United States Patent [19]

Huggins

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[54] **NOISE SUPPRESSIVE FAN SHROUD**

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[52] **U.S. Cl.** ..... **181/50,** 181/49, 181/33 M, 165/59

[51] **Int. Cl.** **F01n 1/10,** F01n 1/24

[58] **Field of Search** ..... 165/87, 98, 107, 165/120, 135, 154, 157, 59; 181/33 K, 33 H, 33 AE, 33 M, 36 R, 49, 50, 55, 63; 415/119, 200, 185, 205, 210, 217

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[57] **ABSTRACT**

A noise suppressive fan structure and a heat exchanger having on one side thereof the fan structure in which the fan structure comprises a fan having blades rotatable about an axis and shrouds adjacent the fan comprising closely spaced sound absorbing baffles that are curvilinear, spaced apart and nested to provide a substantially complete shadow to the sound waves from the fan. Where the fan structure is used in conjunction with an air permeable heat exchanger the shroud may be on the side of the fan opposite the heat exchanger.

2 Claims, 4 Drawing Figures

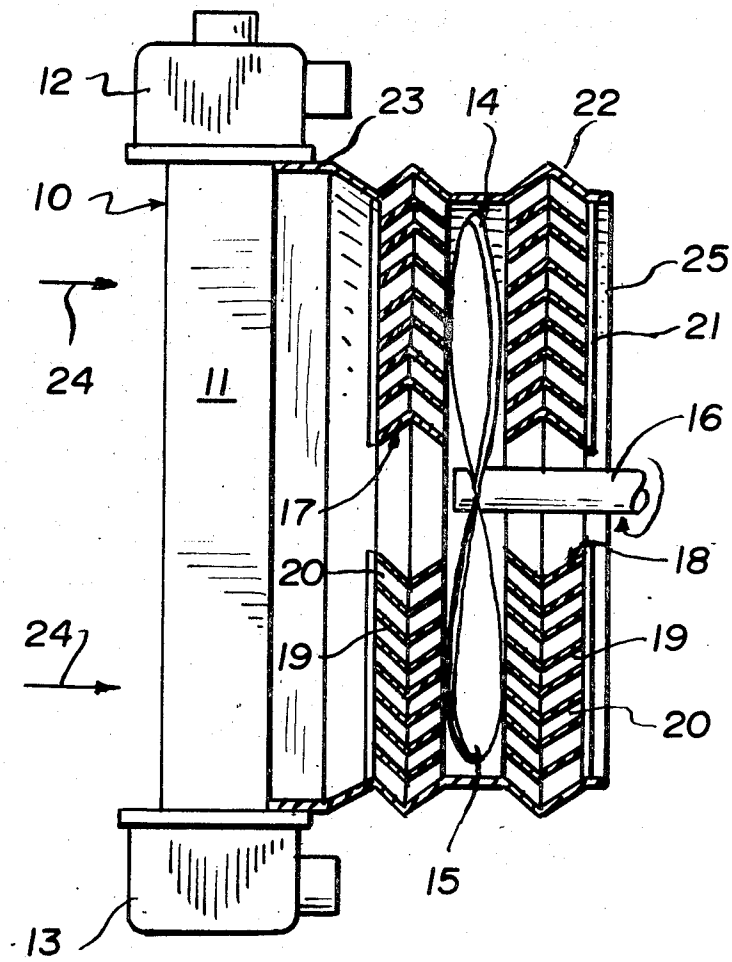


FIG. 1

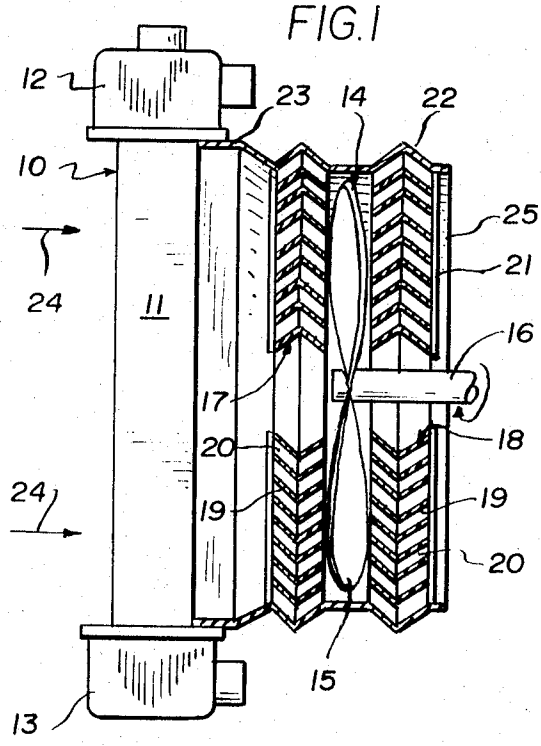


FIG. 3

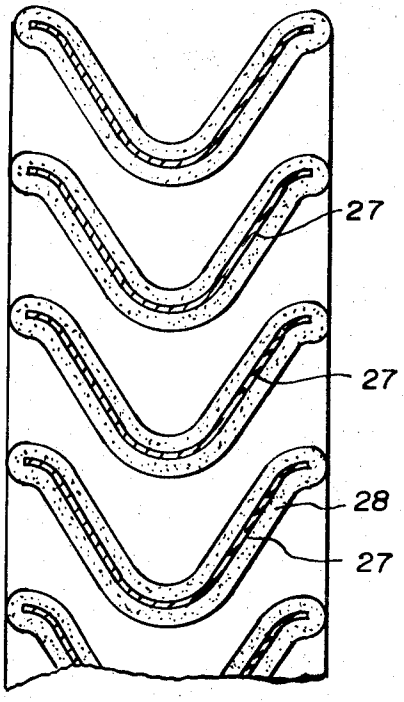
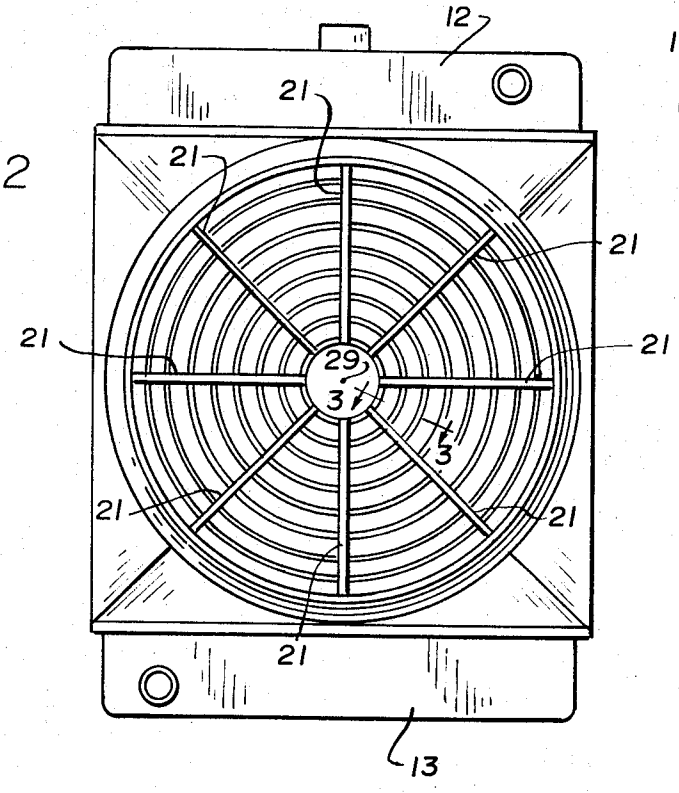


FIG. 2



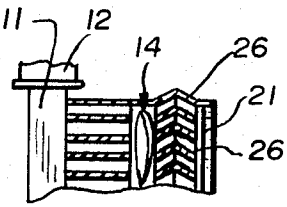


FIG. 4

NOISE SUPPRESSIVE FAN SHROUD

BACKGROUND OF THE INVENTION

A rotating fan having blades rotatable about an axis is a source of considerable noise particularly where the cooling capacity of the fan is large as in cooling fans for heavy duty truck radiators. The fan structure of this invention is noise suppressive whether the fan is used in conjunction with such an air cooled heat exchanger or used merely as an air moving device in general cooling.

SUMMARY OF THE INVENTION

The noise suppressive fan structure of this invention comprises a fan having blades rotatable about an axis and shrouds on opposite sides of the fan each comprising closely spaced baffles comprising sound deadening material with the baffles being positioned essentially edgewise to the plane of rotation of the fan and the baffles each being curvilinear, spaced apart and nested to provide a substantially complete shadow to the sound waves from the fan during rotation thereby without interferring with the volumetric air flow through the fan.

When the fan structure is used as an element in a combination including an air permeable heat exchanger the fan proper is located on one side of the heat exchanger and on the side of the fan opposite the heat exchanger one of the shrouds is provided. In the preferred structure, however, there is provided a similar shroud in the area between the heat exchanger and the fan preferably.

In a still more preferred structure the fan and shroud or shrouds are enclosed within a generally tubular air conduit housing that is open at its opposite ends.

Where the noise suppressive fan structure is used in the combination with the air permeable heat exchanger the tubular housing may be attached at one end to the heat exchanger. Preferably the housing as well as the baffles are coaxial with the axis of rotation of the fan.

BRIEF DESRIPTION OF THE DRAWINGS

FIG. 1 is a view partially in longitudinal section and partially in edge elevation of a heat exchanger and noise suppressive fan structure embodying the invention.

FIG. 2 is a side elevational view of a heat exchanger and noise suppressive fan structure showing a further embodiment of the invention.

FIG. 3 is a fragmentary enlarged sectional view taken substantially along line 3—3 of FIG. 2.

FIG. 4 is a fragmentary sectional view similar to a portion of FIG. 1 but illustrating a further embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the embodiment of FIG. 1 there is disclosed a heat exchanger 10 comprising a customary fin and tube air permeable core 11 with the tubes (not shown) thereof interconnecting an upper tank 12 and a lower tank 13 all in the customary manner.

Positioned to one side of the core 11 is an air cooling fan 14 comprising blades 15 mounted for rotation on a drive shaft 16 which is rotatable about a central axis. Positioned on opposite sides of the fan 14 are shrouds 17 and 18 comprising closely spaced baffles 19 comprising sound absorbing material.

The baffles 19 are essentially edgewise to the fan, are curvilinear and are spaced apart and nested to provide a substantially complete shadow to the sound waves from the fan 14 during rotation thereof and thereby preventing straight line projection of noise in the spaces 20 between adjacent baffles 19. Thus, as can be seen in both FIG. 1 and the enlarged embodiment of FIG. 3, it is impossible to draw a horizontal line between adjacent baffles without intersecting at least one baffle. This means that the straight line projection of noise from the rotating fan which is the source of fan noise will be blocked by at least one baffle.

The baffles 19 of the embodiment of FIG. 1 are generally circular and are held rigidly in spaced relation by struts such as illustrated by the struts 21 in the embodiment of FIGS. 2 and 3. These struts are generally radial and are flat strips arranged edgewise to the direction of air flow.

The baffles 19 which in the illustrated embodiments are circular and substantially coaxial to the axis of rotation of the fan 14 and drive shaft 16 are enclosed by a tubular housing 22 that is open at both ends. Thus as illustrated in FIG. 1 one end 23 of the housing is connected to the heat exchanger 10 so as to receive substantially all of the air 24 drawn through the core 11 by the rotating fan. The opposite end 25 of the housing is open for and unrestricted air flow.

In the embodiment of FIG. 1 the individual baffles 19 are angular in cross section as illustrated and thereby provide a herringbone effect when shown in the section of FIG. 1.

In the embodiment of FIGS. 2 and 3 the baffles 25 are generally sinusoidal but also provide a substantially complete shadow to the sound waves from the rotating fan which generally travel in straight lines parallel to the axis of rotation of the fan. In the embodiment of FIG. 4 the curvilinear baffles 26 are located on one side only of the fan 14 which is the side opposite to the core 11. This structure can be used where cost is a factor, as the air permeable core 11 itself serves as a noise suppressive unit to a certain extent. However, for maximum suppression of noise it is preferred that the baffle structures be positioned on both sides of the fan.

The noise suppressive fan structure may be used as an ordinary air blower but is preferably used with the high speed fans used to cool radiators particularly for heavy duty devices such as trucks, earth moving equipment of other such structures where noise is a serious problem. It can of course be used to advantage to produce quiet unit heaters or any other heat exchanger device or structure with which the fan shroud of this invention may be associated.

In addition to suppressing noise the shrouds have the secondary effect of converting velocity rotation of air caused by the fan to linear velocity thereby providing better air distribution over the external surfaces of the heat exchanger such as the radiator core 11. This latter effect is especially important when the air is being pushed through the radiator as from right to left in FIG. 1 rather than being pulled through as illustrated by the arrows 24 of FIG. 1.

The baffles 25 of the shroud may be made of any sound absorbing material. Thus one structure is to construct the baffles of sheet metal as illustrated at 27 in FIG. 3 and to coat them with a synthetic plastic sound absorbing material 28 such as cellular polyurethane. If desired, the entire baffles themselves may be made of

a cellular synthetic material that is rigid and strong enough to resist breakage.

The supporting struts **21** used to support the shrouds and maintain the baffles in spaced relation also contribute to straightening out the air flow from the rotating fan **14** as shown in the illustrated embodiments. As explained earlier, in the preferred structure as shown in FIG. **2** the struts that radiate from the axis of rotation **29** are flat and arranged edgewise to the rotating fan **14.**

I claim:

1. A heat exchanger structure, comprising: an air permeable heat exchanger; a fan on one side of said heat exchanger having blades rotatable about an axis; shrouds on the opposite sides of said fan each comprising circularly closely spaced baffles substantially coaxial with said fan axis and each comprising sound absorbing material, said baffles being essentially edgewise to said fan, curvilinear, spaced apart and nested to provide a substantially complete shadow to the sound waves from the fan during rotation thereof and thereby prevent straight line projection of noise in the spaces between adjacent baffles; and a tubular housing open at opposite ends and enclosing said fan and baffles, said housing being attached at one end to said heat exchanger and being coaxial with said fan axis.

2. A heat exchanger structure, comprising: an air permeable finned heat exchanger also functioning as a sound absorbing shroud; a fan on one side of said heat exchanger having blades rotatable about an axis; a shroud on the side of said fan opposite the heat exchanger comprising circularly closely spaced baffles substantially coaxial with said fan axis comprising sound absorbing material, said baffles being essentially edgewise to said fan, curvilinear, spaced apart and nested to provide a substantially complete shadow to the sound waves from the fan during rotation thereof and thereby prevent straight line projection of noise in the spaces between adjacent baffles; and a tubular housing open at opposite ends and enclosing said fan and baffles, said housing being attached at one end to said heat exchanger and being coaxial with said fan axis.

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