July 6, 1937. A. FEINBERG 2,086,022

VENTILATING SYSTEM

Filed March 20, 1936 2 Sheets-Sheet 1

Fig. 1.

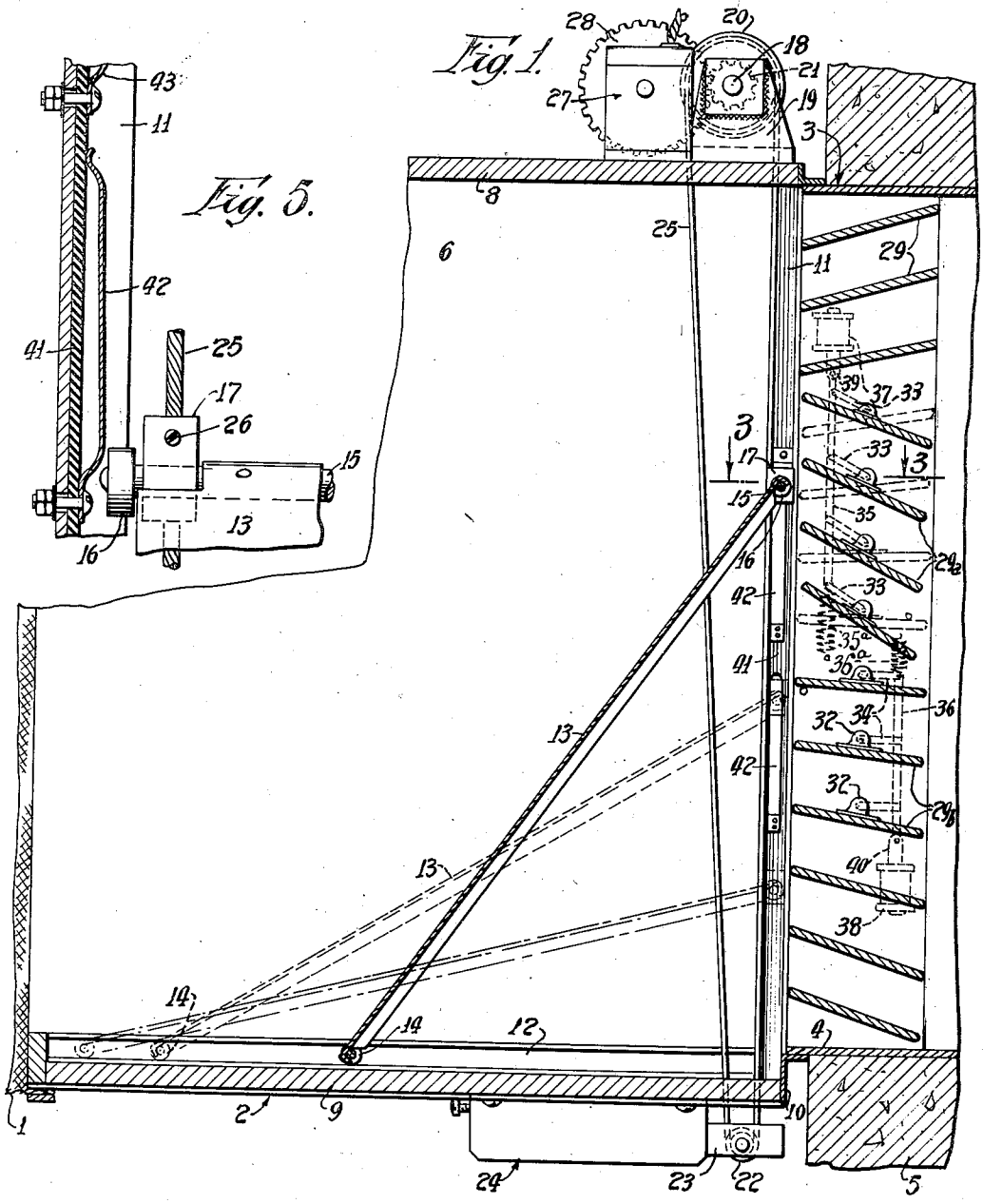


Fig. 5.

Inventor:
Archie Feinberg,
By: Arthur W. Wilcox,
Attorney.

Witness:
E. Camporini

July 6, 1937. A. FEINBERG 2,086,022

VENTILATING SYSTEM

Filed March 20, 1936 2 Sheets-Sheet 2

Fig. 2.

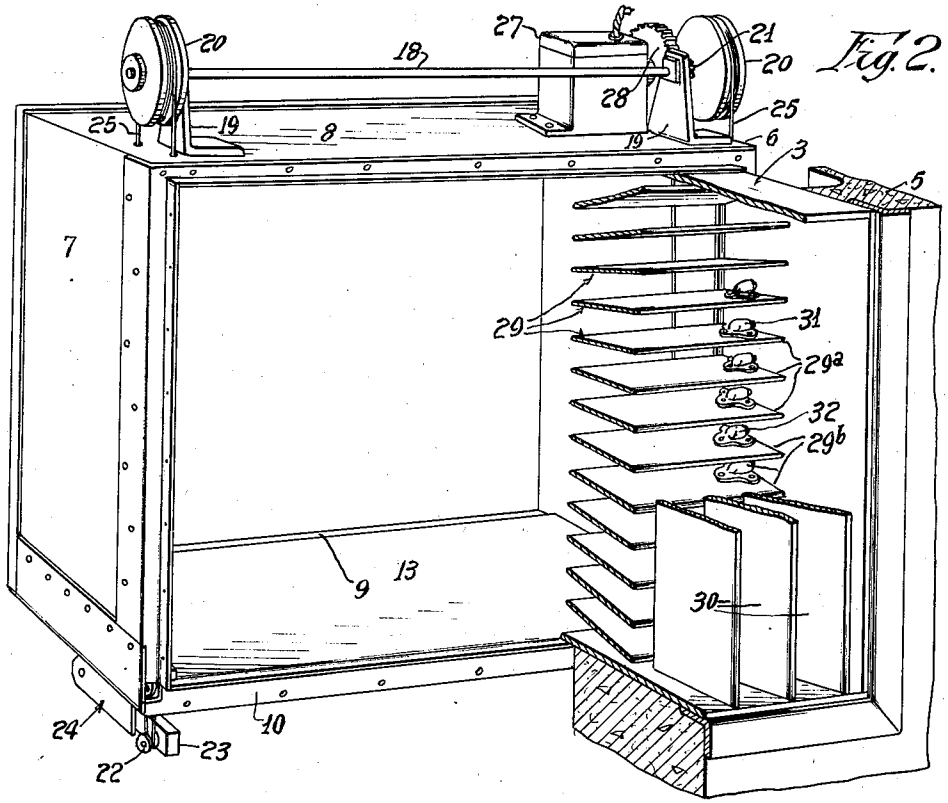
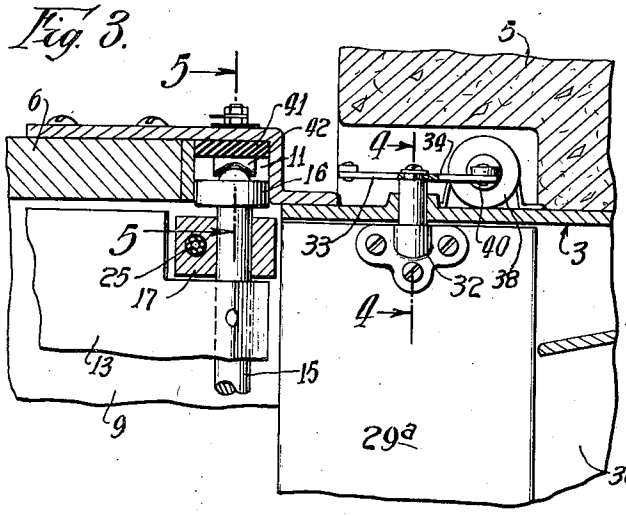


Fig. 3.



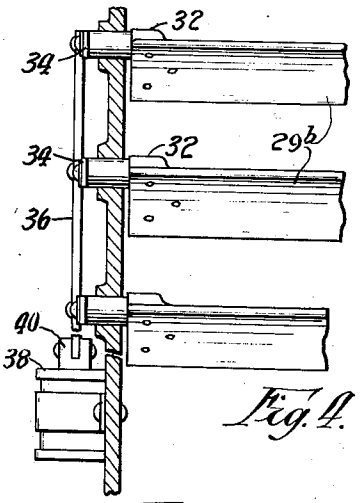


Fig. 4.

Witness:
E. Camporini

Inventor:
Archie Feinberg,
By: Arthur McCulloch
Attorney.

Patented July 6, 1937 2,086,022

UNITED STATES PATENT OFFICE

2,086,022

VENTILATING SYSTEM

Archie Feinberg, Chicago, Ill., assignor to United States Air Conditioning Corporation, Minneapolis, Minn., a corporation of Minnesota

Application March 20, 1936, Serial No. 69,863

12 Claims. (Cl. 98—37)

This invention relates to improvements in ventilating systems and it consists of the matters hereinafter described and more particularly pointed out in the appended claims.

The improvements herein are more particularly concerned with the discharge end of a ventilating system air duct in which means are provided for reducing the volume of blast without materially reducing the velocity thereof. Such means usually includes a plate-like equalizer member, movable to close off desired portions of said discharge end to reduce the volumetric area thereof.

However, when such area is varied the diffusing means now employed in connection therewith does not direct the blast for a uniform distribution thereof according to said varied area and the volume of the blast discharged.

One of the objects of the present invention is to provide improved air diffusing means associated with an air duct discharge end of variable area and which means operates to adjust itself to maintain full diffusion efficiency regardless of the volumetric area of said discharge end.

Another object of the invention is to provide an improved diffusing means of this kind which is simple in construction and is controlled by the position of the equalizer member in the discharge end of the duct for determining the area thereof and consequently the volume of the air blast discharged therefrom.

The above mentioned objects of the invention, as well as others, together with the several advantages thereof, will more fully appear as I proceed with my specification.

In the drawings:

Fig. 1 is a longitudinal vertical sectional view through the equalizer casing and diffuser of a ventilating system embodying the preferred form of the invention.

Fig. 2 is a perspective view of the equalizer casing from the front thereof with a part of the associated diffusing means shown in sectional perspective.

Fig. 3 is a horizontal detail sectional view through a part of the equalizer casing and diffusing means, on an enlarged scale as taken on the line 3—3 of Fig. 1.

Figs. 4 and 5 are detail vertical sectional views through parts of the diffusing means and equalizer casing respectively, as taken on the lines 4—4 and 5—5 respectively of Fig. 3.

Referring now in detail to that embodiment of the invention, illustrated in the accompanying drawings, 1 indicates one end of the air duct of a ventilating system, the other end of which is operatively connected to the discharge side of a blower, not shown. The first mentioned end of the duct is connected to one end of an equalizer casing 2, the other end of which is connected to the casing 3 of an air diffusing means. Ordinarily, said casing 3 is set in an opening 4 in a building wall 5 so as to discharge into the room or other building space to be ventilated.

As shown herein, the equalizer casing is of a rectangular cross section. It includes upright side walls 6—7 respectively, and horizontal top and bottom walls 8—9 respectively. At the front end of the respective walls of the equalizer casing is a structural frame 10 of angle or like bars. Along the side members of this frame, at the front end thereof, are guide grooves 11 and along the junction of the side walls with the bottom walls are guide grooves 12. The purpose of said grooves will soon appear.

The casing 2 has substantially the same cross section and volumetric area as the duct 1. Thus under certain conditions, when the blower of the system (not shown) is in operation, an air blast of maximum volume and velocity is delivered through the equalizer casing. However, assume that outside air is being taken into the blower. Should the temperature of such air drop, it is apparent that not so great a volume of air is desired for cooling and ventilating purposes.

To meet all conditions, I provide in the casing 2, means for changing the area of the discharge end of the casing to reduce the volume of the delivered air blast, without materially reducing the velocity thereof.

It is apparent that if the desired reduced volume be attained only by reducing velocity through lower blower speed, certain portions at the rear of the space being ventilated will be without air turbulence or motion. The reason therefore, is that the air blast cannot carry as far back as desired, due to such reduced velocity.

The means before mentioned for reducing volumetric area of the discharge end of the duct, as defined by the outlet of the equalizer casing, preferably constitutes a plate-like equalizer member 13 of a width and length approximating the width and length of the casing 2. This length may be less than the height of the casing. The rear end of said member 13 is provided at each side with rollers 14 which run in the guide grooves 12 before mentioned. The front end of said member carries a shaft 15 on the ends of which are rollers 16 which run in the grooves 11 for guided movement. Rotatively mounted on said shaft near said rollers, are cable clamping

blocks 17. When the rollers 16 move up or down in the guide grooves 11 and when the rollers 14 move longitudinally in the guide grooves 12, it is apparent that the front end of the equalizer member 13 will travel in a straight line perpendicularly and the rear end will travel in a straight line horizontally. The angle which said member assumes, of course, is determined by the positions of its front and rear ends.

The said equalizer member 13 is so proportioned with respect to the casing that in one instance it will lie substantially flat upon the bottom thereof as shown in Fig. 2. At this time the full volumetric area of the casing is available for the discharge of the air blast in the duct at the maximum velocity. When the front end of the equalizer plate or member is in its highest position, it will extend at an angle of about 45°. This will close off approximately 60% of the volumetric area of the discharge end of the casing, from the bottom and upward thereof, leaving a volumetric area of only 40% available for discharge purposes. It is apparent that these percentages may be varied as desired by changing the proportions before mentioned. It is also apparent that the percentages of area for the discharge end, may also be varied by bringing the front end of the plate or member 13 into the desired elevation as determined by the position of the associated rollers 16 in the guides grooves 11.

Movement may be imparted to said plate or member 13 in any suitable manner, either mechanically or manually. It is desired, of course, that this movement be mechanical and occur at the time of and be controlled by the change in temperature in the space being ventilated. As shown herein, the mechanical means for moving said member is as follows:

Extending transversely of the front end of the top wall of the equalizer casing, is a cross shaft 18. Said shaft is journalled in suitable brackets 19 on the top wall 8 of the casing 2 and on each end of this shaft is a drum 20. On that end of said shaft 18 associated with the side wall 6 of the equalizer casing is a pinion 21. At the bottom of the front end of the casing are pulleys 22, one for each drum. Each pulley is carried on one end of an arm 23 of an associated cable tensioning mechanism 24.

A cable 25 is wrapped around each drum 20 and one end of each cable extends down through an opening in the top wall of the casing and is then secured in the associated block 17. The other end of each cable passes through suitable openings in the top and bottom walls of the casing and is then wrapped around the associated pulley 22. Each cable then extends up through another opening in the bottom wall of the casing so as to be attached to its associated block 17. A screw 26 (see Fig. 5) carried by the block 17, secures the ends of each cable to its respective block. The mechanisms 24 before mentioned operate through the arms 23 to keep the cables 25 taut.

When the shaft 18 is rotated in one direction or the other, it is apparent that the front end of the equalizer member 13 will move upwardly or downwardly in a straight line with respect to the grooves 11, to close off the desired part of the bottom end of the volumetric discharge area of the casing.

To drive the shaft 18 in the proper direction, I provide an electrically operated motor 27 of a kind including a shaft that rotates slowly through a predetermined number of degrees, either backward or forward. Such motors, which operate on low voltage, supplied from a transformer, may be purchased in open market and are designed to provide mechanical motion in true proportion to the demand of temperature. A motor of this kind, known under the trade name of "Modutrol Motor" is well adapted for this use, as it offers a practical means of obtaining true modulation of heat, cold, humidity or air flow.

Ordinarily the shaft of said motor is provided outside of the casing with an arm but in adapting said motor to the desired use herein, this arm is removed and a gear 28 is substituted. The motor is so positioned on the top wall of the casing that said gear meshes with and drives the pinion 21 on the shaft 18.

The motor 27 may be electrically connected to and is controlled by a thermostatic switch (not shown) centrally arranged at a convenient point in the space being ventilated. Thus should the temperature in said space be such as to require an air change in said space, said switch will cause energization of the motor 27. Thus the equalizing member 13 will more or less open up or close off the discharge end of the casing as the case may be. Instead of a temperature controlled switch a manually controlled switch may be used.

It is, of course, apparent that some means is desirable for diffusing the issuing air blast so that it will be distributed evenly over the space being ventilated, otherwise the blast will be too localized. Therefore, it is advisable to use a modification of the diffuser shown in the Feinberg and Halvorsen Patent No. 1,601,815 of October 6, 1926. The structure of said patent includes sets of deflectors whereby the blast of air may be directed both horizontally and vertically. These louver-like deflector blades were set as to angularity and were changed manually. In my prior Patent No. 2,021,408 of November 19, 1935, such a diffuser is shown in connection with a blast controlled damper arranged in the discharge end of the duct.

In the present instance, I employ the principles of the diffuser shown in the Feinberg and Halvorsen patent before referred to, but have incorporated in the diffuser, certain modifications which make the same operate more efficiently as to directional characteristics when the volumetric area of the discharge end is reduced.

In the casing 3 of the diffusing means, are provided inner and outer sets of louver-like deflectors 29 and 30 respectively. As shown herein, the deflectors of the inner set are arranged horizontally and the deflectors in the outer set are arranged vertically. These deflectors are pivotally mounted at their ends in the associated walls of the casing 3 so that they may be disposed at those relative angles providing the best diffusion of air. The pivots for said deflectors may be disposed at a point between said edge as desired. As herein shown, the pivots for certain of the deflectors 29, arranged in groups bearing the numerals 29*a*—29*b*, are disposed midway between the edges of the deflectors and have bearing in the side walls of the casing 3. The pivots for each group of such deflectors are indicated at 31 and 32 respectively. Secured to said pivots 31 and 32, outside of one wall of the casing are arms 33 and 34 respectively. The arms 33 are connected together by a link 35 and the arms 34 are connected together by a link 36. It is apparent that when either of the links 35—36 receives an endwise movement, the deflectors of the associated group are caused to change their positions from one angular position to another.

Movement of the links 35—36 and associated arms and deflectors is in accordance with certain angular positions of the member 13 and as shown herein, is produced electrically although it may be produced mechanically. When produced electrically, as shown herein, there is mounted on the outside of the diffuser casing, solenoids 37—38 respectively, each having an armature 39 and 40 respectively. The armature 39 is connected to the top end of the link 35 and the armature 40 is connected to the bottom end of the link 36.

In that groove 11 associated with the side wall 6 of the casing 2 is mounted a strip of insulation 41 and on said strip are provided yielding contacts 42 and 43 respectively. These contacts are electrically connected with the solenoids 37 and 38 respectively. The yielding contacts are so disposed that when one of the rollers 16 moves upwardly or downwardly in the associated groove 11, the end of the shaft 15 will engage said contacts. When such contact is made, this will energize the associated solenoid to swing those deflectors 29*a* or 29*b* connected thereto into the desired angular position. In this respect, it is pointed out that as the deflectors 29*a*—29*b* actuated by said solenoids are pivoted at points between their edges, this substantially balances said deflectors for movement. Springs 35*a*—36*a* shown in dotted lines in Fig. 1 may be connected to the links of the groups of deflectors 29*a*—29*b* to return them to their normally set position when the associated solenoids become deenergized.

The contacts 42—43 are so spaced on the insulation strip 41 as to correspond with predetermined positions of the roller 16 operating in that groove 11 associated with the side wall 6 of the casing. As shown herein these positions of said contacts are such that the contact 42 is engaged by the end of the shaft 15 to energize the solenoid 38 when the rollers 16 have reached a point about ⅓ of their movement upwardly in the grooves 11. The contact 43 is positioned so as to be engaged by the shaft end when the rollers 16 have reached a point about ⅔ of their movement upwardly in the grooves 11.

In the operation of the structure as described, assume that the equalizer member 13 is disposed at the bottom of the casing 22. With the blower in operation, the maximum area for the discharge of the blast of air, is available at the end of the casing 2 and diffuser 3. Assume now that the temperature in the space being ventilated drops so as to require a reduction in volume of air delivered into said space. By reason of the operation of the switch before mentioned, the motor 27 is energized and starts into operation and will drive the shaft 18 through as much of a revolution as will bring the shaft 15 into a position wherein one of its ends will engage the contact 42. This swings the member 13 into a position closing off a predetermined bottom portion of the discharge end of the casing so that the effective area of the discharge is reduced to result in a reduction in volume. At this time, the solenoid 38 becomes energized to swing the associated group of louvers 29*b* into a new angular position. With the change in volumetric area for the blast discharge, the static pressure in the duct changes therewith so as to be reflected in the dynamic pressure produced by the blower. Thus while volume is reduced, velocity remains constant.

In this reduced volume, it is apparent that the equalizer member 13 operates to deflect the bottom portion of the air blast upwardly. This portion of the blast so deflected, engages the group of louvers 29*b* actuated by solenoid 38 and this deflects the blast portion downwardly. Thus even though the volume of the blast be reduced, the distribution of the blast remains constant and even as before.

Assume now that the temperature in the space being ventilated is again reduced. Through the thermostatic switch before mentioned, the motor 27 may again be energized to cause the member 13 to be swung into a position so that the shaft end engages the contact 43. When said shaft end leaves the contact 42, this deenergizes the solenoid 38 so that the group of louvers 29*b* associated therewith return to their originally set positions. When the shaft end engages the contact 43, this energizes the solenoid 37 to swing its associated group of louvers 29*a* into a new angular position. In this position of the parts, the effective volumetric discharge area is further reduced, the static pressure in the duct is increased so as to be reflected in a reduction of the dynamic pressure produced by the blower. With the member 13 in its new angular position, it acts as a steeper deflector for the bottom portion of the blast discharged. With the louvers 29*a* in their new position, they will act to deflect the bottom portion of the blast downwardly as before to maintain even distribution.

Should the temperature in the space being ventilated again drop, the member 13 moves into its maximum angular position which gives the greatest reduction of volumetric discharge. This position, of course, further increases static pressure which is reflected in a further reduction of the dynamic pressure produced by the blower so that while the volume may be reduced, the velocity remains constant. If desired, another group of the louvers 29 may be arranged to operate as before described when the member 13 is in its maximum position, reducing the effective discharge area of the casing 2, to that permitting the discharge of an air blast of smallest volume.

When the temperature in the space being ventilated rises, the motor 27 will be energized to run in the other direction to cause movement of the member 13 so as to increase the area of discharge. In this movement of the said member 13 into further open position, the static pressure becomes correspondingly reduced which is reflected in the increased dynamic pressure produced by the blower to maintain constant velocity.

It is apparent that with the arrangement described, when the volume of the blast is reduced or increased, the velocity of the blast remains constant and at certain blast volumes, the distribution of the blast remains constant. Thus an efficient ventilation is afforded in connection with different temperature changes in the space being ventilated.

While in describing the invention, I have referred in detail to the form, arrangement and construction of certain of the parts thereof, the same is to be considered only in the illustrative sense so that I do not wish to be limited thereto except as may be specifically pointed out in the appended claims.

I claim as my invention:

1. In combination with the discharge end of the air duct of a ventilating system, an air diffusing member associated with said discharge end and mounted for movement into different diffusing angles, means operable to change the effective area of said discharge end, and means operating automatically in conjunction with said first men-

tioned means for changing the angular position of said diffusing member, at least in part when the effective area of said discharge end is changed.

2. In combination with the discharge end of the air duct of a ventilating system, an air diffusing member associated with said discharge end and mounted for movement into different diffusing angles, means operable to change the effective area of said discharge end, and means controlled by and operating in conjunction with said last mentioned means as the same changes the effective area of said discharge end for changing the angular position of said diffusing member.

3. In combination with the discharge end of the air duct of a ventilating system, an air diffusing member associated with said discharge end and mounted for movement into different diffusing angles, means movable into different positions to change the effective area of said discharge end, and means controlled by said last mentioned means when the latter is in certain positions for changing the angular positions of said diffusing member.

4. In combination with the discharge end of the air duct of a ventilating system, air diffusing means at said discharge end and including a plurality of deflecting members, at least some of which are mounted for movement into different deflecting angles, means operable to determine the effective area of said discharge end, and means operating automatically for changing the angle of certain ones of said some of said deflecting members as a result of the movement of said effective area determining means into positions providing different effective areas for said discharge end.

5. In combination with the discharge end of the air duct of a ventilating system, air diffusing means at said discharge end and including a plurality of deflecting members, at least some of which are mounted for movement into different deflecting angles, a member in said discharge end and operable to close off successive portions of said end, from the bottom up, to determine the effective area thereof, and means operating automatically as said member is operated into different positions to close off successive portions of said discharge end for changing the angle of certain of said deflecting members.

6. In combination with the discharge end of the air duct of a ventilating system, air diffusing means at said discharge end and including a plurality of deflecting members, at least some of which are mounted for movement into different deflecting angles, means in said discharge end and operable to close off successive portions of said end, from the bottom up, to determine the effective area thereof and for deflecting the air blast in the duct toward the open top portion of said discharge end, and means operating automatically as said means in said discharge end is operated into different positions to close off successive portions of said discharge end, for changing the angle of certain of said deflecting members.

7. In combination with the discharge end of the air duct of a ventilating system, air diffusing means at said discharge end and including sets of vertical and horizontal louver-like deflecting members, at least certain of said members in one of said sets of deflecting members being mounted for movement into different deflecting angles, means in said discharge end and operable to determine the effective area thereof, and means operating automatically as said means in said discharge end is operated into different positions providing different effective areas for said end for changing the deflecting angle of said certain of said louver-like deflecting members in said one set thereof.

8. In combination with the discharge end of the air duct of a ventilating system, air diffusing means at said discharge end and including sets of vertical and horizontal louver-like deflecting members, means in said discharge end and operable to determine the effective area of said discharge end, and means operating automatically as a result of the movement of said means in said discharge end into postions changing the area of said discharge end for changing the deflecting angle of certain of the louver-like deflecting members in the horizontal set thereof.

9. In combination with the discharge end of the air duct of a ventilating system, means in said end of the air duct and movable into different positions for controlling the effective area of said end, an air diffuser for said discharge end including a deflector member for changing the direction of a part of the air blast from said discharge end, and electrical means for moving said deflector member into a changed position and which electrical means is controlled by said first mentioned means in certain positions thereof.

10. In combination with the discharge end of the air duct of a ventilating system, a member in said end of the duct and movable into different positions for controlling the effective area of said end, an air diffuser in said discharge end including a plurality of deflectors for changing the direction of a part of the air blast from said discharge end, and electrical means for successively changing the angular position of certain of said deflectors in accordance with the effective area of said discharge end and which electrical means is controlled by said member in said discharge end in certain positions thereof.

11. In combination with the discharge end of the air duct of a ventilating system, means in said end of the duct and having a portion movable in a definite path so as to control the effective area of said end, air diffusing means associated with said end and including a deflector member for changing the direction of a part of the blast from said discharge end, electrical means connected to said deflector member for changing the angular position thereof, and a contact arranged adjacent said path and adapted to be engaged by a part movable with said first mentioned means for controlling said electrical means.

12. In combination with the discharge end of the air duct of a ventilating system, means in said end of the duct and having a portion movable in a definite path so as to control the effective area of said end, an air diffusing means for said end of the duct and including sets of horizontal and vertical louvers for directing the blast from said end in the desired direction, electrical means for moving certain louvers in one of said sets for changing the angular positions thereof, and contacts arranged along said path and each associated with different louvers in the said one set and adapted to be successively engaged by a portion movable with said first mentioned means for energizing and deenergizing said electrical means to successively change the angular positions of said different louvers in said one set.

ARCHIE FEINBERG.