(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 387 987 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **90300979.3**

(51) Int. Cl.[5]: **F04D 29/54**

(22) Date of filing: **31.01.90**

(30) Priority: **13.03.89 US 322475**

(43) Date of publication of application:
19.09.90 Bulletin 90/38

(84) Designated Contracting States:
DE FR GB

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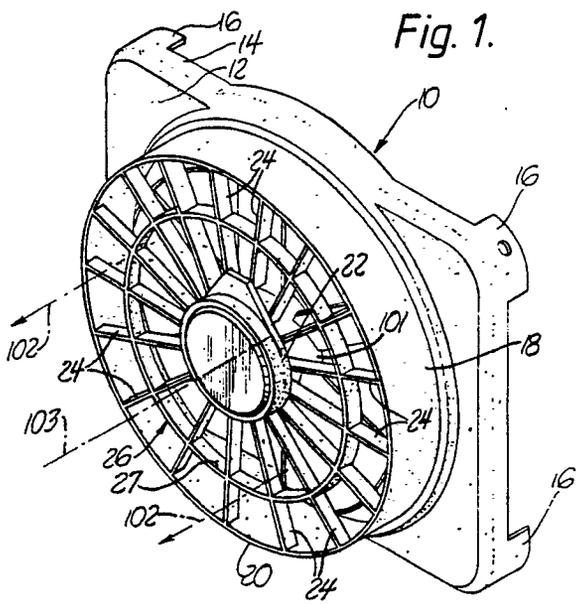
(54) Stabilizer ring for a fan-mounting apparatus.

(57) A mounting bracket (10) for an engine cooling fan includes a central hub (22) for removably receiving the fan. Support vanes (24) extend radially from the hub (22) to an outer support ring (18). At least one inner ring (26) is provided between the hub (22) and the outer support ring (18). Each inner ring (26) includes a surface for redirecting radial airflow to axial airflow.

Fig. 1.



EP 0 387 987 A2

STABILIZER RING FOR A FAN-MOUNTING APPARATUS

Background of the Invention

Field of the Invention

The present invention relates generally to automotive engine cooling systems as specified in the preamble of Claim 1, for example as disclosed in US-A-4,548 548, and in particular is concerned with a stabilizer element added to a mounting apparatus for an automotive engine cooling fan to strengthen the mounting apparatus.

Description of the Related Art

Many engine cooling systems for automotive vehicles include a fan for increasing the quantity of airflow through a radiator. An engine cooling fan is mounted on a bracket or shroud adjacent a radiator. Such fans may be driven by mechanical connection to an engine shaft or by other means, e.g. electric current.

Generally, an engine cooling fan produces two types of airflow from the fan blades. First, axial airflow is discharged from the fan blades in a direction generally parallel to the fan axis of rotation. Second, radial airflow is discharged from the fan blades in a direction generally perpendicular to the fan axis of rotation. Whilst axial airflow provides the majority of cooling air in an engine compartment, radial airflow provides only a minimal cooling effect.

The art continues to seek improvements. It is desirable that a fan-mounting apparatus, i.e. a bracket, or a shroud, provide the necessary support for a fan whilst contributing as little weight as possible to the system. Ideally, the mounting apparatus would be constructed from minimal mass and be capable of withstanding the torsional stresses induced by airflow and vibrations from the fan. Furthermore, it is desirable that improved mounting brackets and shrouds redirect the radial airflow to axial airflow to increase the cooling effect of the system. It is also desirable that airflow noise from a strengthened mounting apparatus be no greater than the noise associated with conventional shrouds and brackets.

Summary of the Invention

A fan-mounting apparatus according to the present invention is characterised by the features specified in the characterising portion of claim 1.

The present invention includes a stabilizer element added to a shroud or bracket for strengthening the mounting apparatus. The present stabilizer redirects radial airflow to axial airflow to increase fan efficiency. The present stabilizer is economical and can be incorporated with conventional mounting brackets and shrouds, and does not add any appreciable noise from airflow.

In a preferred embodiment, the present invention includes a mounting bracket for an engine cooling fan. A central hub removably receives the fan. Support vanes extend radially from the hub to an outer support ring. At least one inner ring is provided between the hub and the outer support ring. Each inner ring includes a surface for redirecting radial airflow to axial airflow.

In various embodiments of the invention, the stabilizer element can be formed as a ring or circular element, or as a plurality of arcuate portions spaced at selected radii from the central hub. The cross-section and radius of each arcuate section can be selected to optimize a desired function, e.g. structural re-inforcement, redirection of radial airflow or noise abatement.

Brief Description of the Drawings

Figure 1 is a perspective view illustrating a fan mounted on a shroud utilizing a first embodiment of a stabilizer ring according to the present invention.

Figure 2 is a rear elevational view of the shroud of Figure 1 wherein the fan has been removed for purposes of clarity of illustration.

Figure 3A is an enlarged sectional view taken along line 3-3 of Figure 2.

Figure 3B is a perspective view of a portion of the ring in Figure 3A.

Figures 4-7 are enlarged sectional views of alternative shapes of the ring shown in Figure 1.

Figure 8 is a rear elevational view of a mounting bracket incorporating an alternative embodiment of a ring according to the present invention.

Figure 9 is a rear elevational view of a second embodiment of a mounting bracket incorporating a plurality of rings according to the present invention.

Detailed Description of the Preferred Embodiment

For purposes of this disclosure, a stabilizer element according to the present invention is incorporated in a fan shroud (Figures 1-2) and in a pair

of mounting brackets (Figures 8 and 9). It should be understood that the stabilizer element according to the present invention can be incorporated in any selected conventional fan-mounting apparatus.

A first preferred embodiment of the present invention is incorporated in a shroud, indicated generally at 10 in Figures 1 and 2. Shroud 10 can be formed from any suitable plastics or mouldable material and includes a rectilinear face plate 12 bounded by a peripheral and forwardly-extending wall 14. Shroud 10 can be mounted in an engine compartment adjacent a radiator (not illustrated) by conventional fasteners (not illustrated) at mounting ears 16. If desired, various mounting ears and brackets can be incorporated with shroud 10 to facilitate mounting in an engine compartment.

Face plate 12 includes a rearwardly-extending cylindrical ejector 18 which forms the rear, discharge end of shroud 10. Preferably, the diameter of ejector 18 is slightly greater than the diameter of the blades of a fan 101 (illustrated only in Figure 1). Ejector 18 includes an outwardly-flaring bell-mouth portion 20. Fan 101 is removably mounted on support collar 22 by conventional fasteners (not illustrated). Fan 101 can be driven by a conventional electric motor or can be mechanically connected to an engine power shaft. As fan 101 is rotated, air is pulled from the radiator side of shroud 10 through ejector 18 and blown onto an engine. Axial airflow 102, which is generally parallel to a fan axis of rotation 103, provides the major portion of the cooling effect.

A plurality of radially-extending stator vanes 24 are provided between the support collar 22 and ejector 18. Each vane 24 is a planar member having ends integrally moulded with the support collar 22 and ejector 18.

In the shroud 10 of Figures 1-2, a concentric, stabilizer ring 26 is provided between vanes 24. Ring 26 is formed from a mouldable, plastics material and can be integrally moulded with vanes 24. Ring 26 performs two major purposes. Firstly, ring 26 stabilizes vanes 24 against torsional stresses induced from airflow, thereby increasing the structural integrity of shroud 10. Secondly, ring 26 redirects radial airflow to axial airflow, and thereby improves the cooling efficiency of the fan 101.

The specific shape and location of ring 26 can vary, depending upon which function of the ring is to be maximized. For example, the ring 26, illustrated in detail in Figures 3A and 3B, is a curved member having a thickness T and a face 27 of a width W equal to the width of vanes 24. As illustrated in Figure 3B, when radial airflow 104 encounters face 27, it is redirected to axial airflow 102.

In the example illustrated in Figures 1 and 2, ring 26 has a diameter approximately 60-70% the diameter of the ejector 18. In other embodiments, ring 26 may have a diameter in a range of 10-90% of the diameter of ejector 18. For example, in most fans, the airflow discharged near an outer tip of a fan blade is greater than the airflow discharged near a hub of the fan. If it is preferred to maximize the redirection of radial airflow 104 to axial airflow 102, ring 26 would be positioned in the maximum zone of radial airflow 104. In another example, the stabilization effect of ring 26 may require that ring 26 be positioned at a point other than the point of maximum radial airflow 104.

Alternative cross-sections and shapes of ring 26 are illustrated in Figures 4, 5, 6 and 7. In Figure 4, ring 30 includes a sloped leading edge 31 which acts as a scoop for receiving airflow from fan 101. Ring edge 32 is bounded by end surface 34. Ring edge 32 is provided at an acute angle A with respect to the end surface 34 of vane 24 and ring 30 is oriented with respect to vanes 24 to redirect radial airflow.

In Figure 5, which has been greatly enlarged for purposes of clarity of illustration, ring edge 32 is provided flush with end surface 34. In Figure 6, ring edge 32 is parallel to and laterally-spaced from end surface 34. In Figure 7, a ring 36 having a well-known airfoil shape and cross section is illustrated. Various modifications to a ring can be made to enhance its ability to capture and redirect radial airflow 104. A selected ring element can be integrally moulded with vanes 24 at a selected radius from the fan axis of rotation.

A first embodiment of a fan-mounting bracket 40 is illustrated in Figure 8. Bracket 40 includes a central support collar 42 for removably mounting a fan. An outer support ring 44 is provided at approximately the outer tips of a mounted fan (not illustrated). Support vanes 46A-46D having mounting ears 48 extend radially from support collar 42. If desired, support collar 42, outer ring 44, vanes 46A-46D and mounting ears 48 can be integrally moulded.

A stabilization ring element 50 is provided between support collar 42 and outer ring 44. If desired, ring 50 can be less than 360° and can be formed from a plurality of arcuate portions as illustrated in Figure 8, wherein ring element 50 is not provided between vanes 46A and 46B. If desired, ring element 50 can be provided in sections of varying diameter. For example, ring sections 51 and 54 are provided at a smaller radius than ring section 53. Various configurations, cross-sections and shapes of ring element 50 can be provided, depending upon the needs of a particular mounting bracket. Elements such as a mounting tab 52 or section 51 can be moulded with any section on ring element 50.

Figure 9 illustrates a second embodiment of a

mounting bracket 60 incorporating multiple, concentric stabilizer rings 61, 62, 63 and 64. Bracket 60 includes a support collar 66 having radially extending support vanes 67, 68, and 69 connected to an outer support ring 70. Various mounting ears 72, 73 and 74 are connected to the outer support ring 70. If desired, bracket 60 can be moulded as an integral unit.

Control rings 61 and 63 are provided at selected radii from the centrepoint of support collar 66. Control rings 62 and 64 are provided at a selected portion of the radial distance about support collar 66. Various support vanes 75-83 are selectively spaced between control rings 61 and the outer support ring 70. Rings 61, 62, 63 and 64 are selectively positioned to stabilize bracket 60 and redirect radial airflow from a fan blade to axial airflow to improve fan efficiency.

As stated above, various embodiments of the present stabilizer ring can be easily envisioned. Each stabilizer ring can be positioned and shaped to maximize the function of stabilization and/or airflow redirection whilst minimizing additional noise.

Claims

1. A fan-mounting apparatus (10;40;60) for resisting torsional stresses induced by airflow, which apparatus (10;40;60) comprises a collar member (22;42;66) for removably receiving a fan; support members (24;46A,46B,46C,46D;67,68,69) extending radially from the collar member (22;42;66); and an outer ring member (20;44;70) located adjacent outer ends of the fan and connected to the support members (24;46A,46B,46C,46D;67,68,69), characterised in that the apparatus (10;40;60) also includes an inner ring member (26;50;61,62,63,64) extending at least partially concentrically about the collar member (22;42;66) at a selected distance between an outer circumference of the collar member (22;42;66) and an inner circumference of the outer ring member (20;44;70) to strengthen the apparatus, the inner ring member (26;50;61,62,63,64) being connected to the support members (24;46A,46B,46C,46D;67,68,69).

2. A fan-mounting apparatus (10) according to claim 1, in which the collar member (22), the support members (24) and the outer ring member (20) comprise a shroud.

3. A fan-mounting apparatus (10) according to claim 2, in which the support members (24) are support vanes extending radially from the collar member (22); and the inner ring member (26) has a surface oriented approximately parallel to the fan axis of rotation (103).

4. A fan-mounting apparatus (10) according to claim 3, in which the inner ring surface includes a sloped edge (31) for scooping air.

5. A fan-mounting apparatus (10) according to claim 4, in which the sloped edge (31) for scooping air extends at an acute angle (A) to an end surface (34) of each support vane (24).

6. A fan-mounting apparatus (10) according to claim 4, in which the sloped edge (31) for scooping air is flush with an end surface (34) of each support vane (24).

7. A fan-mounting apparatus (10) according to claim 4, in which the sloped edge (31) for scooping air is parallel to, and laterally-spaced from, an end surface (34) of each support vane (24).

8. A fan-mounting apparatus (60) according to claim 1, in which the apparatus includes bracket members (72,73,74) extending radially from the outer ring members (70).

9. A fan-mounting apparatus (40) according to claim 1, in which the inner ring member (50) comprises at least one circumferential arcuate member (51,52,53) having a surface oriented approximately parallel to the fan axis of rotation (103).

10. A fan-mounting apparatus (60) according to claim 1, in which the inner ring member comprises a plurality of concentric arcuate members (61,62,63,64) positioned at selected radii from the fan axis of rotation (103), each arcuate member (61,62,63,64) including a surface oriented approximately parallel to the fan axis of rotation (103).

Fig. 3B

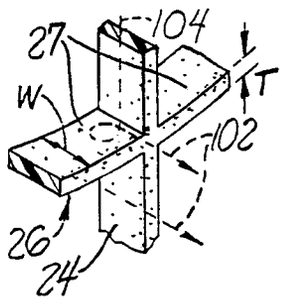


Fig. 1.

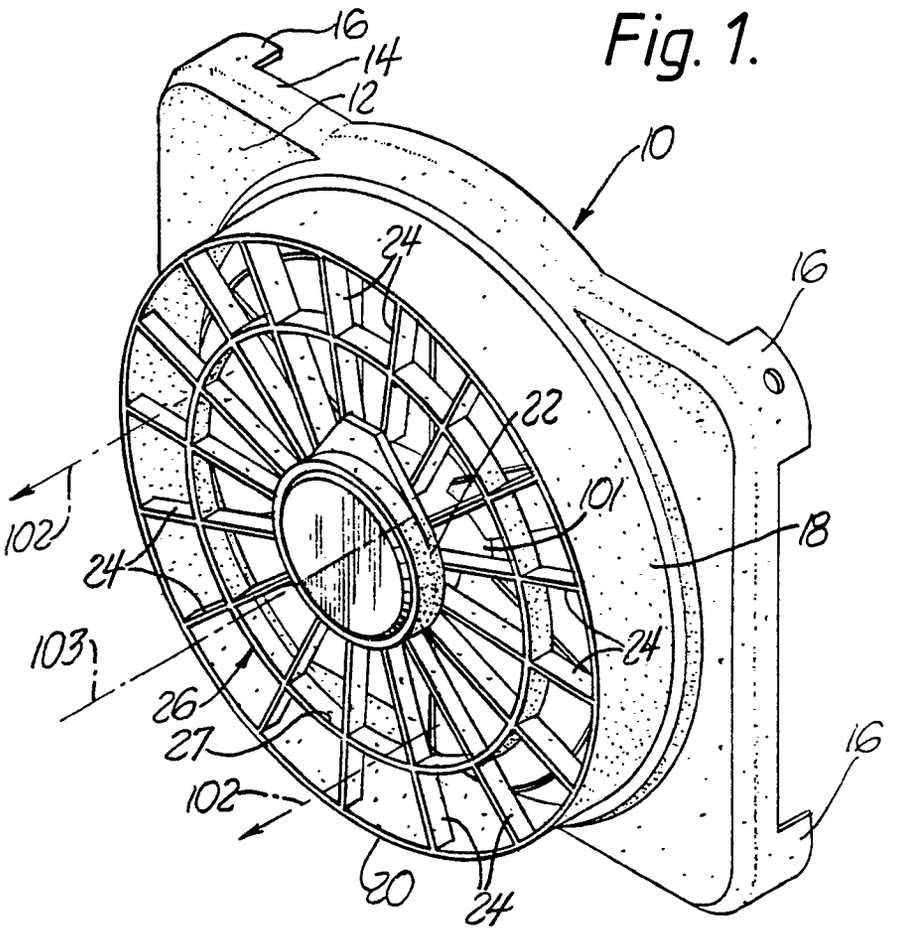


Fig. 3A

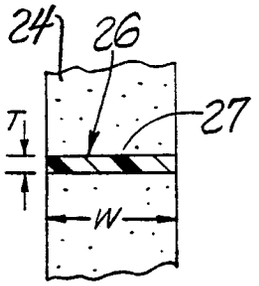


Fig. 2.

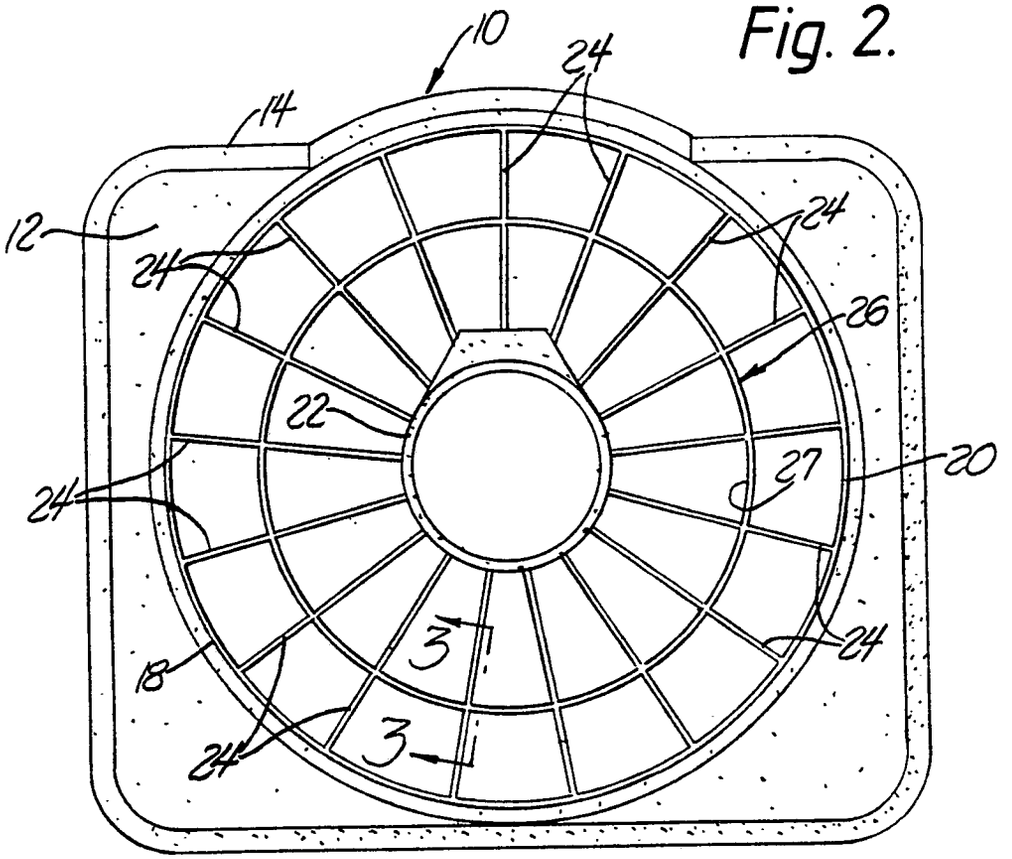


Fig. 4.

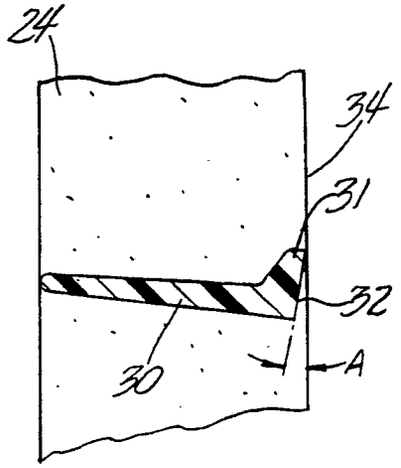


Fig. 5.

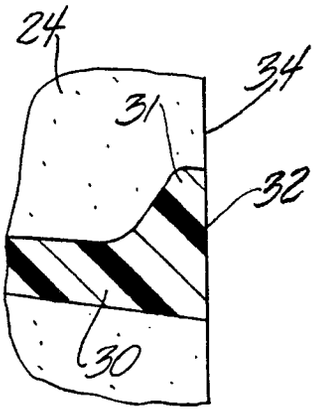


Fig. 6.

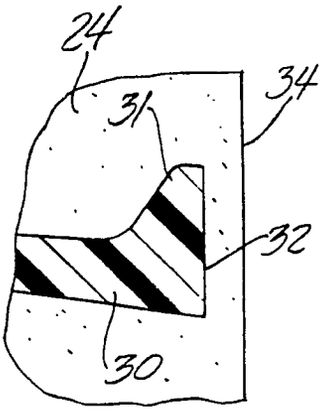
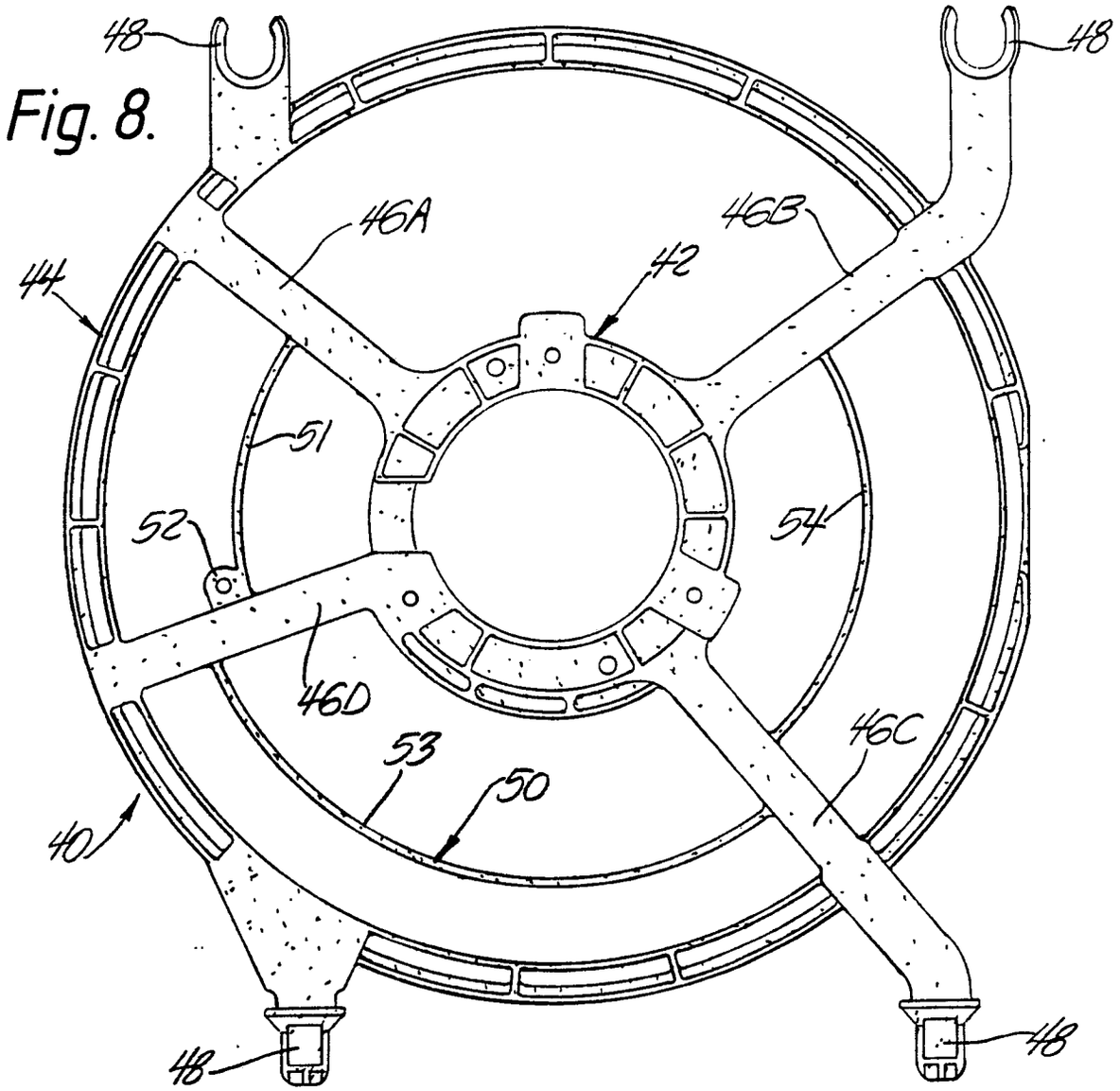


Fig. 8.



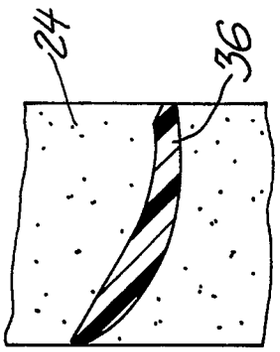


Fig. 7.

Fig. 9.