various positions, for example, in vertical or horizontal positions.

Referring to Fig. 7, it is within the concept of this invention to provide slots or openings 35 in the vanes, these slots extending longitudinally of the tubular portions 16 of the vanes. The ends of the openings 35 have laterally or angularly extending portions or rests 36 and 37, the openings thus providing, in effect, double bayonet slots. The follower portions 26 of the pins 25 extend through the slots 35 and when the ventilator is open they are disposed within the extensions 36. To close the ventilator, each vane is turned slightly to cause its followers 26 to move laterally from the rests 36 into alignment with the slots 35, after which the vanes can be slid axially to engage their rim portions 18 with the seats 17 (or 17'). The vanes are then rotated to cause their followers 26 to enter the rests 37, which act to retain the vanes in closed relationship. To open the ventilator or damper device, the above procedure is reversed, it being apparent that during the closing and opening operation, the vanes are actuated in succession.

Referring now to Fig. 8, the ventilator 40, which is similar to the ventilator shown in Fig. 2, is particularly adapted to use in connection with a two-way flow duct 41 which is frequently used in air-conditioning systems. As indicated by the arrows, the air may enter a space to be conditioned through the annular space 42 existing between the outer tube 43 and the inner tube 44 of the duct 41, and discharge from the space through the central tube 44. To adapt the ventilator for use in connection with such a duct, we secure a tubular extension or sleeve 45 to the tubular portion 46 of one of the intermediate vanes of the series of concentric, adjustable vanes 47, 48, 49, 50 or 51 of the ventilator (here shown as attached to the vane 49). The sleeve 45 is received within the inner tube 44 and is slidable axially thereof as the vane 49 is moved axially to open and closed positions. By this arrangement, the vanes 47 to 51 may be adjusted to effect flow of air through the space 42 or through the inner tube 44 or through both, and the rate

of air flow may be varied by adjusting the vanes.

Figs. 9 and 10 illustrate an alternative friction means for retaining the cam follower 55 of an annular vane 56 in different positions within the cam slot 57 of the next outer vane 58 of a series of concentric vanes. A detent element 60, preferably made from spring metal, is mounted on the vane 58, in spaced relation thereto, by means of rivets or the like. The element is provided with a series of depressions 62 on its inner side, the depressions being arranged in a line following the cam slot 57. The cam follower 55 is provided with a rounded head 63 which is adapted to engage the resilient element 60 and to snap successively into the depressions 62 so as to retain the vane 56 in different positions of adjustment relative to the next outer vane 58.

Fig. 11 shows an outermost vane 70 of a multi-vane ventilator as having an annular deflector portion 71 which serves to direct the flow of air entering a room between the vane 70 and the next inner vane 72 of the series axially away from the wall or ceiling 73 of the room. By this means, the air may take a funnel-shaped flow pattern which is sometimes desirable. Moreover, by directing the air away from the wall or ceiling, soiling thereof is minimized.

In Fig. 12 the tubular portion 79 of the innermost or central vane 80 of the ventilator surrounds a tube 81 which may be employed for suspending a lighting fixture, the vane 80 having fingerpieces 82 by which it may be rotated.

While the adjustable damper or ventilator device is herein shown and described in several preferred forms of construction, by way of example, it will be apparent that other modifications might be made in the structure without departing from the spirit of the invention. Consequently, we do not wish to be limited in this respect, but desire to be afforded the full scope of the appended claims.

We claim as our invention:

1. A flow control device adapted to be carried by a supporting structure, including a plurality of concentric annular vanes of progressively increasing diameters adapted to nest together, the outermost of said vanes being adapted to be mounted on the supporting structure, each of said vanes, excepting said outermost, being connected to the next vane outwardly therefrom by a cam means for moving such vane axially relative to said next vane outwardly therefrom in response to rotation thereof, each of said cam means being disposed between a pair of said vanes and including a cam on one of the vanes of such pair and a cam follower on the other of the vanes of such pair and engaging said cam.

2. A flow control device according to claim 1 wherein said cam of each of said cam means comprises a slot and wherein said cam follower thereof comprises a pin disposed in such slot.

3. A flow control device according to claim 1 wherein said cam of each of said cam means comprises a slot and wherein said cam follower thereof comprises a pin disposed in such slot, said slot of each of said cam means including a portion which makes an acute angle with the common axis of said annular vanes.

4. A flow control device according to claim 1 wherein said cam of each of said cam means comprises a slot and wherein said cam follower thereof comprises a pin disposed in such slot, said slot of each of said cam means including a portion parallel to the common axis of said annular vanes.

5. A flow control device adapted to be carried by a supporting structure, including a plurality of concentric annular vanes of progressively increasing diameters adapted to nest together, the outermost of said vanes being adapted to be mounted on the supporting structure, each of said vanes, excepting said outermost, being connected to the next vane outwardly therefrom by a cam means for moving such vane axially relative to said next vane outwardly therefrom in response to rotation thereof, each of said vanes having a tubular portion, each of said cam means being disposed between a pair of said tubular portions and including a plurality of cams on one of the tubular portions of such pair and a plurality of cam followers on the other and engaging said cams, respectively.

6. A flow control device according to claim 5 wherein said cams of each cam means are slots and said cam followers are pins disposed in said slots, respectively.

7. A flow control device according to claim 6 including detent means carried by said tubular portions of said vanes, respectively, in registry with said slots, respectively, and engaged by the outer ends of said pins, respectively.

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