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3,345,930

AIR GRILL INCLUDING A WOODEN FRAME

Original Filed May 10, 1965

FIG. 1

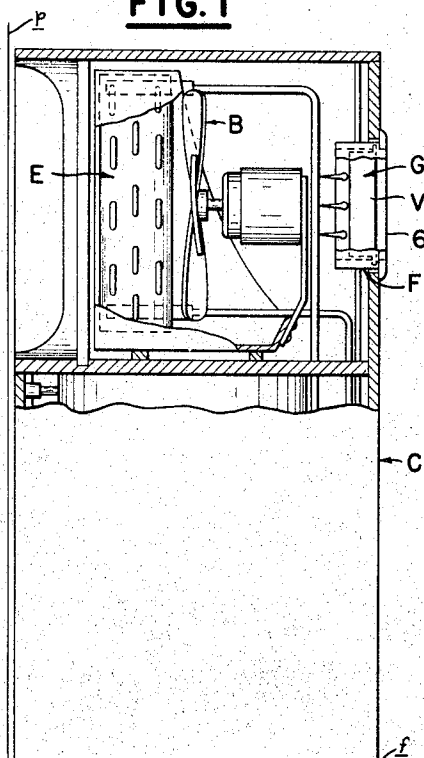


FIG. 3

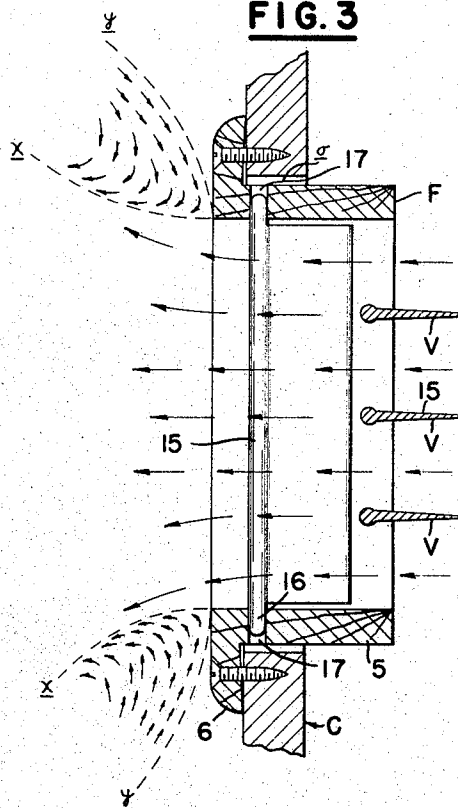


FIG. 2

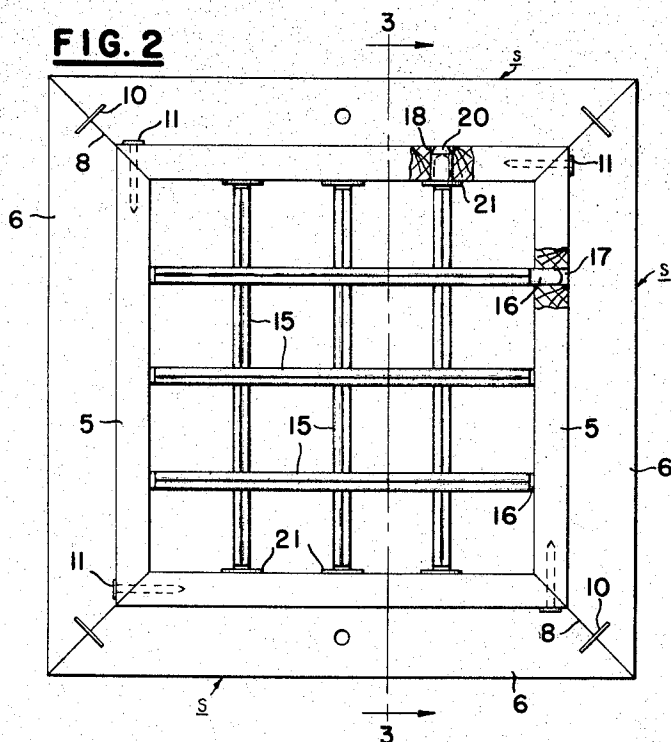
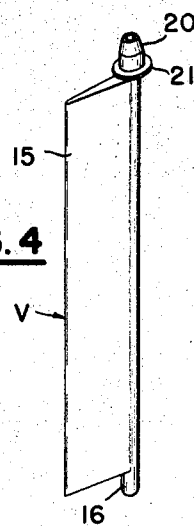


FIG. 4



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AIR GRILL INCLUDING A WOODEN FRAME

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Continuation of application Ser. No. 454,422, May 10, 1965. This application Nov. 7, 1966, Ser. No. 600,325
5 Claims. (Cl. 98—114)

ABSTRACT OF THE DISCLOSURE

A cabinet having cooling means therein for cooling air is also provided with a blower means for discharging air through an opening in the cabinet. A grill disposed within this opening includes a frame defining an opening and two pairs of spaced vanes pivotally supported within the opening of the frame. The vanes may be formed of metal, and the frame, composed of four interconnected walls, is homogeneous throughout and produced from wood or the like having a low thermal value. The inner surface of the facing of each of the walls of the frame is spaced from the adjacent surface of the cabinet to define a narrow insulating air space extending around the frame between the facing and the cabinet.

This is a continuation of application Ser. No. 454,422, filed May 10, 1965, now abandoned.

This invention relates to a grill mounted in the supply opening of a room cabinet from which cooled air is discharged in response to operation of an air-conditioning system. More particularly, the invention is concerned with the mounting for such a grill in the air supply opening formed through one wall of a cabinet of wood or the like, when installed in a room where a high degree of humidity is apt to be present. Such a place, for example, is aboard a yacht or ship, particularly when operating in tropical or sub-tropical waters.

The usual air grill commonly utilizes one or more sets of vanes carried in a frame which is fitted within the air supply opening of a cabinet wherein is enclosed a plenum chamber, an air conditioning system, or the cooling unit thereof. Such a frame, usually of metal, is generally formed with an out-turned flange forming a facing adapted to overlie the periphery of the supply opening through which cooled air is discharged from the cabinet. The cabinet, usually of wood, is desirably finished to match the woodwork in the surrounding room or cabin, which is generally mahogany, walnut or some other fine wood. In operation, the cooled air stream driven through the grill (1) transfers thereto, and particularly to its frame, a relatively low temperature and, at its point of discharge into the room, (2) creates a relatively low pressure area immediately adjacent the facing of the grill. As a result, the warmer room air is drawn into the low pressure area toward the air supply opening to approach the grill laterally from all directions. The room air which is relatively warm may also be heavily laden with moisture so that, upon its contact with the facing, some of the moisture in the air is extracted in the form of condensation which tends to collect on the proximate cabinet wall and drip downwardly thereon. This is objectionable because, inter alia, (1) the cabinet finish is thereby spoiled and, where the cabinet is wall-mounted, as is common (2) the water drip will wet any bunk therebelow or occupant thereof. It is primarily this problem

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of condensate forming on the facing of the grill at the point of cooled air emergence from the supply opening that the present invention is designed to overcome.

Further objects and advantages relate mainly to the grill frame which is made of wood or the like. They include an improved matching appearance compatible with that of the associated cabinet; the strong and durable interconnection of four strips into a unitary frame structure for effective support of multiple sets of adjustable vanes; a mounting for the vanes in the frame such that a stabilized frictional resistance will be assured for holding each vane indefinitely in a selected position of adjustment therein; a mounting wherein vibrations transmitted from the vanes will be largely absorbed by the frame, thereby preventing repeated impacts thereto with consequent wear and noise; and bearings having a high thermal insulation value fixedly carried by the frame providing for the vanes pivotal mountings to which the frictional resistance remains substantially constant during varying conditions of humidity, and pressure and/or velocity of the air discharged. These and other objects are achieved by the invention herein disclosed, an exemplification of which is illustrated in the accompanying drawing in the manner following:

FIGURE 1 is a side elevational view of a conventional cabinet one wall of which is partly cut away to exhibit therein the evaporator-blower unit of an air conditioning system, with the present air grill positioned oppositely thereof in an air supply opening provided in a selected wall of the cabinet;

FIG. 2 is an enlarged rear elevational view of the air grill per se;

FIG. 3 is a fragmentary sectional view, taken on line 3—3 of FIG. 2; and

FIG. 4 is a perspective view of a single adjustable vane to one of whose trunnions is applied a special insulated bearing which assures a constant frictional resistance under varying operating conditions.

In FIG. 1 there is illustrated a cabinet C of wood or the like which may be attractively finished for use in a room which is to be air conditioned. As shown, it stands upon a floor *f* adjacent a bulkhead or partition *p*. A small room or cabin, such as those on a yacht or ship, affords only a limited choice of positions for reception of such a cabinet, so a wall-mounting thereof is frequently selected instead. One wall of the cabinet—its front, its top, or either side—is formed therethrough with an air supply opening *o* wherein is affixed the air grill G of the present invention. This opening communicates with a plenum chamber or, as shown, with a compartment containing an evaporator E with which is associated a motor-driven blower B, herein termed the evaporator-blower unit. The remaining units which are commonly comprised in an air conditioning system may also be accommodated in the same cabinet, or elsewhere, but no showing thereof is deemed to be necessary here.

The grill consists of two units, viz. (1) one or more sets of vanes V, usually of metal or the like having a relatively high thermal conduction value, and (2) a rectangular frame F therefor produced from angled strips *s* of wood or the like having the grain running lengthwise thereof. As shown, the angle of each strip is slightly less than 90 degrees to provide a wall 5 whose cross section is shown as rectangular, and an out-turned flange 6, the free edge portion of the latter being gradually tapered to form a relatively narrow edge 7. Each strip *s* of the frame is both unitary and homogenous in

that it consists of a single piece of fibrous material, such as wood. Between this flange 6 and proximate cabinet wall is formed a narrow space for a purpose which will presently appear. Opposite ends of each strip are mitered for interengagement to provide closely-fitting joints 8 when assembled to produce the rectangular frame F. These joints between the walls 5 are normally hidden within the cabinet when the frame is installed in its supply opening *o*, but elsewhere are exposed in the out-turned flange portions thereof which provide for the grill an exposed and attractive facing which overlaps the wall portions of the cabinet immediately adjacent the supply opening *o* therein. As by means of staples 10 and small fasteners 11 driven into the strips at points adjacent their mitered ends, the strip components of the frame are fixedly secured together in unitary relation. When fitted into the air supply opening *o* of the cabinet (FIG. 3), the flanged facing is rested against the proximate wall and pressure-engaged therewith linearly along its narrow outer free edge in response to axial advance of securing screws 12. The four walls 5 then form a closed rectangular mouth through which cooled air is discharged in response to operation of the air conditioning system. The wall component of each frame is desirably rectangular in cross section, so that, when fitted in a supply opening *o*, its long dimension will lie transversely of the cabinet wall, extending from a point exteriorly of its outer face to a point well within the cabinet interior (FIG. 2). The rectangular mouth thus provided by the frame is relatively long, whereby the cooled air driven therethrough to the cabinet exterior is required to travel a substantial distance while confined between frame walls whose thermal conductivity is low.

Each vane V comprises a thin elongated rectangular blade 15 having a pair of aligned trunnions 16, one extended from each end of the vane. These trunnions are journaled for rotation in holes 17 and 18 formed in the frame walls 5, the holes being disposed in two parallel rows, one row in each of two opposite strips *s* adjacent the juncture of the walls 5 with the out-turned flanges 6, and the other rows in the two remaining strips *s* adjacent the free edges of their walls. With such an arrangement, one set of vanes may be mounted with their trunnions fitted into the holes 17 relatively close to the out-turned flanges 6; the second set of vanes is then mounted to lie in another plane, parallel with the first but rearwardly thereof and transversely thereto, with all vane trunnions fitted into the holes 18 which are disposed close to the free edges of the strip walls 5. The spacing of all holes 17 and 18 is substantially equal to the width of the vane so that, when the vanes are turned to lie in a common plane, the opening through the frames will be substantially closed.

The type of grill herein illustrated, in which each vane is movable independently of the others, permits of infinite adjustments whereby to deflect unlimitedly the air stream which is driven through the grill. This is but one of several types of grill which may be employed herein, depending upon the conditions to be encountered. The vanes described are adapted to be trunnion-mounted in the holes of a frame which is made of wood or the like; these holes are sized to receive the trunnions snugly with only a moderate force needed to advance them to final positions; and, when so assembled, a sufficient frictional resistance to rotative movement is created therebetween, tending to hold each vane in whatever adjusted position it is left in.

In many grills, the initial vane adjustment becomes permanent, whereas in others it is contemplated that different adjustments will be made from time to time. In such cases, or whenever it is desired to stabilize the frictional resistance during periods of varying conditions in humidity and air pressure and/or velocity, or simply to increase such resistance, I may use bearings 20 of plastic or the like (FIG. 4), each bearing being slightly

tapered inwardly toward one end and provided at its opposite end with an out-turned collar 21. Wherever used, the holes 17 and/or 18 should be properly sized for reception of such bearings, each with a light drive fit so as to be immovable therein. The collars 21 then engage the inner face of each strip wall 5 to fix the axial position of the bearings. The fit of the vane trunnions within these bearings is relatively close, but need not be tight, so that the frictional resistance is only slight, and remains so over a long period of time. It is optional whether to use such a bearing for only one or both trunnions of the same vane, or for selected trunnions only, according to the preferences of those occupying the room into which cooled air is discharged through the grill so equipped. The thermal insulation provided by these bearings is also a factor in preventing transfer of low temperature units from the vanes.

It is to be noted that the provision of four identical strips *s*, each preformed with holes 17 or 18 for reception of the vane trunnions 16 (with or without bearings added), facilitates (1) assembly of the vanes into operative positions and (2) advance of the strips *s* to final positions wherein they are secured fixedly and permanently together. It is further to be noted that the frame strips of wood or the like are not only low in thermal conductivity, but are fibrous in nature with capacity for limited absorption of vibrations transmitted from the vanes, thus preventing (1) enlargement of the holes 17 and 18 through repeated impact of the trunnions therewith, and (2) eliminating noises which usually accompany or follow such vibrations—both being important desiderata in an air grill of the kind under consideration. And finally, it is to be noted that the exposed faces of the grill frame, when fitted within the supply opening of the cabinet, are adaptable to a finishing treatment the same as the exterior faces of the cabinet so as to be esthetically compatible therewith in all respects.

During periods of operation, air is discharged through the mouth of the grill in a stream which continues on into the surrounding room. This air is cooled well below the temperature of the room air, and is also relatively dry as contrasted with that of the moisture-laden air commonly present in rooms most in need of air conditioning treatment. In consequence, the grill vanes, if made of metal or the like which are relatively high in thermal conductivity, soon acquire a low temperature approaching that of the air stream passing therethrough. The present grill frame, however, being made of wood or the like—a material which is relatively low in thermal conductivity—remains substantially immune to any temperature change. This is important to the success of the present invention because of (1) the low pressure condition created at the grill facing immediately adjacent the outflowing stream of cooled air entering the room, and (2) the absence on the cabinet wall immediately adjacent the grill, of any cooled surface with which the warm air of the room may establish contact while advancing into the low pressure area. The location and approximate extent of this area is indicated in a general way in FIG. 3 as between the broken arcuate lines *x* and *y*, the point of minimum pressure being substantially at the juncture of these two lines where surfaces of the grill mouth and facing meet. It has long been a common experience for warm humid air to be drawn from all sides into the prevailing low pressure area adjacent the grill where it is caused to sweat freely upon contact with the cooled facing of the grill at that point. Condensate is then produced, its drops collecting upon the proximate cabinet face to drip downwardly thereof. This is a serious failing against which long-sought protective measures have proved ineffectual, particularly in climates which are high in humidity.

The present grill frame is low in thermal conductivity, as already pointed out, but its flanged facing which over-

lies the proximate cabinet wall through a limited area is contoured to deflect outwardly and away from said wall the warm room air which is drawn into the low pressure area immediately surrounding the grill (FIG. 3). It is the facing portion of the frame alone which is exposed to contact from the inflowing warm room air, and because the facing remains relatively warm its capacity to produce condensate is reduced to a negligible point. Its contour, which comprises a thin outer edge pressed tightly against the cabinet wall, is gradually thickened so as to deflect outwardly the warm air advancing laterally toward the grill mouth. The room air thus advancing toward the grill mouth continues to remain warm when first meeting the cold air stream emerging from the mouth of the grill, the condition of the two air streams of unequal temperatures being such that commingling of one with the other may then take place free of any condensation of moisture upon the cabinet at any place.

Use of wood for the grill frame and facing, to be successful, requires that there be adequate provision for preventing water infiltration. In the present grill, the frame walls which define the mouth through which the cooled air is driven need no special protection because the driven air is relatively dry, its humidity content approximately 30 to 40 percent. The frame facing, however, is exposed to the moist room air, relatively warm, which is drawn into the low pressure area, but because of low conductivity of the frame walls is subject to little or no chilling effect from the cooled air passing through the grill. It is to be noted that any flow of cold thermal units toward the grill facing must proceed crosswise of the grain of the wooden grill frame. Mahogany which is one of the preferred woods for the frame has a thermal conductivity approximating that of California redwood (.74) or Douglas fir (.76), both at 16% moisture, the conductivity being measured by the number of B.t.u. per hour leaking through material one foot square by one inch in thickness with a temperature difference of one degree on opposite sides. A degree of conductivity so low as this is only a fraction of that present in other materials such as most of the metals. The facing of the present grill never acquires a temperature so low as to produce condensation of moisture present in the warm room air. This is because (1) the low conductivity of the frame wood in contact with the passing stream of cooled air is incapable of transmitting a low temperature to the facing, and (2) the position of the facing to one side of the passing cool air stream prevents contact therefrom. The air space between the facing and proximate cabinet wall is also a factor of insulation. This space which extends continuously around the frame exterior is in communication with the cabinet chamber from which the cooled air is discharged outwardly through the grill. Were it not for the air within this space, the grill facing on its rear side might be subject to chilling exposure from some of the same air which is driven through the grill. This would be objectionable, particularly if material having a higher thermal conductivity value than wood were used in the construction of the cabinet. By the provision of this narrow air insulation space, the possibility of chilling the frame from its rear is obviated, thereby further assuring prevention of condensation thereupon.

I claim:

1. In combination, a cabinet having a supply opening from which a stream of cooled air is discharged into a surrounding room, an air grill mounted within said supply opening, means to cool the air within the cabinet, blower means for discharging cooled air through said grill, thereby creating at the point of air discharge, immediately adjacent the supply opening, a low pressure area into which the relatively warm room air is laterally drawn from all sides, the grill comprising a frame defining an opening wherein a set of spaced vanes is arranged crosswise of the frame to be supported thereby, the frame being also formed with a continuous facing adapted to overlie and engage an outer face of the cabinet immediately adjacent

the supply opening and to be exposed within the low pressure area when so disposed, the frame and its facing being homogeneous throughout and produced from wood or the like having a low thermal value on the order of .75 at 16% moisture whereby to retard conduction therethrough of low thermal units to the frame facing upon the said outer face of the cabinet, the cooled air driven through the grill being incapable, by itself, of chilling the relatively warm room air in contact with the frame facing, while advancing into the low pressure area adjacent the grill, the engagement of the facing with the cabinet being confined to a relatively small portion of the facing area confronting the cabinet to leave between itself and the cabinet a thin air insulating space of extended area in communication with the cooled air supply within the cabinet whereby to substantially immunize the rear side of the facing from any chilling effects therefrom, the frame tending to remain substantially unaffected temperaturewise from cooled air driven through the grill and incapable of chilling the relatively warm room air in contact with the frame facing while advancing into the low pressure area adjacent the grill.

2. In combination, a cabinet having a supply opening from which a stream of cooled air is discharged into a surrounding room, an air grill mounted within said supply opening, means to cool the air within the cabinet, blower means to discharge air from the cabinet, a stream of cooled air being discharged through said supply opening into a surrounding room thereby creating at the point of air discharge, immediately adjacent the supply opening, a low pressure area into which the relatively warm room air is laterally drawn from all sides, the grill comprising a frame defining an opening wherein a set of spaced vanes is arranged crosswise of the frame to be supported thereby, the frame being also formed with a continuous facing adapted to overlie and engage an outer face of the cabinet immediately adjacent the supply opening and to be exposed within the low pressure area when so disposed, the frame and its facing being homogeneous throughout and produced from wood or the like having a low thermal value on the order of .75 at 16% moisture whereby to retard conduction therethrough of low thermal units to the frame facing upon the said outer face of the cabinet, the cooled air driven through the grill being incapable, by itself, of chilling the relatively warm room air in contact with the frame facing, while advancing into the low pressure area adjacent the grill, the frame comprising four interconnected wall means of rectangular cross section, each joined at one end cross sectionally thereof to a facing extended angularly therefrom whereby to overlap the said cabinet outer face through an area adjacent the periphery of the supply opening, each wall means being extended cross sectionally of itself away from the said cabinet outer face to terminate within the cabinet at a point substantially beyond its opposite inner face to define between the two ends of the frame wall cross sectionally thereof a sufficient distance to prevent conduction therebetween, through its own body, of thermal units in any substantial degree.

3. In combination, a body means having a supply opening from which a stream of cooled air is discharged into a surrounding room thereby creating at the point of air discharge, immediately adjacent the supply opening, a low pressure area into which the relatively warm room air is drawn laterally from all sides, means for cooling the air within the body means, blower means for discharging the air within the body means through said supply opening, a grill comprising a frame defining an opening wherein is a set of thin spaced vanes arranged crosswise of the frame and supported thereby, the frame including a plurality of interconnected strips each including a wall and an out-turned flange whose inner surface defines a facing adapted to overlie the adjacent surface of the body means and being spaced therefrom to define a narrow insulating air space extending around the frame between the facing

and the adjacent portions of the body means, said frame walls being spaced from the adjacent portions of the supply opening to provide communication between the air space and the interior of the body means from which cooled air is discharged outwardly through said opening whereby to substantially immunize the rear side of the facing from any chilling effects, the frame and its facing being formed of fibrous wood material and having a low thermal conduction value whereby to remain substantially unaffected temperaturewise from cooled air driven through the grill and incapable of chilling the relatively warm room air in contact with the frame while advancing into the low pressure area adjacent the grill.

4. Apparatus as defined in claim 3 wherein the out-turned flange of each strip defines a relatively narrow outer free edge which is pressure-engaged with the body means around the outer edge of the frame.

5. Apparatus as defined in claim 3 wherein the inner surface of the flange extends at an angle slightly less than 90 degrees to the wall portion of each of the strips to define a tapered air space closed along the outer edge of the frame.

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