

[54] **CEILING AIR DIFFUSER** 3,018,712 1/1962 Wacker..... 236/49
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[56] **References Cited**

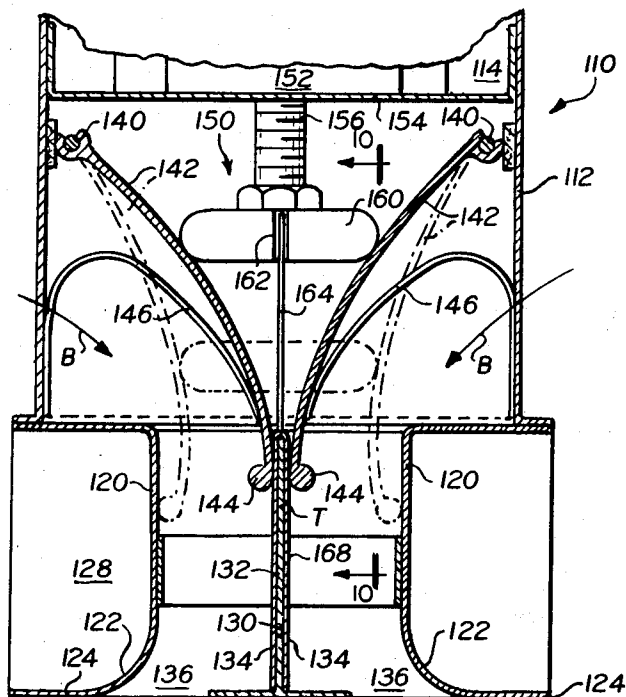
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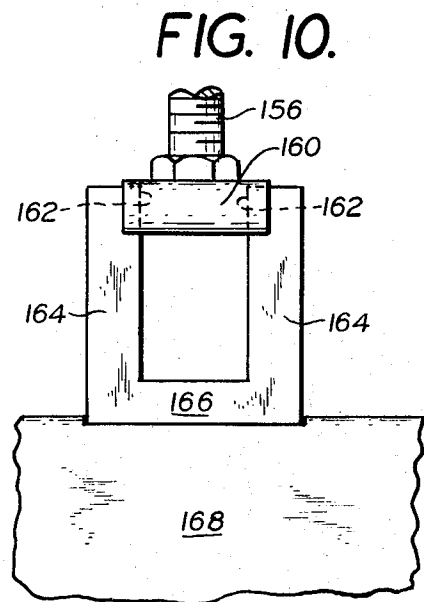
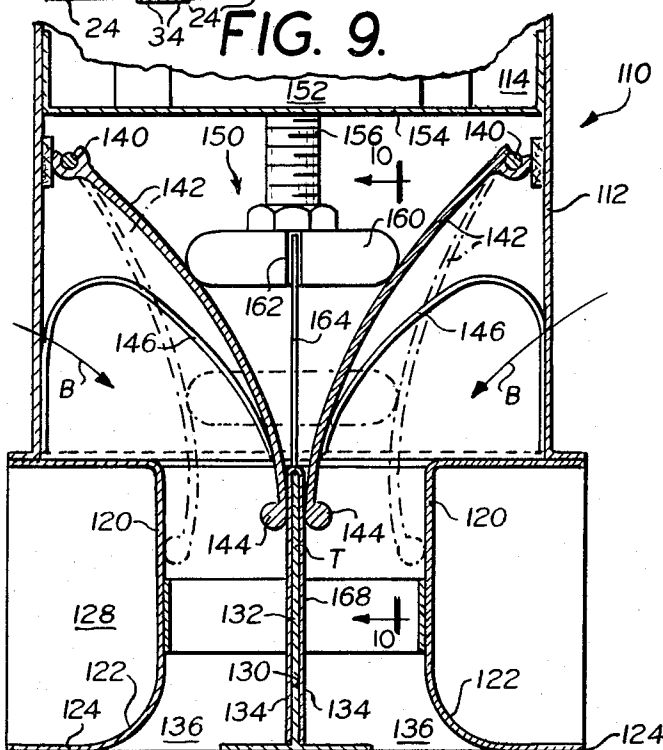
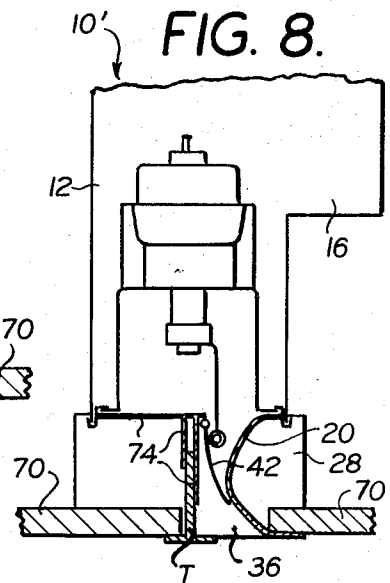
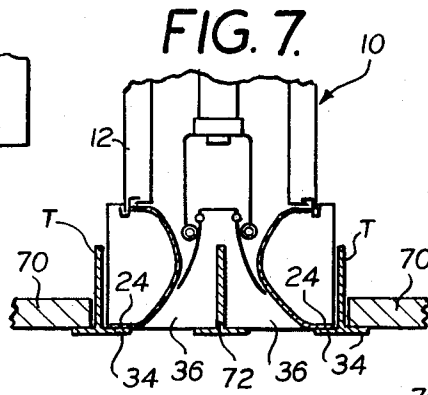
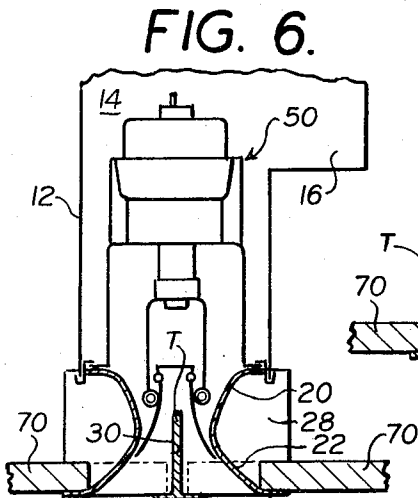
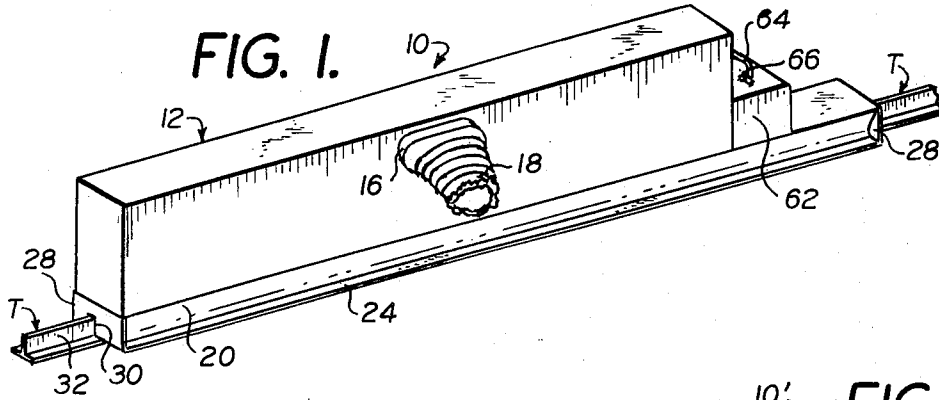
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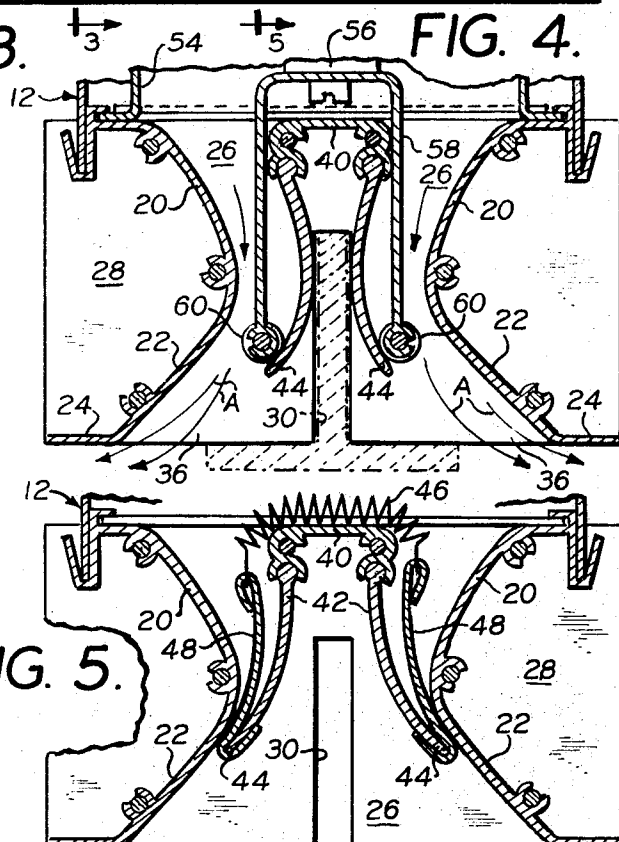
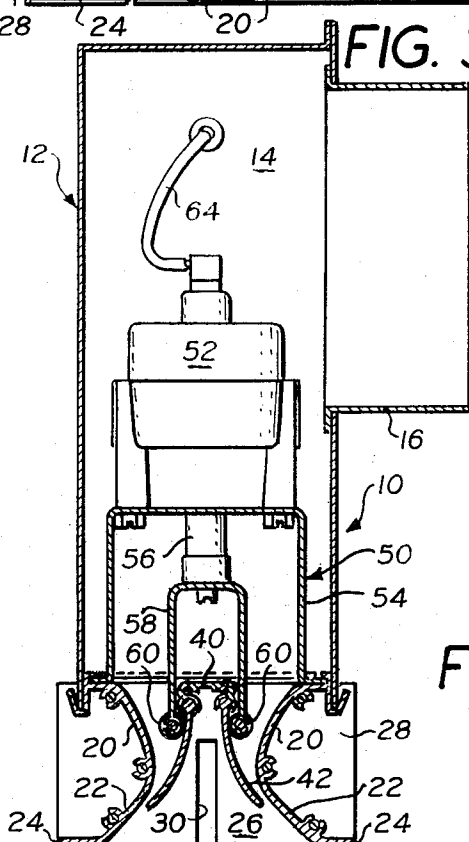
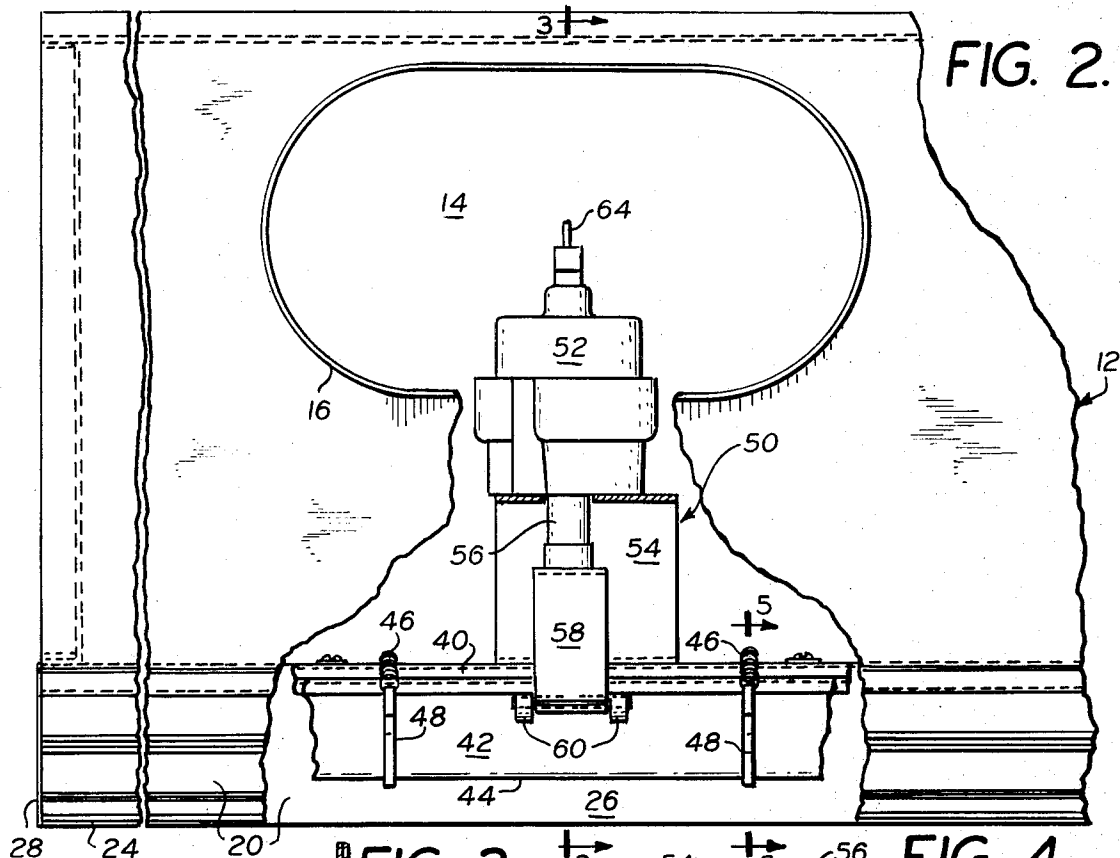
[57] **ABSTRACT**

A ceiling air diffuser of the elongated slot type, with thermostatically controlled pneumatically positioned air flow control vanes to produce a variable volume modulated conditioned air supply.

3 Claims, 10 Drawing Figures







CEILING AIR DIFFUSER

BACKGROUND OF THE INVENTION

Air diffusers are the terminal elements in central air conditioning distribution systems, and their performance is critical to the efficiency and economy of operation of these systems. Most air diffuser installations are made advantageously in ceilings, and the elongated slot type is widely used for establishing good air distribution characteristics in large areas.

Some of the desirable performance features built into the modern air diffuser include: horizontal air discharge patterns for good air mixing action; variable volume design for modulating air distribution over a wide range of air flow as the space demand requires, keeping both air pressure in supply ducts and discharge velocity from diffuser constant; automatic thermostatically monitored adjustment of air flow control vanes to achieve efficient and carefree operation; and, where an even broader range of air flow control is desired, the regulated induction of warm ambient air for admixing with conditioned air in the diffusing process.

In addition to the performance features mentioned here, it is most desirable for a ceiling air diffuser to be capable of being readily installed or relocated with a minimum of structural change into both new and existing ceilings.

SUMMARY OF THE INVENTION

The novel ceiling air diffuser of the present invention incorporates all the favorable characteristics outlined above. It has been conceived to include and combine maximum operating efficiency design with the simplest of installation requirements.

More specifically, the air diffuser of this invention has a pair of end plates notched to fit over, embrace, and be located on a conventional ceiling tee bar. Installation of the air diffuser involves merely setting the unit in place and making the necessary air supply hose and control tubing connections. Other possible types of ceiling mounting include simple openings in plaster ceilings where the side flanges overlap the opening. For this method of installation, the end plates are formed with matching flanges and a center tee section forms an integral part of the diffuser assembly. This diffuser may also be located in a tee framed opening where all sides rest on tees, usually called "exposed Tee mounting" (see FIG. 7.). In all cases the air passage is independent of the ceiling tees and will perform similarly whether they are present or not.

Further aspects of this invention will be brought forth clearly in the illustrative embodiments of the drawings and description which follow.

DRAWINGS

In the drawings:

FIG. 1 is a perspective view of a preferred embodiment of the air diffuser of this invention mounted on a ceiling tee bar;

FIG. 2 is a partial side elevational view, broken away in part, of the double-slot air diffuser of FIG. 1;

FIG. 3 is a sectional view, taken along line 3—3 of FIG. 2, showing the air flow control vanes in near-closed position;

FIG. 4 is a sectional view similar to FIG. 3, but to a larger scale and showing the air control vanes in a fully opened position and the ceiling tee bar in phantom;

FIG. 5 is a partial sectional view taken along line 5—5 of FIG. 2;

FIG. 6 is a schematic sectional view of the air diffuser of FIGS. 1—5 installed on a ceiling tee bar of a drop ceiling;

FIG. 7 is a schematic sectional view of the air diffuser of FIGS. 1—5 installed between existing ceiling tee bars;

FIG. 8 is a schematic sectional view of an alternate embodiment, i.e., a single slot air diffuser, mounted on the ceiling tee bar of a drop ceiling;

FIG. 9 is a partial sectional view of an induction type air diffuser embodying this invention; and

FIG. 10 is an elevational view taken along line 10—10 of FIG. 9 showing further detail of the vane positioning mechanism of this embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 shows a typical elongated slot air diffuser 10 of this invention mounted on ceiling tee bar T. As seen in FIGS. 1—5, diffuser unit 10 has a generally rectangular shaped housing 12 which defines an air plenum chamber 14 (FIGS. 2 and 3). Air inlet port 16 is connected to the supply duct of an air conditioner (not shown) through flexible coupling hose 18. Each lower longitudinal side wall 20 is joined to and depends from the corresponding side wall of housing 12, extending downwardly to an outwardly flared portion 22, and terminates in outwardly extending flange 24. Walls 20 represent the outer longitudinal limit of air discharge slot area 26, as clearly seen in FIGS. 3—5.

At each end of air diffuser 10, an end plate 28 extends transversely across the space between lower side walls 20 and serves to terminate air diffuser discharge slot area 26. A centrally located notch 30 in each end plate 28 is proportioned to fit over and engage the central vertical web 32 of ceiling tee bar T, with the bottom of each end plate 28 resting on horizontal flanges 34 of ceiling tee bar T.

As seen clearly in FIG. 4, when air diffuser unit 10 is in place, fixed member 40 divides air diffuser discharge slot area 26 into two air streams, and joving vanes 44 become the inner walls of each air discharge slot. The resultant configuration of each air discharge slot 36, with outwardly flared wall portion 22 assures the desirable horizontal air flow pattern indicated by the arrows A of FIG. 4.

A support bracket 40 is attached along the central longitudinal axis of air diffuser housing 12 and pivotally carries the pair of arcuate air flow control vanes 42, each with its free end 44 extending downwardly into its own air discharge slot 36. Springs 46, resting across the top of bracket 40 and connected at each end to spring clips 48, resiliently urge control vane ends 44 outwardly toward wall portions 22, to the position of FIGS. 3 and 5, so that vanes 42 normally close off communication between air plenum chamber 14 and air discharge slots 36.

Vane positioning mechanism, generally designated 50 and located in the central portion of air diffuser 10, includes pneumatic motor 52, mounted on bracket 54, with downwardly extending piston rod 56 carrying support yoke 58. Each side of yoke 58 rotatably supports a pair of rollers 60, positioned to contact the outer arcuate surfaces of vanes 42. Pneumatic motor 52 is actuated and controlled by thermostat 62 (FIG. 1), which

may be mounted conveniently on air diffuser 10 directly as shown, or elsewhere if desired. Tubing 64 connects motor 52 with thermostat 62; tubing 66 joins thermostat 62 with the pneumatic air supply (not shown).

As can be readily seen, demand for conditioned air, transmitted from thermostat 62, actuates motor 52 to project yoke 58 and rollers 60 downwardly. By virtue of their arcuate surfaces, vanes 42 are cammed and pivoted inwardly and held in position by rollers 60 against the action of springs 46. This selective rotation of vanes 42 opens communication between air plenum chamber 14 and air discharge slots 36, permitting variable conditioned air flow as required.

Thus air diffuser 10 provides a variable volume conditioned air supply by changing its air outlet area, maintaining constant air duct pressure and constant air discharge velocity, and distributing the air in a horizontal pattern for maximum efficiency.

Installation of air diffuser 10 in a typical drop ceiling is schematically illustrated in FIG. 6, where end plates 28 have been mounted on existing ceiling tee bar T. To accommodate air diffuser 10, ceiling tiles 70 have been cut back from their phantom position shown where they had rested on horizontal flanges 34 of the tee bar, and tiles 70 are here supported by flanges 24 of lower diffuser walls 20.

An alternate installation is described in FIG. 7, where air diffuser 10 is mounted between existing ceiling bars T. Here, flanges 24 of the diffuser 10 rest on flanges 34 of the previously existing ceiling tees T, while a new tee bar 72 is provided to give the same appearance as the ceiling tee bar T of FIGS. 1, 4 and 6.

In FIG. 8, a single air discharge slot diffuser 10' is illustrated schematically. All structure, function, and operation of diffuser 10' is identical with that of diffuser 10 described above, except that only one discharge slot 36, exists created by one lower wall 20 and one air flow control vane 42 and its associated position-control mechanism. The opposite lower wall 20 is replaced by hollow wall 74.

Another embodiment of this invention is shown in FIGS. 9 and 10, where variable volume air diffuser 110 is of the induction type, in which ambient air may be induced in selectively variable amounts and admixed with the conditioned air provided from plenum air chamber 114.

Each lower side wall 120 depends from the corresponding longitudinal side wall of housing 112, extending downwardly to an outwardly flared portion 122 and terminating in outwardly extending flange 124. End plates 128 are notched at 130 to accept the vertical web 132 of ceiling tee bar T. Dual air discharge slots 136 are thus created by each vane 142 as the outside limit of its slot and vertical sleeve 168 with the corresponding horizontal flange of sleeve 168 as the inner wall of each air discharge slot 136.

Separate pivotal mountings 140 are provided for paired, elongated air flow control vanes 142, each of which terminates at its lower downstream free end in a bead portion 144. Leaf springs 146 are affixed to the walls of housing 112 and bear against flow control vanes 142, which are thus resiliently held in the normal closed solid-line position of FIG. 9.

Vane positioning mechanism 150 comprises pneumatic motor 152, mounted on support bracket 154 and downwardly projecting piston rod 156. Vane contact-

ing element 160 is threadedly connected to piston rod 156 and has a pair of oppositely disposed notches 162, adapted for slidable engagement with the arms 164 of guide member 166, which in turn is supported by sleeve 168, embracing vertical web 132 of ceiling tee T.

It is clear that downward movement of vane contacting element 160 will progressively open communication between conditioned air plenum chamber 114 and air discharge slots 136, until the fully open position shown in phantom in FIG. 9 is reached. Any intermediate position of the vanes 142, inducing ambient air in the direction of arrows B (through inlet ports not shown) into the gaps between vanes 142 and walls 120. The combined air then emerges from discharge slots 136 in the horizontal distribution pattern dictated by the discharge slot configuration.

The induction air diffuser 110 obviously may be installed in a ceiling just as simply as, and in the same manner as, air diffuser 10 described above.

Illustrative and non-limiting examples of this invention have been disclosed fully herein; the inventive concepts represented are defined by the appended claims.

What is claimed:

1. An air diffuser of the elongated-slot type for mounting on a ceiling tee bar, comprising:

an elongated air plenum chamber housing;

at least one elongated vertically disposed outwardly flaring lower side wall, depending from the corresponding side wall of said air plenum chamber housing and defining the outside of an elongated air discharge slot of the air diffuser;

a pair of vertically disposed transverse end plates, one at either end of the air diffuser, each of said end plates having a centrally located notch adapted to fit over and engage the vertically upstanding web of the ceiling tee bar, so that when the air diffuser is mounted in place, the vertical web and one horizontal flange of the ceiling tee bar appear normally as in other areas of the ceiling, but help to hide from view the operating mechanism of the diffuser;

at least one elongated air flow control vane pivotally mounted at its upper end, with its lower free end resiliently urged toward one side of the elongated air discharge slot to a position in which said air flow control vane cuts off communication between said air plenum chamber housing and the air discharge slot; and

means for selectively positioning the free lower end of said air flow control vane and variably opening communication between said plenum chamber housing and the air discharge slot, thereby regulating the effective air outlet opening.

2. An air diffuser as defined in claim 1, wherein each of two of said outwardly flaring lower side walls define the outer side of an elongated air discharge slot, while the center assembly straddles the web of the ceiling tee bar and defines the inner side of an elongated air discharge slot, so that a pair of mirror-image oriented elongated air discharge slots are formed, and wherein a pair of said air flow control vanes, one for each air discharge slot, are controlled by one and the same means for selectively positioning the free lower ends of said air flow control vanes.

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3. The air diffuser defined in claim 1, wherein said means for selectively positioning the free lower end of said air flow control vane comprises:
a pneumatic motor, mounted within said elongated air plenum chamber housing;
a thermostat operatively connected to and control-

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ling said pneumatic motor; and
at least one vane contacting element, adapted to bear against and position said air flow control vane when said vane contacting element is lowered or raised by said pneumatic motor.

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