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Pratinidhi

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[54] **FLEXIBLE BLADE FAN WITH RIBBED BLADES**

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[52] **U.S. Cl.**.....**416/132,** 416/240

[51] **Int. Cl.**.....**F04d 29/36**

[58] **Field of Search**.....416/132, 240, 214, 416/210

[56] **References Cited**

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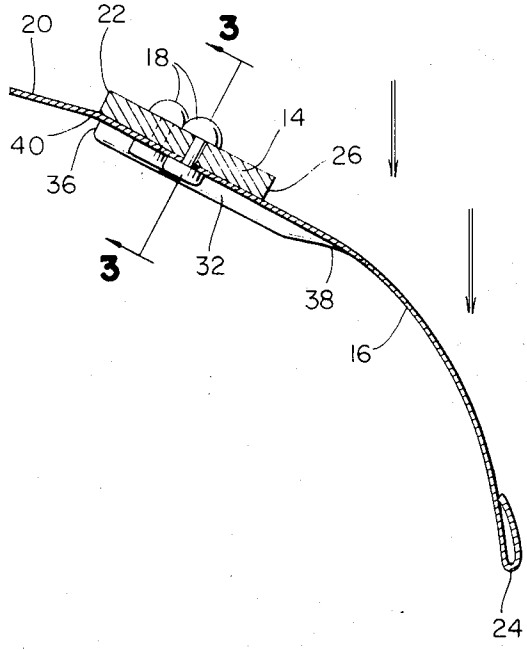
[57] **ABSTRACT**

A flexible bladed automotive cooling fan in which the blades are provided with a plurality of radially spaced, transversely extending, raised ribs on the side thereof opposite the arms to which the blades are connected, the ribs extending from the leading edges of the arms to a position intermediate the trailing edges of the arms and the blades.

15 Claims, 3 Drawing Figures



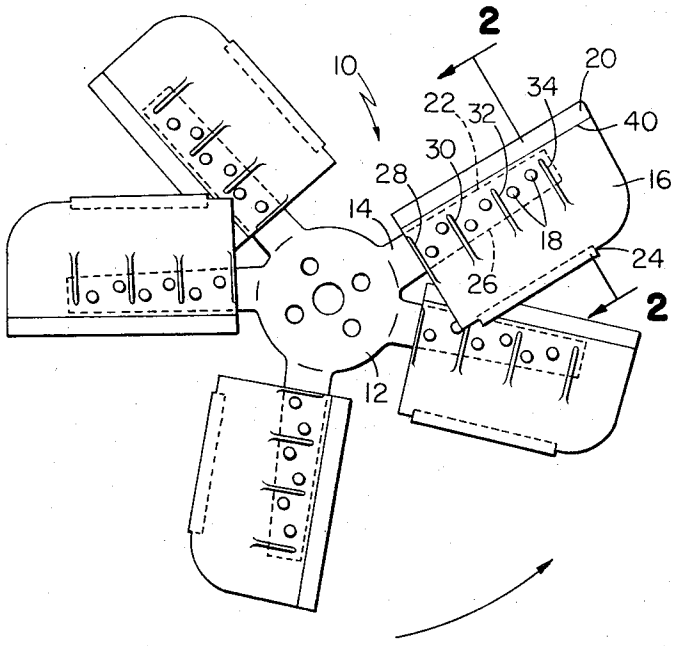


FIG 1

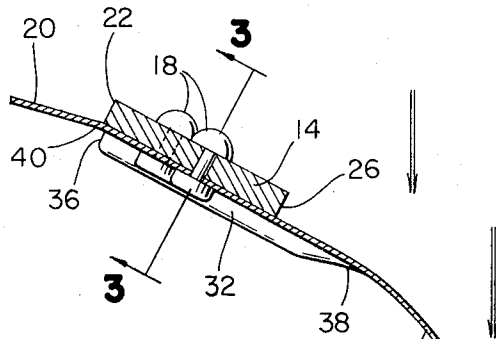


FIG 2

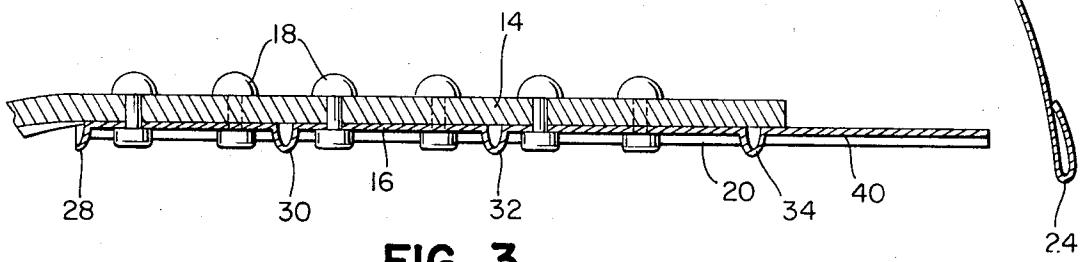


FIG 3

FLEXIBLE BLADE FAN WITH RIBBED BLADES

This invention relates to automotive cooling fans and more particularly to an improved flexible bladed fan.

It is a principal object of this invention to provide a flexible bladed fan of simplified construction and of inherently lighter weight for given dimensions of a fan than has been achieved in current designs of such fans. It is a further object to achieve a significant reduction in the traditionally high cost of flexible bladed fans. It is an additional object to achieve such simplification, weight and cost reductions without material functional impairment of the flexible bladed fan.

In general, the invention features, in a fan having a hub, a plurality of arms extending radially from the hub, and flexible blades connected adjacent their leading edges to the arms, the provision of a plurality of radially spaced, transversely extending raised ribs in the blades, the ribs extending from adjacent the leading edges of the arms to a position intermediate the trailing edges of the arms and the blades. In a preferred embodiment one of the ribs is positioned at the edge of each blade adjacent the hub, a plurality of ribs are positioned between the blade edge adjacent the hub and the tip end of the arm, and a radially extending rib or crimp is provided along the leading edge of the blade.

Other objects, features and advantages of this invention will be apparent to those skilled in the art from the following detailed description of a preferred embodiment thereof, taken together with the accompanying drawings, in which:

FIG. 1 is a plan view of the downstream side of a fan embodying the invention;

FIG. 2 is a sectional view taken along the line 2—2 of FIG. 1; and

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

With reference to FIG. 1 of the drawings it will be seen that fan **10** comprises a hub **12** having a plurality of arms **14** extending generally radially therefrom. Secured to each arm **14** is a fan blade **16** of resilient material, AISI 301 stainless steel, 0.015 inch thick, in a preferred embodiment.

Each blade **16** is positioned directly against the downstream side of an arm **14**, having its leading edge **20**, defined by the direction of fan rotation, forward of the leading edge **22** of the arm **14**. Blade **16** extends transversely to a trailing edge **24** behind the trailing edge **26** of arm **14** and is curved toward the downstream side behind arm **14**, presenting a convex surface on the upstream side of the blade **16**. Blade **16** is secured to arm **14** by a plurality of fasteners, e.g., rivets **18**, radially spaced along arm **14** and blade **16**, the heads of the rivets bearing directly on the downstream side of the blade. Blade **16** extends radially along arm **14** and beyond the end thereof.

Radially spaced along each blade **16** are a plurality of raised ribs **28**, **30**, **32**, **34**, therein, protruding downstream away from arm **14** and extending transversely from adjacent the leading edge **22** of arm **14** to a position intermediate the trailing edges **24**, **26** of blade **16** and arm **14**, as best shown in FIGS. **2** and **3**. The leading edges **36** of ribs **28**, **30**, **32**, **34** are aligned with the arm **14** leading edge **24** and the trailing edges **38** thereof are positioned immediately behind the arm **14** trailing edge **26** blending into the trailing portion of

blade **16** as it curves downstream to minimize stress risers thereat. One rib **28**, essentially an upturned edge, is provided along the blade edge adjacent hub **12**. The other ribs **30**, **32**, **34** are radially spaced between rib **28** and the end of arm **14** with rivets **18** positioned therebetween. A radially extending rib in the form of a crimp or bend along line **40** is provided along the entire leading portion of blade **16**.

In operation, as fan **10** is rotated at increasing rotational speeds, the blades **14** decamber behind ribs **28**, **30**, **32**, **34** due to the effects of centrifugal force and air pressure. The ribs **28**, **30**, **32**, **34** control the blade flexure and prevent stress risers around rivets **18**. Crimp **40** provides longitudinal blade stability. Advantageously the reinforcing cap usually employed with flexible bladed fans is eliminated with a resultant design simplification and weight and cost reduction without material functional impairment.

Since blade deflection occurs behind arms **14**, no coining or bending operation is necessary on the arm trailing edges **26**. Weight and cost reduction are further enhanced by the use of lighter material for the fan hub **12** and arms **14**, e.g., SAE 950 or 1020 steel, 0.134 inch thick made possible by the smaller loads imposed on arms **14** with the elimination of reinforcing caps.

Other embodiments of this invention will occur to those skilled in the art which are within the scope of the following claims.

What is claimed is:

1. In an automotive cooling fan comprising a hub, a plurality of arms radially extending from said hub, and radially extending resilient blades which decamber as rotational speed increases connected to said arms, said arms and blades also extending transversely between leading and trailing edges thereof defined by the direction of fan rotation, and said blades each connected adjacent its leading edge to arm and extending transversely to its trailing edge behind the trailing edge of said arm, that improvement in which each said blade is provided with a plurality of raised ribs radially spaced along said blade and extending transversely thereof from adjacent the leading edge of said arm to which said blade is connected to a position intermediate the trailing edges of said arm and said blade, said ribs raised on the side of said blade away from said arm.

2. The improvement claimed in claim 1 in which a rib is provided in said blade adjacent its said leading edge extending radially along the radial extent of said blade.

3. The improvement claimed in claim 2 in which said blade is connected to said arm on the downstream side thereof.

4. The improvement claimed in claim 1 in which said blade is connected to said arm by fasteners positioned between said ribs.

5. The improvement claimed in claim 4 in which said fasteners comprise rivets bearing directly on said blade on the side thereof opposite said arm.

6. The improvement claimed in claim 1 in which said blade includes a transversely extending inner edge adjacent said hub and one of said ribs is positioned on said inner edge.

7. The improvement claimed in claim 6 in which a rib is provided in said blade adjacent its said leading edge extending radially along the radial extent of said blade.

8. The improvement claimed in claim 7 in which said blade is connected to said arm on the downstream side thereof.

9. The improvement claimed in claim 8 in which said blade is connected to said arm by rivets bearing directly on said blade between said ribs on the side of said blade opposite said arm.

10. The improvement claimed in claim 1 in which said blade includes a transversely extending inner edge adjacent said hub and said ribs are radially spaced along said blade between said inner edge and the outer end of said arm.

11. The improvement claimed in claim 10 in which one of said ribs in positioned on said inner edge.

12. The improvement claimed in claim 10 in which a rib is provided in said blade adjacent its said leading edge extending radially along the radial extent of said blade.

13. The improvement claimed in claim 12 in which said blade is connected to said arm on the downstream side thereof.

14. The improvement claimed in claim 13 in which one of said ribs is positioned on said inner edge.

15. The improvement claimed in claim 14 in which said blade is connected to said arm by rivets bearing directly on said blade between said ribs on the side of said blade opposite said arm.

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