July 30, 1957 J. KRONRAD ET AL 2,800,851

VENTILATOR WITH MOVABLE LOUVERS

Filed July 10, 1953 3 Sheets-Sheet 1

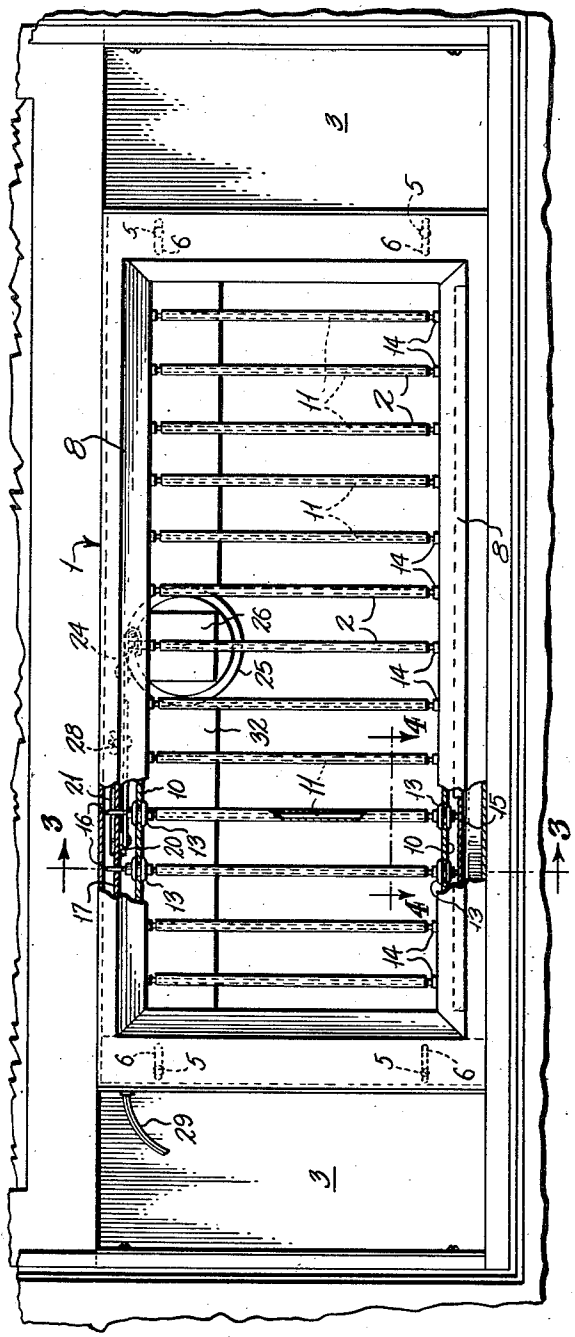


Fig. 1.

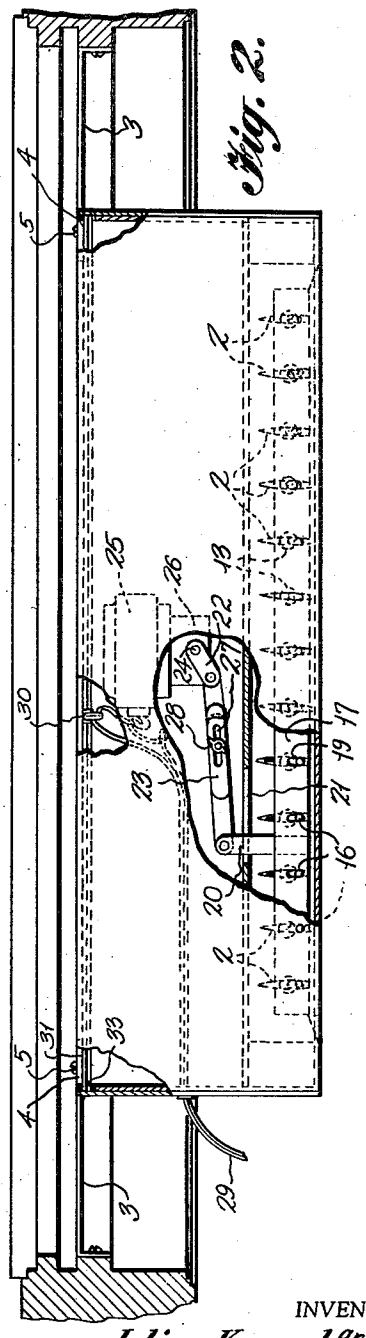


Fig. 2.

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Filed July 10, 1953 3 Sheets-Sheet 2

Fig. 3.

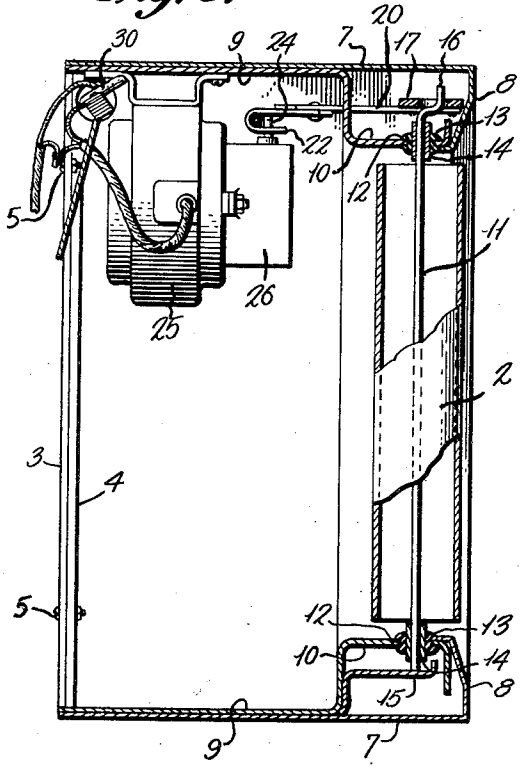


Fig. 4.

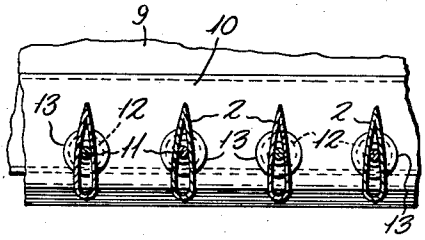
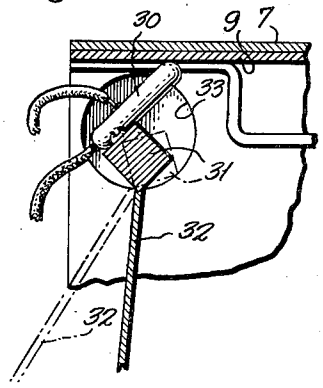


Fig. 5.



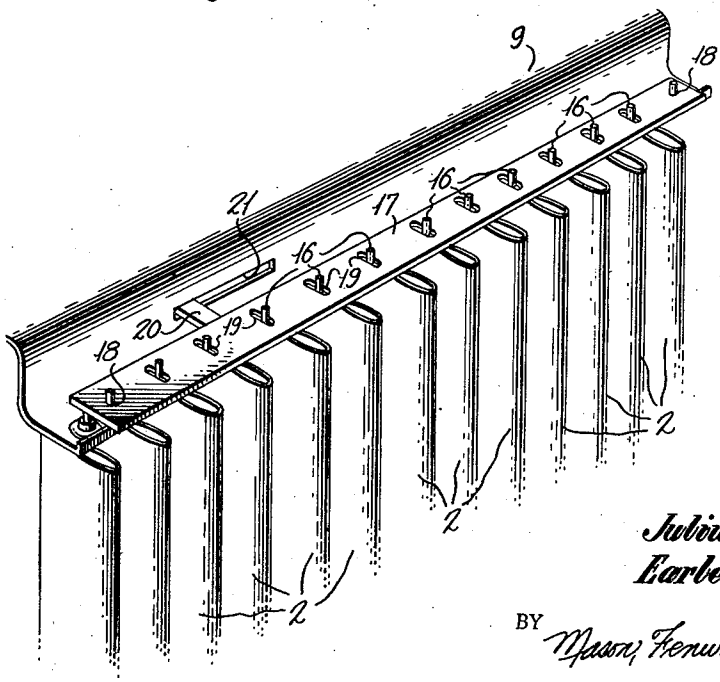


Fig. 6.

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Filed July 10, 1953 3 Sheets-Sheet 3

Fig. 7.

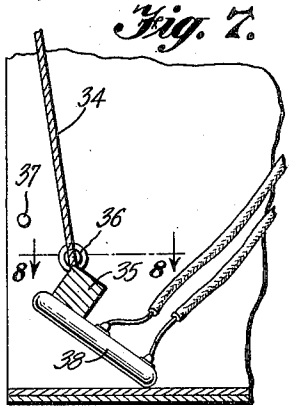


Fig. 8.

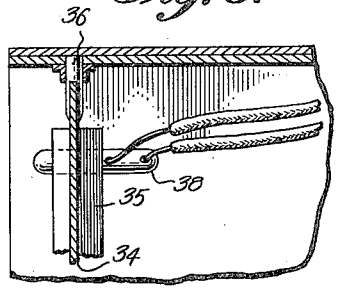


Fig. 9.

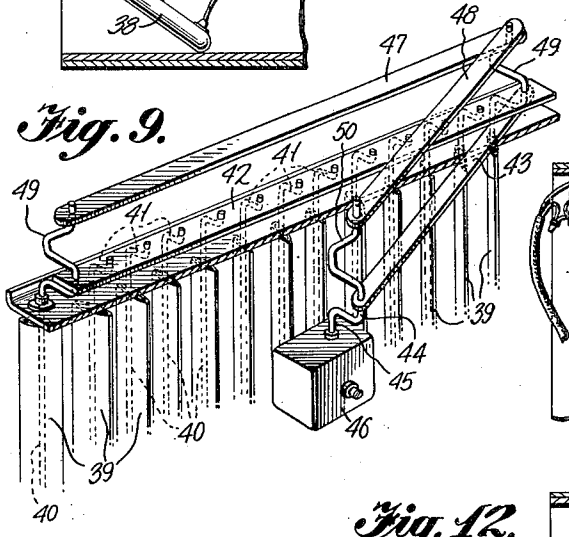


Fig. 10.

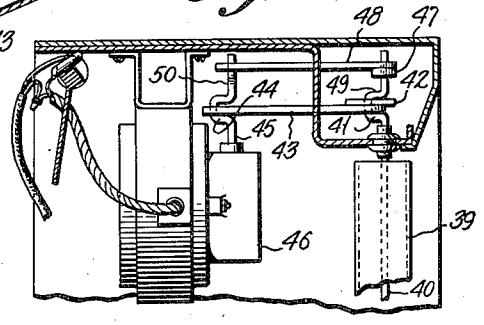


Fig. 12.

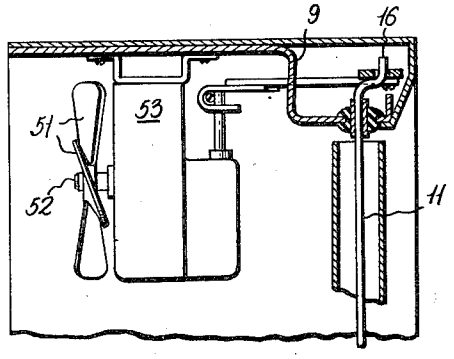
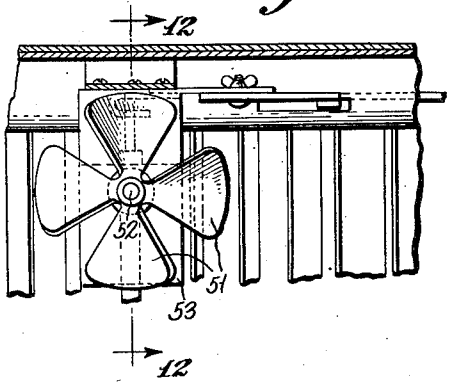


Fig. 11.



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VENTILATOR WITH MOVABLE LOUVERS

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Application July 10, 1953, Serial No. 367,173

5 Claims. (Cl. 98—99.8)

This invention relates to ventilators, and more particularly to ventilators which have a plurality of oscillatable vanes.

Many attempts have been made to produce a device which would circulate air over a wide area. The best known device of this character is the oscillating fan. In order to secure a wider distribution of the air from a fan it has been proposed to use a plurality of vanes in front of the fan, and oscillate these vanes by means of the fan motor to direct the air over a wide area. More recently the cooling of homes and buildings has been attempted by the use of a single exhaust fan which acts to draw in outside air through the windows and doors in various rooms in the building, and exhaust it from a common point. This has been quite successful, but it has been found that the air drawn in through the openings will follow almost a straight line course to the doorway of the room, and the air within the room outside of this path of travel remains relatively undisturbed. Thus the maximum cooling effect can be felt only in the direct paths of air travel.

The object of the present invention is to provide a ventilating device which can be located in the window or other openings of a room, which will serve to distribute the air drawn in through the opening over wide areas in the room.

Another object of the invention is to provide a device which will deliver an intermittent stream of air to replace a steady one which is physiologically uncomfortable.

Yet another object is to provide such a device which will convert any continuous air stream into an oscillatory one.

A further object of the invention is to provide such a device which is automatic in its operation and which is set into operation by an air stream, and stopped by cessation of movement of the air.

Still another object of the invention is to provide a device of this nature in which noises due to vibration have been eliminated, and remains noise free after much wear, and which is substantially soundless in its operation.

A still further object is the provision of a ventilator so designed that it can be mass produced without need for precision machining and in which simple provision is made for adjustment.

Other objects of the invention will become apparent from the following description of a practical embodiment thereof when taken in conjunction with the drawings which accompany, and form a part of, this specification.

In the drawings:

Figure 1 is a front elevation of a ventilator embodying the principles of the present invention, with parts being broken away and the unit in position in a window;

Figure 2 is a top view of the unit, with parts being broken away and the window frame being shown in section;

Figure 3 is a vertical section through the ventilator unit and is taken on the line 3—3 of Figure 1;

Figure 4 is a fragmentary horizontal section taken on the line 4—4 of Figure 1 showing the cross-sectional arrangement of the vanes;

Figure 5 is an enlarged fragmentary vertical section showing the control leaf in its mounting;

Figure 6 is a perspective view of the upper portions of the vanes and the communicating link which causes the vanes to move in unison;

Figure 7 is a vertical section through a modified form of the control leaf, showing the leaf mounted at the bottom of the unit;

Figure 8 is a partial horizontal section taken on the line 8—8 of Figure 7;

Figure 9 is a perspective view of portions of a ventilating unit in which the vanes are rotatable and the driving mechanism therefor;

Figure 10 is a vertical section through a portion of the unit shown in Figure 9;

Figure 11 is a partial vertical longitudinal section through a modified unit illustrating a driving blade for motivating the fan blades; and,

Figure 12 is a vertical transverse section through the unit shown in Figure 11.

In general, the invention comprises a ventilator unit having a plurality of oscillatable vanes designed to be postioned in a window or other opening, and to operate automatically in accordance with air movement. All, or a desired number, of the openings in a building may be equipped with these units and a single exhaust fan will cause the operation of all units. When the exhaust fan is operating, units within a particular room can be controlled by the opening or closing of a communicating door or transom.

Referring to the drawings in detail, and first to the unit shown in Figures 1 to 6, the unit comprises a rectangular frame 1 about a rectangular opening in which are positioned a plurality of parallel vanes 2. Extension panels 3 are attached to the sides of the frame at the rear, to bridge the spaces between the sides of the frame and the sides of a window opening into which the unit is to be placed. The extension panels are the same height as the frame 1, and are attached to straps 4, which are connected to the top and bottom of the frame and extend along the sides of the frame at the rear, by means of bolts 5 which pass through horizontal slots 6 in the extension panels 3. The slots will permit widthwise adjustments of the extension panels to fit windows of different sizes. When the panels are adjusted to the desired width, the bolts can be tightened to rigidly secure the panels to the frame. The extensions have out-turned flanges at their outer edges to lie flush against the window frame and to be secured thereto in any desired manner.

The frame 1 is of double thickness throughout. Each side of the frame is composed of two metal sheets which are in surface contact throughout the major portion of their widths. The outer sheet 7 has its front edge turned inwardly at right angles, as at 8, to form a facing member for the frame. The inner sheet 9 is bent upwardly near the front of the frame, then forwardly to extend to the facing 8 and then downwardly to form a longitudinal channel 10 extending the length of its front edge. As the top of channel 10 is spaced from the outer sheet 7, a chamber is formed in which certain of the operating parts of the device may be housed.

Vanes 2 are positioned vertically between the top and bottom members of the frame, and are journaled for oscillatory movement in these frame members. Each vane is formed from a rectilinear sheet bent to form a rounded leading edge and a pointed trailing edge, with slightly arcuate sides connecting the edges. This gives the vanes a teardrop shape in cross section. A shaft 11

passes vertically through the center of the vane and extends some distance beyond the top and bottom edges. The shaft and vane are spot welded, or otherwise rigidly secured, together. Channel portions **10** of the inner frame sheets **9** are provided with equally spaced openings **12** along their lengths for mounting the vanes. Each opening is provided with a rubber grommet **13** having a central opening to receive a vertically positioned bearing member **14**. The projecting ends of the shaft **11** are rotatably mounted in the bearings **14**. This mounting will permit substantially noiseless movement of the vanes, as the rubber grommet will absorb shocks and in effect provide a floating mount for the vane shafts. The yieldable material of the grommets will accommodate itself to slight imperfections in mounting the vanes, and also permit a vane to rotate even tho its shaft should become slightly bent.

A shelf **15** extends the length of the compartment in the lower frame member, spaced below the top wall of channel **10** and having a vertically depending rear flange welded or otherwise secured to the upward extension of channel **10**. The bottom ends of shafts **11** rest upon the shelf, so that the shelf becomes a thrust bearing to support the weight of the vanes and hold them against axial movement. The upper ends of shafts **11** are offset to form cranks **16**, by means of which the vanes can be oscillated. All of the cranks **16** are connected together by means of a link **17** which extends across the tops of all of the shafts **11**. Link **17** is provided with circular openings **18** at its ends to receive cranks **16** of the end vanes. The link is also provided with a plurality of slots **19** to receive the cranks of the vanes intermediate the end vanes.

By this arrangement precision machining is dispensed with as the intermediate cranks find their seats in the slots **19** even though there is some irregularity in the positioning of the vanes, or the slots. When the link is positioned on the end cranks the other cranks will fit in the slots, and movement of the link in a lengthwise direction will cause simultaneous and similar movement of all of the vanes.

There is an arm **20** which extends perpendicularly from the back of link **17** and through a slot **21** in the channel **10**, by means of which the link may be moved back and forth. The free end of arm **20** is connected to a crank arm **22** by a connecting rod **23**. Crank arm **22** is fixed upon the end of shaft **24** which is rotated by a motor **25** through suitable gearing in a reduction gear box **26**. It will be obvious that when the motor is running crank **22**, connecting rod **23**, arm **20**, and link **17** will cause the vanes to be oscillated from side to side. Connecting rod **23** is formed in two parts which are relatively adjustable to increase or decrease the length of the rod and thereby change the angle of oscillation of the vanes. The two parts of the connecting rod are provided with slots **27** and connected by means of a bolt **28** which passes through the slots.

Motor **25** is provided with a conventional lead cord **29** which can be plugged into any convenient electric outlet. The operation of the motor is controlled by means of a switch **30** connected into one wire of the lead cord. Switch **30** has been shown as a mercury switch, but it will be understood that any conventional type of switch may be used. As shown, switch **30** is secured upon a mounting bar **31** for the control leaf **32**. Mounting bar **31** is rectilinear in cross section, and shown as being square. The ends of the rod are seated in circular openings **33** in the inner sheets **9** of the side walls of the frame. Openings **33** are considerably larger than the ends of the rod so that the ends of the rod are freely movable in the openings. The rod is of solid metal and the control leaf is of sheet material and, therefore, the rod will exert slightly more torque than the leaf. Due to its polygonal cross section, the rod will find its seat in the opening with the opposite edges of one face of

the rod contacting the wall of the opening. This will cause the leaf to be positioned at an angle, as shown in dotted line in Figure 5. Due to the weight of the bar it will require considerable air force to move the leaf. The effective width of the leaf is also reduced due to its angular position. When a sufficient air stream is moving through the ventilator, the leaf will be moved from the position shown in dotted lines to the full line position in Figure 5. The switch striking the top of the unit will serve as a stop to hold the leaf against further movement. This will bring the mounting rod and leaf into a position of near balance and the mercury switch to "on" position. When in this position, very little air pressure against the leaf will hold it in place. Since considerable force is necessary to move the leaf from its position of rest, and very little force is necessary to hold it in position after it has been moved, fluttering operation of the switch is eliminated and there will be no hunting.

In using the invention, the ventilators are placed in the windows of the various rooms of a building, and one or more exhaust fans are positioned at suitable places within the building. When the exhaust fan is turned on, it will cause air to be drawn in through all of the open windows within the building and the force of the indrawn air will cause the control leaves **32** of the various ventilators to be moved to operative position to close the switches **30**. When the motor starts, the vanes will oscillate, causing the incoming air stream to be continuously deflected first to one side and then to the other. Even through the air is being drawn from a central point, the deflection caused by the moving vanes will set up initial directions of movement for the air stream which must be overcome by the suction force. This will cause the air to move through the room in arcuate paths, thus greatly widening the course of air through the room, with the result that much more effective mixture of the outside air with that of the room is obtained. In addition, the uncomfortable effect of a steady unvarying stream of air is prevented. The operation of individual ventilators in different rooms may be controlled by simply opening or closing the door or transom leading into the room to subject the ventilator to the effect of the exhaust fan. Through the use of these devices a plurality of oscillating air streams may be provided with the use of but one fan.

It may be desirable at times to have the control leaf located at the bottom of the unit, with the leaf extending upwardly. Such arrangement is illustrated in Figures 7 and 8. To secure the counterbalanced action necessary for proper operation of the leaf, the leaf **34** is heavier than the bar **35**. Instead of the bar providing the pivot, extensions **36** from the ends of the leaf near its juncture with the bar are journalled in the sides of the unit. The greater weight will be in the leaf, and cause it to tilt forward against a pin **37**, where the switch **38** will be in off position. When an air stream is created, the leaf will be tilted until the switch strikes the bottom of the unit, and the leaf is in a nearly balanced position and the switch is closed. This modified form of leaf operates on the same principle as that first described; that is, the leaf is counterbalanced so that it will swing to off position when the air stream ceases, and to a nearly balanced position when an air stream strikes it.

In Figures 9 and 10 there is shown a modified type of ventilator in which the vanes are rotated rather than oscillated. The vanes **39** are mounted as previously described, but the vane positions are staggered with respect to one another to prevent all of the vanes being simultaneously parallel to the front of the housing during rotation, which would completely close the housing. In other words, the vanes are angularly related and are not parallel. The vane shafts **40** are provided with cranks **41**, and the cranks are connected by a link **42**. The link is caused to move by means of a pitman **43** connected to crank **44** on shaft **45** projecting from the gear box **46**. The op-

posite end of pitman 43 is connected to the crank 41 of one of the end vane shafts. Rotation of shaft 45 will cause the vanes to move in continuous rotation. To prevent possible binding when the cranks and connecting members are on dead-center position, auxiliary mechanism is employed. This consists of a second link 47 and pitman 48. The shafts of the end vanes are provided with additional crank throws 49, disposed at ninety degrees to the cranks 41 and they receive the ends of the link 47. One of them also receives one end of the pitman 48, and the opposite end of the pitman is connected to a second crank 50 on shaft 45. Crank 50 is also positioned at ninety degrees to crank 44. By this arrangement, even tho one pitman and link is in dead-center position the other will be in in full driving position.

By providing the ventilator with an air motor the pivoted control leaf, previously described, may be dispensed with. Such an arrangement is shown in Figures 11 and 12. The ventilator may be either the type shown in Figures 1 to 6, or that shown in Figures 7 and 8. The electric motor is replaced by a fan blade 51 mounted upon a shaft 52 extending from the gear box 53. The fan blade is positioned vertically behind the air deflecting vanes in the path of the air stream through the vanes. When an air stream is created, by a remote exhaust fan or otherwise, the air stream will flow against the fan blade 51 causing it to rotate and to oscillate or rotate the vanes depending upon the driving structure used. Cutting off the air stream will stop the operation of the ventilator.

By providing the ventilator having an electric motor with a manual switch instead of the automatic leaf control, it can be used to convert any air stream from a steady stream to an oscillating one.

Any of the above described units may be used in combination with moist filters, conventional air conditioning units, heating units, etc. to condition the air within the room, if desired. One of the units may be placed in front of a stationary fan to convert that fan into one which delivers an oscillating breeze.

While in the above one practical embodiment of the invention has been disclosed, it will be understood that various changes may be made from the precise structure described and illustrated without departing from the spirit of the invention, as defined in the appended claims.

What is claimed is:

1. A ventilator comprising, a rectangular frame having top, bottom and side members, extensions adjustably connected to the sides of said frame for mounting said frame in an opening, a plurality of vanes vertically arranged in parallel relation between the top and bottom members of said frame, shafts extending from the top and bottom edges of said vanes, the top and bottom members of said frame having openings to receive the shafts of said vanes, bearing sleeves about the ends of said shafts, grommets of yieldable material in said openings surround and support said bearing sleeves, said shafts at the tops of said vanes having cranks thereon, a connecting link connected to all of said cranks, said link having openings near its ends to receive and closely surround the cranks of the end vanes and a plurality of spaced slots between said end crank openings to receive the cranks of intermediate vane shafts, a motor, means to couple said motor to said link to impart pivotal movement to said vanes when said motor is operating, a switch to start and stop said motor, and means coupled to said switch and movable by air currents passing through said ventilator to operate said switch.

2. In a ventilator as claimed in claim 1, said frame having openings with arcuate walls on opposite sides, a control leaf comprising a leaf and a mounting bar attached thereto, said mounting bar having polygonal cross section and its ends resting in said openings in the frame for free rocking movement therein, said leaf mounted to be in a plane which includes the cross-sectional center of gravity of the mounting rod, whereby said leaf and mounting rod will approach a balanced state when said leaf is moved toward a vertical position and said mounting rod will overbalance said leaf when said leaf is inclined.

3. A ventilator comprising, an open frame, a plurality of vanes pivotally mounted within the frame, means to connect the vanes for simultaneous pivotal movement, a motor, means to couple said motor to said vane connecting means to pivotally move said vanes upon operation of said motor, each of said vanes being angularly related to adjacent vanes, said mounting for said vanes comprising a shaft projecting beyond the edges of said vane, openings in said frame to receive said shafts, said shafts at the tops of said vanes having cranks thereon, a link connecting all of said cranks, a pitman having one end connected to the crank of one end vane, a drive shaft connected to said motor and having a crank thereon to which the opposite end of said pitman is connected, each of the shafts of said end vanes having a second crank, a second link connecting the second crank, a second pitman connected to one of said second cranks, and said drive shaft having a second crank being angularly positioned with respect to said first mentioned cranks.

4. A ventilator comprising, an open frame, a plurality of vanes pivotally mounted within the frame, means to connect the vanes for simultaneous pivotal movement, a motor, means to couple said motor to said vane connecting means to pivotally move said vanes upon operation of said motor, and means to control the operation of said motor including a pivoted control leaf movable by air currents passing through the ventilator and a switch operated by pivotal movement of said control vane, said frame having openings with arcuate walls on opposite sides, said control leaf comprising a leaf and a mounting bar attached thereto, said mounting bar having polygonal cross section and its ends resting in said openings in the frame for free rocking movement therein, said leaf mounted to be in a plane which includes the cross-sectional center of gravity of the mounting bar, whereby said leaf and mounting bar will approach a balanced state when said leaf is moved toward a vertical position and said mounting bar will overbalance said leaf when said leaf is inclined.

5. A ventilator comprising, an open frame, a plurality of vanes pivotally mounted within the frame, means to connect the vanes for simultaneous pivotal movement, a motor, means to couple said motor to said vane connecting means to pivotally move said vanes upon operation of said motor, each of said vanes having a crank at one end, said means to connect said vanes comprising a link having openings near its ends to receive and closely embrace the cranks of the end vanes and a plurality of spaced slots intermediate the end openings to receive the cranks of vanes intermediate the ends, said slots extending crosswise of said link and being of such width as to closely embrace said cranks.

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