Nov. 19, 1935. A. FEINBERG 2,021,408

VENTILATING SYSTEM

Filed Oct. 5, 1931

Fig. 1.

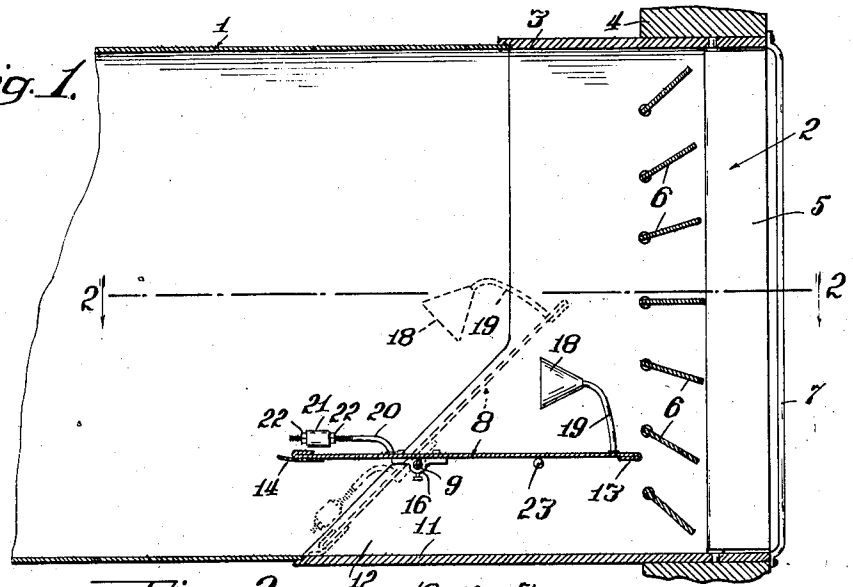


Fig. 2.

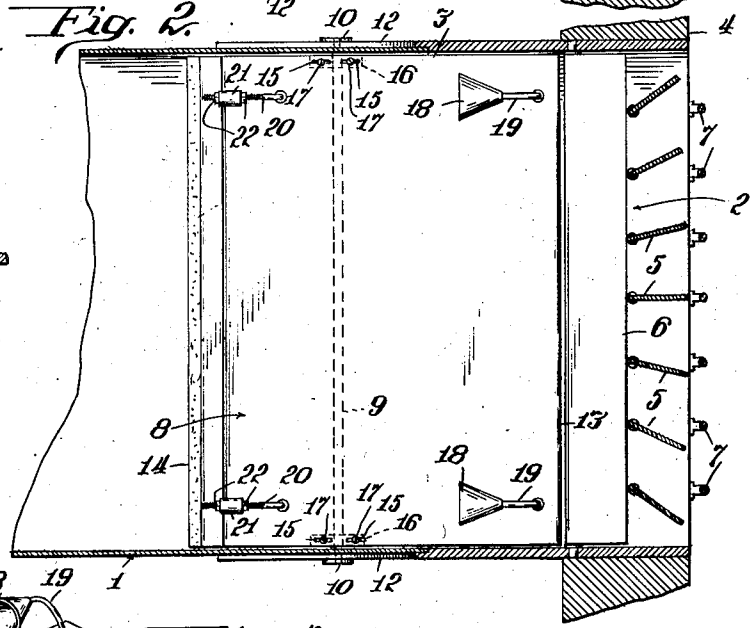


Fig. 4.

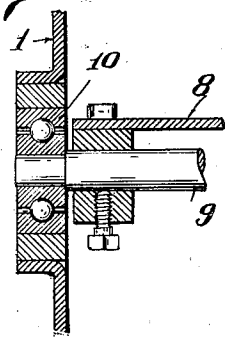
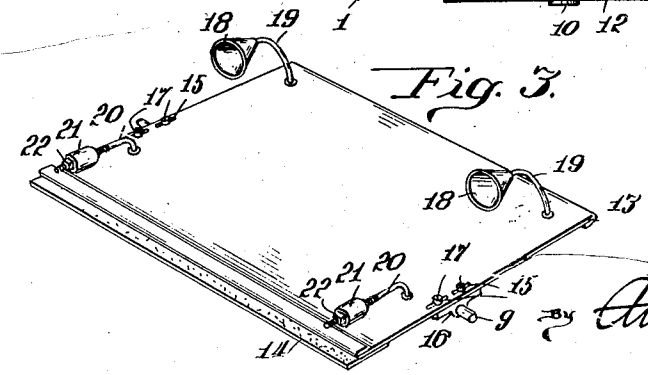


Fig. 3.



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2,021,408

VENTILATING SYSTEM

Archie Feinberg, Evanston, Ill.

Application October 5, 1931, Serial No. 566,908

12 Claims. (Cl. 98—40)

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 invention is more especially concerned with that type of ventilating system including an air delivery duct and a diffuser or deflector means at the discharge or outlet end thereof. Such systems are largely used in theaters or like places of public gatherings, and are usually disposed in one of the upright walls thereof. In theaters, this discharge or outlet end is often disposed in that wall having the arched opening for the stage and under normal temperature conditions, the associated blower runs at its maximum to deliver air as far back as the last row of seats in the auditorium as it is the usual custom to make a complete air change about every three minutes.

For illustration purpose, an auditorium having thirty rows of seats requires an air apparatus having a 30,000 cubic foot capacity per minute. In order to obtain proper distribution of this maximum quantity of air, through the usual diffusing means provided at the discharge end of the duct, said means must have a square foot area permitting the establishment of an air velocity approximating 1,500 feet per minute. With an outside air temperature of about 70° a reduction in the volume of air delivered, is necessary for the comfort of the patrons. A reduction of 50% of the maximum volume of air passing through such a diffuser will result in a drop in velocity to about 750 feet per minute and this velocity is insufficient to carry the reduced volume to the rear rows of seats in the auditorium.

It is now the practice when the temperature of the outside air which the blower delivers through the duct falls, to slow down the speed of the blower through its associated driving motor or otherwise. With such a procedure, the volume of the air, as well as its velocity, is reduced in proportion, so that when the discharge end is positioned relatively high, the air thus discharged does not reach the back row of seats, but only reaches some intermediate row. With such a condition, certain of the patrons in the auditorium feel little or no air movement, while others complain as to the coolness of the air delivered.

Thus by cutting down the velocity and volume of the air certain objections arise because the ventilation is spotty, as certain portions of the auditorium are unventilated and warm while others are over-ventilated, and too cool.

The primary object of the invention is to provide a simple and efficient means of an automatic character and which is associated with the discharge end of the air delivery duct whereby the air discharged may be reduced in volume without effecting its velocity, so that the air movement is even over the entire room or auditorium to provide the desired uniform temperature condition.

Another object of the invention is to provide means which operates automatically as the air velocity and volume in the duct is reduced, to restrict the effective area of the discharge end, thus stepping up the reduced velocity in proportion without effecting the volume, said means acting so soon as the maximum velocity and volume is again established in said duct, as when the blower is speeded up to offset a rise in temperature of outside air, to again increase the area of said discharge end.

Still a further object of the invention is to provide a means of this kind which may be formed as a part of unitary structure of the diffusing or deflector means, thus reducing manufacturing and installation costs.

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

In the drawing:—

Fig. 1 is a vertical sectional view through the diffusing discharge end of a ventilating system embodying my invention.

Fig. 2 is a horizontal sectional view through the same as taken on the line 2—2 of Fig. 1.

Fig. 3 is a perspective view of a certain unbalanced damper forming a part of the invention.

Fig. 4 is a detail vertical sectional view through one bearing end of the damper shown in Figs. 1 and 2.

In general, my invention contemplates the provision in a ventilating duct and in close proximity to the diffusing discharge end thereof, of a means which is actuated when the maximum volume of the air is reduced, to restrict the effective area of said end so that the velocity is stepped up and so soon as the maximum volume is again reestablished, said area is increased in proportion. The before mentioned means includes an unbalanced damper or member so formed that the maximum velocity of the air blast in the duct will hold said member in the plane of the line of draft, the other end of said member being so formed that so soon as said velocity is reduced, said member assumes a position restricting the area of said outlet end

so that the velocity is stepped up without effecting the reduced volume.

Referring now in detail to that embodiment of the invention, illustrated in the accompanying drawing:—1 indicates one end of the duct of a ventilating system, the other end of which is preferably connected with the discharge side of a motor driven blower, not shown. Ordinarily such a blower which has its inlet connected to outside atmosphere is capable of different speeds for delivering different velocities and volumes of air into said duct.

Said end 1 of said duct is connected up to a suitable air diffusing or deflecting means 2 which is preferably of the type shown in the Feinberg and Halverson Patent #1,601,815 of October 5, 1926, which includes sets of deflectors whereby the blast of air may be directed both horizontally and vertically.

The duct 1 is made of sheet metal and is of a rectangular cross section, while the diffuser 2 includes an open rectangular casing 3 set in a suitable opening in a building wall 4, the duct being connected to the casing in any suitable manner.

In the front half of the casing 3, are sets of front and rear deflectors 5 and 6 respectively, the former in this instance being perpendicularly disposed, and the latter being horizontally disposed. The deflectors in each set are pivotally connected at their ends in the associated walls of the casing so that they may be disposed at those relative angles providing the best diffusion of air. As shown in Fig. 1, the deflectors of the horizontal set are disposed to direct the air upwardly and downwardly from the center one, while those in the perpendicular set are disposed to direct the air in both directions laterally from the center one. Preferably but not necessarily so, the front of the casing may be provided with any suitable grille 7 to conceal from view the said deflectors above mentioned.

In the casing to the rear of the deflectors 6 is located a damper mechanism which is automatic in its action so that when the velocity of the air in the duct is reduced from the maximum, said mechanism operates to restrict the effective area of the casing and when said maximum velocity is restored, said area is increased and such means is as follows:—

8 indicates as a whole, a flat plate-like unbalanced damper having a shaft 9 secured thereto, and the ends of said shaft are journalled in antifriction bearings 10, in turn supported in any suitable manner. So that the damper mechanism and the diffuser with which it is associated may be made as a unitary structure for ease in manufacturing, shipping, installing and adjusting, the bottom wall 11 and the rear bottom parts of the side walls 12 of the casing are made of a greater depth so to enclose the damper mechanism when said damper is in that position which is hereinafter termed, a "closed" position. With such a structure the antifriction bearings 10 are set in portions of said side walls as is apparent from Figs. 1 and 4 of the drawing.

The damper as herein shown is of a width approximating the width of the inside of the casing and is of such a length that when it is in its angular closed position, it acts to close off the bottom half of the casing. The damper is beaded over at its top or outer end as at 13 for stiffness and its bottom or inner end is stiffened in a similar manner and is provided with a sealing strip 14 of felt or the like.

The damper is unbalanced in that the shaft 9 is disposed off-center with respect to the top and bottom (or inner and outer) ends thereof, so that the damper may be compared to a lever of the first class having a long power arm and a shorter load arm. Fixed near the ends of said shafts, in line with pairs of slots 15 in opposite margins of the damper are blocks 16 and screws 17 pass through said slots into said blocks whereby the respective lengths of said arms may be adjusted during assembly and even during installations when necessary.

Secured to the top surface of the long arm of the damper, near the bead 13 are funnel-like wind cups 18 supported from the damper by means of arms 19. These cups and arms are so formed that when the damper stands in a horizontal open position, they face directly in the line of the blast and when the damper stands in the inclined closed position, they present but little of their interior in the line of said blast. Secured to the top surface of the short arm of the damper, near its end, are threaded rods 20 disposed parallel with the damper and upon which weight members 21 are mounted for adjustment, there being nuts 22 on said rods to secure the weights in the adjusted position.

The weights are so disposed that when no forced draft of air is passing through the duct, the damper stands in the inclined position shown in dotted lines in Fig. 1 with its top end disposed in about the median horizontal plane of the diffuser so that only its top half is effective as an outlet, said top end in this position being spaced rearwardly from the deflectors 6.

The blower supplying the blast of air is capable of running at various speeds and this is usually provided by a multispeed motor or a clutch between a single speed motor and the blower shaft. At the high speed of the blower the maximum velocity and volume of air is provided in the duct and in the lower speed, the velocity and volume is reduced in proportion.

Assume now with the parts shown in dotted lines in Fig. 1, and the motor has been started to drive the blower at its maximum speed. The blast of air now rushes toward the discharge end of the duct. The blast now impinges upon the rear or outer end of the damper which as before described is of the greater area and carries the wind cups. The blast acting upon said part of the damper tends to depress the same and this soon brings the wind cups into such a position that their open ends face into the blast. This assists said part of the damper in overcoming gravity effect of the other part of the damper so that the damper swings into the horizontal position shown in full lines in Fig. 1 so that the damper is now "open" and disposed in the line of draft.

The depressing action before mentioned, is sufficient to overcome the action of the weights on the inner or front end of the damper and with the long arm of the damper, trailing in the direction of the blast, the damper as a whole presents only its thickness to the blast. As this thickness is negligible, it is apparent that the blast has a substantially unobstructed outlet or discharge through the diffuser. In its passage out through the same, it is apparent that the deflectors 5 and 6 will direct the blast in the desired direction. To prevent any tendency of the damper to flutter in the blast, stop pins 23 may be provided on each side wall of the casing for engagement by the long arm of the damper as best shown in Fig. 1.

With the blower operating at its maximum, it is

apparent that the moving air is delivered to all parts of the room or auditorium as desired. Assume now that a drop in temperature in outside air has taken place and that this air, delivered in full volume and velocity renders the room or auditorium too cool for comfort of the patrons.

Heretofore, this condition was sought to be overcome by reducing the blower speed but this not only reduced the volume of the blast but also the velocity thereof so that those patrons in only a part of the room or auditorium received the benefits of the blast and those to the rear thereof complained because of the rise in temperature in their vicinity. Thus with the apparatus at present in use, it is impossible to provide efficient ventilation by reducing the volume and velocity of the blast.

In connection with my improved system, so soon as the blower speed is reduced, the velocity and volume is reduced as heretofore when the weight of the inner end or shorter end of the damper overcomes the push or thrust on the outer end or longer arm of the damper so that the damper swings into the inclined closed position shown in Fig. 1. When in this position, the cushion strip 14 will engage the bottom wall of the casing and the beaded edge 13 thereof will stand in a position about midway the height of the diffuser and a short distance to the rear thereof thus reducing or choking the effective discharge area of the diffuser. With the blower running, at say half speed, and with the volume and velocity of the blast reduced in proportion, the same does not have that thrust necessary to swing the damper into the horizontal full open position. Said blast however, in its state of reduced velocity and volume, is directed by the damper toward the open top half of the diffuser and as the area is thus reduced, the velocity of the blast but not the volume is increased in proportion with the result that a uniform air movement is afforded for patrons in all seats of the auditorium.

Should outside atmospheric temperatures rise, the blower is again speeded up to its maximum and the velocity of the blast acts to automatically swing the damper into full open position in the manner before described.

After the damper has been adjusted during installation it is entirely automatic in operation, opening and closing in accordance with the velocity of the blast of air in the duct, and in one instance maximum volume and velocity of air is delivered and in another instance a reduced volume is delivered without a reduction in velocity. After being once adjusted the mechanism described requires no attention on the part of an operator.

The invention may be readily employed in connection with ventilating systems now in use merely by the provision of exchanging the diffuser casing embodied in said system for a new one embodying the mechanism above described.

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

I claim as my invention:—

1. In combination with the discharge end of the air duct of a ventilating system adapted to have an air blast therein variable from one velocity and volume to another and lesser velocity and volume and vice versa and means associated with said discharge end and automatically operable under blast action for maintaining the first mentioned velocity of the blast discharged from said discharge end when said blast has said lesser velocity and volume in said duct said means and end being so formed as to prevent closing off of said end at a minimum velocity of air blast in said duct.

2. In combination with the discharge end of the air duct of a ventilating system adapted to have an air blast therein variable from one velocity and volume to another and lesser velocity and volume, a damper associated with said discharge end and mounted on a horizontal axis, said damper having an area to one side of said axis greater than that on the other side, adjustable weight means on said last mentioned side of said damper to increase its gravity effect in the presence of an air blast in said duct of a lesser velocity and volume and air cups on the first mentioned side of said damper and facing toward the direction of said blast and assisting said side of the damper in the presence of a blast of a higher velocity and volume to overcome the weight of said other side so that said damper swings into the plane of the blast.

3. In combination with the discharge end of an air duct of a ventilating system, a casing at said end of the duct and including air diffusing means and a member in said casing adjacent said means and movable in accordance with the velocity of and by said air blast for determining the effective area of said diffusing means but being incapable of entirely closing off said diffusing means.

4. In combination with the discharge end of an air duct of a ventilating system, a casing in said end of the duct and including air diffusing means, a damper pivotally mounted in said casing adjacent said diffusing means and having a greater area to one side of said pivot than to the other side thereof and which last mentioned side is overweighted with respect to the first mentioned side and air catching means on said greater area part of said means.

5. In combination with the discharge end of an air duct of a ventilating system, a casing in said end of the duct and including air diffusing means, a damper pivotally mounted in said casing adjacent said diffusing means and having a greater area to one side of said pivot than to the other side thereof, air catching means on said first mentioned side of said damper and adjustable weight means on the said second mentioned side of said damper.

6. In combination with the discharge end of the air duct of a ventilating system adapted to have an air blast therein variable from one velocity and volume to another and lesser velocity and volume, a damper associated with said discharge end and mounted on a horizontal axis, said damper having an area to one side of said axis greater than that on the other side of said axis and which last mentioned part of the damper has a greater gravity effect so as to overbalance the first in the presence of an air blast in said duct of said lesser velocity and volume and wind catching means on the first mentioned part of said damper so formed as to face fully into line of the blast when said damper is in its horizontal open position for assisting in holding said damper in said open position and to face less fully into said line of the blast when said damper is in its inclined closed position.

7. In combination with the discharge end of the air duct of a ventilating system, a damper adjacent said end of said duct, means providing a pivot for said damper extending transversely of said duct and about which said damper may be swung from an open position wherein it stands parallel with said duct, into a closed position wherein it stands at less than a right angle to said duct, said damper when in the last mentioned position having a portion engaged with one side of the duct and a second portion spaced from the opposite side of the duct and restricting the effective area of said discharge end and operating to deflect the air blast in said duct toward said restricted effective area of said discharge end.

8. In combination with the discharge end of the air duct of a ventilating system, a damper in said duct, means providing a pivot for said damper extending transversely and disposed off center with respect to said duct and about which said damper may be swung from an open position wherein it stands parallel with said duct into a closed position wherein it stands at less than a right angle to said duct, said damper when in the last mentioned position having a part engaged with one side of the duct and having another part spaced from the opposite side of the duct and restricting the effective area of said discharge end and operating as a deflector for the air blast in the duct for directing the same toward said restricted effective area of said discharge end.

9. In combination with the discharge end of the duct of a ventilating system, means within said end for closing off the lower portion of said discharge end, and for deflecting the blast toward and for limiting the discharge to the upper portion thereof said means being operable by the air blast in said discharge end when it reaches a predetermined velocity and volume to open said lower portion to make the entire area of said discharge end effective.

10. In combination with the discharge end of the air duct of a ventilating system, means pivotally mounted between its ends in said discharge end and operable by the air blast therein when it approaches its maximum velocity and volume to open both the upper and lower portions of said discharge end and to close off said lower portion when the velocity and volume of air in the duct reaches a predetermined minimum to direct the blast toward and to limit the discharge thereof to the upper portion of said discharge end.

11. In combination with the discharge end of the air duct of a ventilating system, means in said discharge end and operable when the velocity and volume of air in the duct reaches a predetermined minimum, to close off the lower portion of said discharge end and direct the blast toward and limit the discharge thereof to the upper portion of said discharge end, said means also being operable by the air blast in said discharge end upon a predetermined increase in velocity and volume of said blast in said duct to open said lower portion of said discharge end to make the entire area of said discharge end effective.

12. In combination with the discharge outlet of an air duct of a ventilating system, deflectors in said outlet for diffusing the air blast discharged from said outlet, and a member pivoted on a horizontal axis adjacent the rear of said deflectors and automatically swingable about said axis in accordance with the velocity of the blast in said duct for determining the effective area of said outlet through said deflectors and for deflecting the air blast toward said area for discharge therethrough at substantially the same velocity.

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