Oct. 24, 1967 R. W. LANE ETAL 3,348,466

VERTICAL BLADE LOUVER

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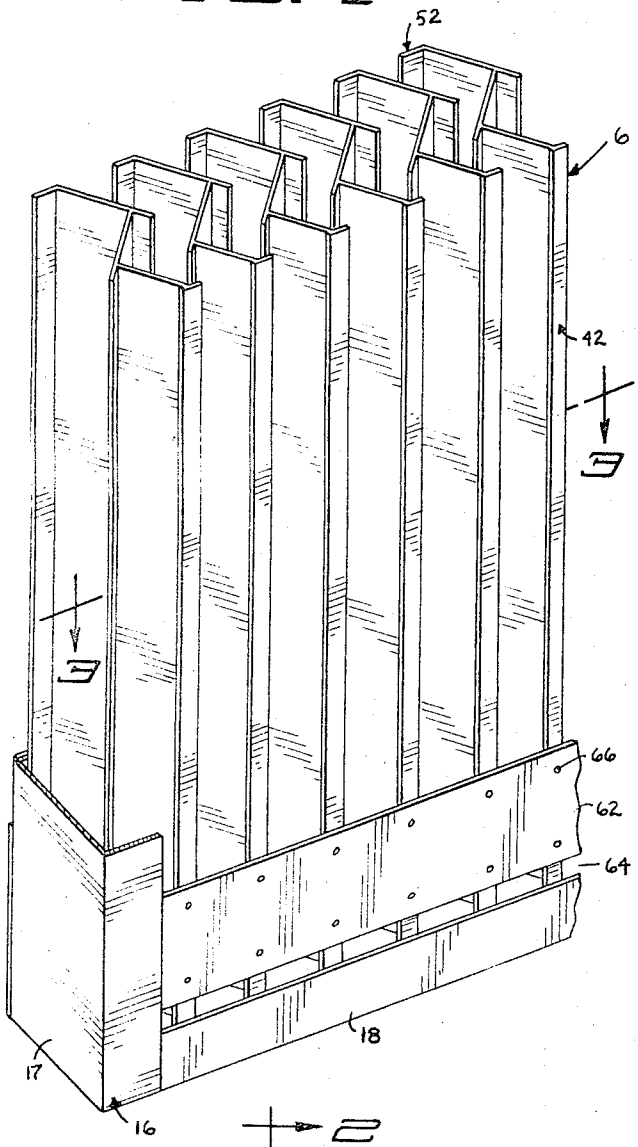
FIG. 1



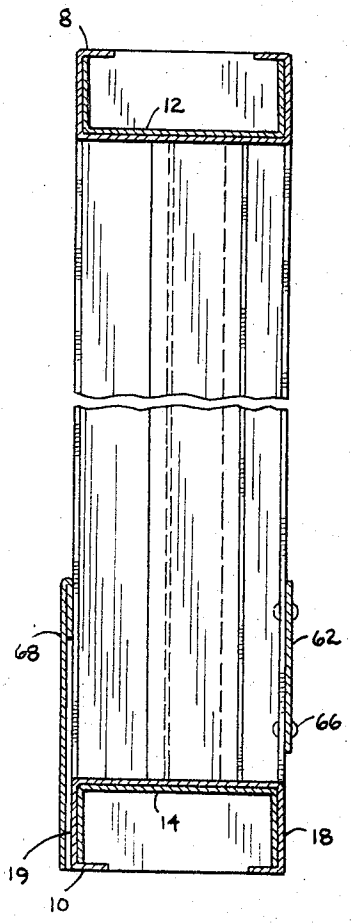


FIG. 2

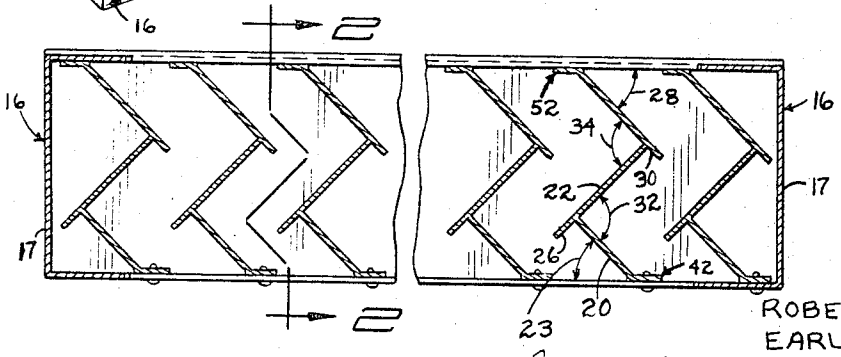


FIG. 3

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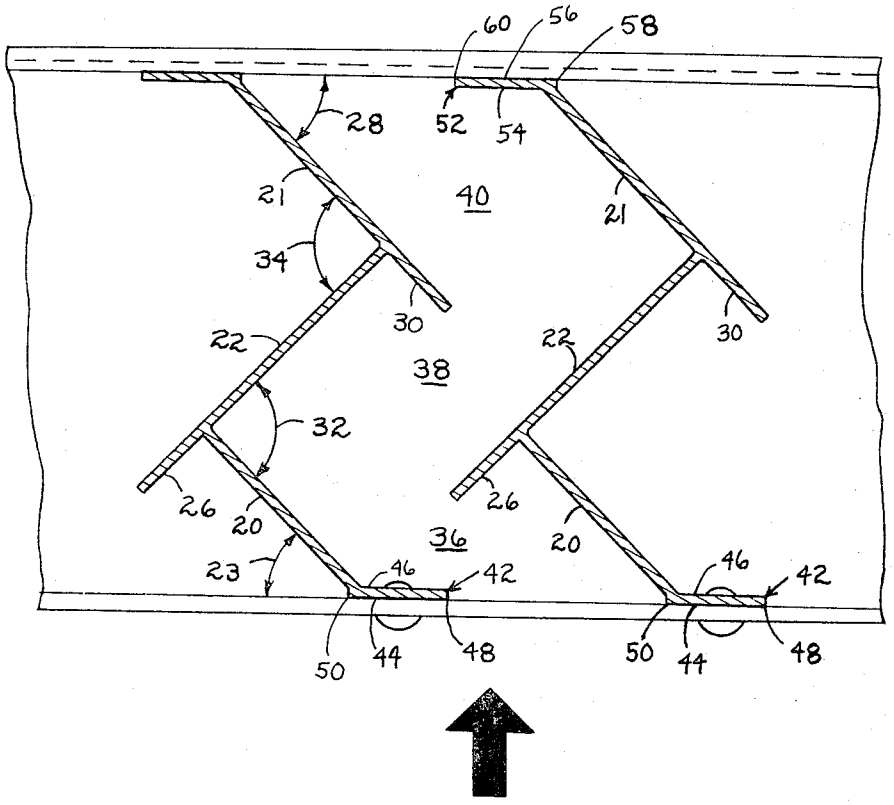

FIG. 4

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VERTICAL BLADE LOUVER

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2 Claims. (Cl. 98—121)

This invention relates in general to ventilating louvers for air-conditioning systems and, more particularly, to louvers of this type wherein the air intake side is exposed to the weather.

The air in an occupied space should at all times be free from toxic, unhealthful or disagreeable fumes, and also should be relatively free from odors and dust. To obtain these conditions, enough clean outside air must always be supplied to an occupied space to counteract or adequately dilute the sources of contamination. Accordingly, in the design of air-conditioning systems for buildings or residences air infiltration is an important factor, and each system is commonly evaluated in terms of the number of air changes per hour it provides. In most air-conditioning systems a large amount of air is re-circulated over and above the amount required to satisfy minimum ventilation conditions. Because of this increased demand for air in quality and quantity, the design of efficient ventilating louvers is of ever-increasing importance. However, attempts to achieve an optimum louver design have frequently met with failure because of the several problems and design limitations which arise, especially when one side of the louver is exposed to normal weather conditions. Louvers of this type must not only satisfy airflow requirements, but must additionally prevent rain and mist from passing through to the interior of the building or residence. To achieve this, however, the various barriers employed by the louvers now commercially available have not been satisfactory, largely because of their detrimental effect upon the airflow. In addition, these same prior art devices have not been totally effective when extreme weather conditions are encountered. Other considerations as to cost, overall appearance, ease of installation, durability and their ability to minimize air frictional resistance or pressure drop, go far in determining the utility of such devices. It is therefore the principal object of this invention to provide a ventilating louver which will eliminate the foregoing shortcomings in the prior art devices and which is capable of optimum performance over a wide range of atmospheric conditions.

Louvers made according to this invention accomplish these results through the use of vertical blades which define Z-shaped air passageways. These blades have extensions into the air passageways in direction to cause maximum turbulence thus to facilitate removal of moisture from the air passing therethrough. Inlet and outlet weather stops consisting of vertically extending integral portions of the blades also serve to induce turbulence. The constrictions to the air passageways caused by the weather stops and the extensions cause air velocity and pressure differences which further facilitate removal of water from the airstream, and all of the blades and their associated extensions and stops serve to carry the water deposited thereon directly to the sill without permitting it to again become air-borne. A horizontal exterior weather shield extends across the forward portion of all the blades in closely spaced relationship to the bottom front sill plate to provide a wind shield to prevent the moisture drawing down the blades from again being picked up and carried in the airstream through the louver, and to provide between the sill and the shield a weep slot through which the collected moisture can drain to the outside of the louver.

In the drawings,

FIG. 1 is a perspective view showing the overall design of the louver, with parts removed to simplify the disclosure;

FIG. 2 is a view taken along the line 2—2 of FIG. 3;

FIG. 3 is a view taken along the line 3—3 of FIG. 1; and

FIG. 4 is an enlarged view showing in cross-section the specific construction of the blades.

Referring to the drawings, and particularly to FIGS. 1 and 2, the invention is shown comprising a plurality of metal blades **6** which are arranged in parallel spaced relation and are fixedly secured between an upper channel member **8** and a similar lower channel member **10**. The channel members **8** and **10** are provided with inner U-shaped splicing elements **12** and **14** which reinforce the composite structure and facilitate the innerconnection of additional louvers. At **16**, **16** is shown the vertical end casings having outer surfaces **17**, **17** adapted to engage the confronting surface of the wall opening. Accordingly, the horizontal channel members **8** and **10** in conjunction with the vertical end casings form a structurally rigid enclosure or framework for the blades **6**. The lower channel member **10** includes an exterior surface **18** which extends horizontally so as to constitute a lower sill plate for the louver. Shown in parallel spaced relation with the sill **18** is the back sill plate **19**.

The specific structure of each of the blades **6** is best shown in FIGS. 3 and 4 and includes an inlet section **20**, an outlet section **21** and an inner section **22**. The inlet section **20** is shown disposed at an acute angle **23** relative to the frontal plane of the louver and is connected to the section **22** at a point intermediate of the length thereof so as to form the front protruding extensions **26**. Similarly, the outlet sections **21** are disposed at an acute angle **28** relative to the back plane of the louver and are connected to the section **22** so as to form the back extensions **30**. The numbers **32** and **34** refer to the respective angles formed at the intersection of the sections **20** and **21** with the inner section **22**. While in this particular embodiment the angles **23** and **28** are at 45 degrees and the angles **32** and **34** are at 90 degrees, it is to be understood that satisfactory results have been achieved by varying these angles slightly.

There is thus provided a plurality of parallel spaced blades each of which are substantially Z-shaped in cross-section and which cooperate in pairs to form a series of small passages for conveying the air through the louver. As shown in the enlarged view of FIG. 4, each of these passages are further subdivided into air inlet passages **36**, air transfer passages **38** and the air outlet passages **40**. The forward extensions **26** are disposed in coplanar relation with the inner sections **22** and project inwardly into the inlet passages **36**. Back extensions **30** are disposed in coplanar relation with the outlet sections **21** and project inwardly into the transfer passages **38**.

Formed integrally with the inlet sections **20** are vertical weather stops **42** whch preferably consist of flat metal strips of rectangular cross-section so as to provide outer and inner surfaces **44** and **46**, respectively, and the leading edges **48** and **50**.

Similarly, rear stops **52** are formed integrally with outlet sections **21** and preferably consist of flat metal strips of rectangular cross-section so as to provide interior and exterior surfaces **54** and **56**, respectively, and the trailing edges **58** and **60**.

At **62** is shown a front exterior shield which extends completely across the front of the louver and in spaced horizontal alignment with the front sill plate **18** so as to form weep slot **64**. The shield **62** is secured by rivets **66**. Similarly, a rear shield **68** extends completely across

the back of the louver and in spaced parallel relation with the front shield **62**.

As will be readily appreciated by those familiar with the many problems and factors involved in the design of air ducts and air distribution systems, the dimensions of the various components and their geometrical relationships are critical in determining their effect upon the airflow. Accordingly, the invention will be illustrated by the following example listing the specific dimensions and trigonometric values of one such louver blade which performed admirably over a wide range of air velocities and adverse atmospheric conditions.

TABLE A

Blade thickness	inches	.08
Louver height	do	72.00
Distance between blades	do	2.00
Length of section **20**	do	1.60
Length of section **21**	do	1.68
Length of section **22**	do	1.80
Angle **23**	degrees	45
Angle **28**	do	45
Angle **32**	do	90
Angle **34**	do	90
Front extensions **26**	inches	.56
Back extensions **30**	do	.38
Front stops **42** (.08 inch thick)	do	.75
Rear stops **52** (.08 inch thick)	do	.75
Weep slot height	do	.50

It is to be understood that the foregoing is submitted by way of example only and that effective results have been achieved by varying certain of the dimensions listed above. For example, the width of the front extensions **26**, as listed in Table A represents 21% of the distance between the blades. However, by extensive testing in wind tunnel conditions, the effective range has been determined to be 18% to 23% of the distance between the blades. Additional relationships which have been determined are illustrated by the following table.

TABLE B

Ratio:	Effective range, percent
Back extensions **30**/distance between blades	12 to 15
Front stops **42**/distance between blades	30 to 38
Back stops **52**/distance between blades	30 to 38

The operation of the invention is best understood by tracing the airflow through the individual passages. Assuming normal conditions, air entering the louver in the direction of the arrow of FIG. 4 would contain water droplets or mist which, of course, must be prevented from passing to the interior or backside of the louver. To achieve this end, the component parts of the louver are each designed to help in removing a portion of the water and the combined effect is the total elimination of water from the air stream leaving the louver. The effect of each component part upon the passing air stream will now be considered.

The front exterior shield **62** is adapted to provide increased weather protection when adverse conditions are encountered, such as rain accompanied with heavy blowing. By means of the weep slot **64**, proper drainage of any water accumulation on the sill is provided. The rear shield **68** is used as a dam to keep water from running into the interior or backside of the louver. As will be appreciated, the height of the weep slot **64** becomes critical since too great a slot height would permit the water on the sill to be blown over the rear sill plate while too small a height would not provide proper drainage of the water. The optimum height has been determined to be approximately ½ inch.

The front protruding extensions **26** are designed to check the passage of water and mist by inducing turbulence inside the louver and thereby cause the water particles to be deposited on the inlet sections **20** and on the extensions **26** themselves, and also serving as vertical channels to carry the extracted water to the sill. Their distance of protrusion into the air stream is determined to produce maximum turbulence and protection without greatly reducing the airflow in c.f.m. Back extensions **30** similarly effect the air down stream as it enters the outlet passages **40**.

The advantages of the Z-shaped design is manifested by the fact that the air is restricted in the vicinity of the transfer passages **38** and allowed to expand in the vicinity of the outlet passages **40**. Since the velocity of the passing air varies inversely with the cross-sectional area of the passages, it is apparent that the velocity of the air increases near the reduced areas near the center of the louver and reduces by expansion in the increased areas of the outlet passages. This velocity change coupled by the fact that the air is simultaneously subjected to a direction change, has been found extremely effective for extracting water from the air stream.

The front stops **42** are designed to serve a dual purpose. First, because of their perpendicular abutment with the passing air stream, a portion of the water is restricted from entering the louver and is deposited on the stops upon contact therewith. These stops also serve to carry any water deposited thereon to the sill below. Secondly, the stops **42** restrict the air entering the louver and thus cause an immediate velocity change which also combines to induce turbulence in the air stream. Rear stops **52**, being disposed in a direction opposed to the direction of the front stops **42**, are adapted to facilitate expansion of the air exhausting from outlet passages **40**.

There is thus provided a ventilating louver capable of optimum performance over a wide range of atmospheric conditions and which is capable of fulfilling the foregoing listed objectives, as well as others.

What is claimed is:

1. In an air ventilating louver having upper and lower blade supporting members and a front sill plate,

(A) a plurality of vertically extending blades mounted between said supporting members in spaced parallel relation, said blades being in substantially Z-shaped cross-section and oriented so as to define:

(1) a series of air inlet passages each of which are disposed at an acute angle with reference to the plane of said sill plate,

(2) a corresponding series of air outlet passages each of which is disposed at an acute angle with reference to the plane of said sill plate and which are in substantially parallel spaced relation with respect to said inlet passages,

(3) a series of air transfer passages in interconnecting communication with corresponding pairs of said inlet and outlet passages, said transfer passages disposed in a direction substantially perpendicular to the direction of said inlet and outlet passages and being adapted to induce turbulence in the air passing through said louver;

(B) a plurality of vertically extending inlet stops mounted on each of said blades being adapted to restrict the air entering said inlet passages and to facilitate the removal of water therefrom, said inlet stops comprising flat metal strips, the width of which are dimensioned so as to be in the range of 30% to 38% of the distance between the blades;

(C) a plurality of vertically extending outlet stops mounted on each of said blades being adapted to expand the air leaving said outlet passages and to facilitate removal of air therefrom, the width of said outlet stops being dimensioned so as to be in the range of 30% to 38% of the distance between the blades; and

(D) an exterior weather shield consisting of a rigid flat plate extending in closely spaced horizontal alignment approximately one-half inch above said front sill plate.

2. A ventilating louver comprising,

(A) upper and lower horizontal blade supporting members,

(B) front and back sill plates,

(C) a plurality of vertically extending blades mounted between said supporting members in spaced parallel alignment with respect to each other, each of said blades including

(1) air inlet and outlet sections disposed in parallel spaced relation and at an acute angle with reference to the plane of said front sill plate,

(2) an inner air transfer section uniting said inlet and outlet sections and disposed substantially perpendicular to the planes of said inlet and outlet sections,

(3) a first protruding section at the intersection of said inlet and inner sections and extending in coplanar relation with respect to said inner section and substantially perpendicular to the plane of said inlet section, said first protruding section being adapted to induce turbulence in the air passing in the vicinity of said first protruding section,

(4) a second protruding section at the intersection of said outlet and inner sections and extending in coplanar relation with said outlet section and substantially perpendicular to the

plane of said inner section, said second protruding section being adapted to induce turbulence in the air passing in the vicinity of said second protruding section,

(5) a vertically extending inlet stop formed integrally with said inlet section and in coplanar relation with said front sill plate, said inlet stop consisting of a flat metal strip, the width of which is dimensioned in the range of 30% to 38% of the distance between the blades, and

(D) an exterior weather shield consisting of a rigid flat plate extending in closely spaced horizontal alignment approximately one-half inch above said front sill plate and in coplanar relation therewith.

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