

United States Patent

Davis

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[54] COOLING FAN

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[58] Field of Search.....165/51; 415/119; 416/228

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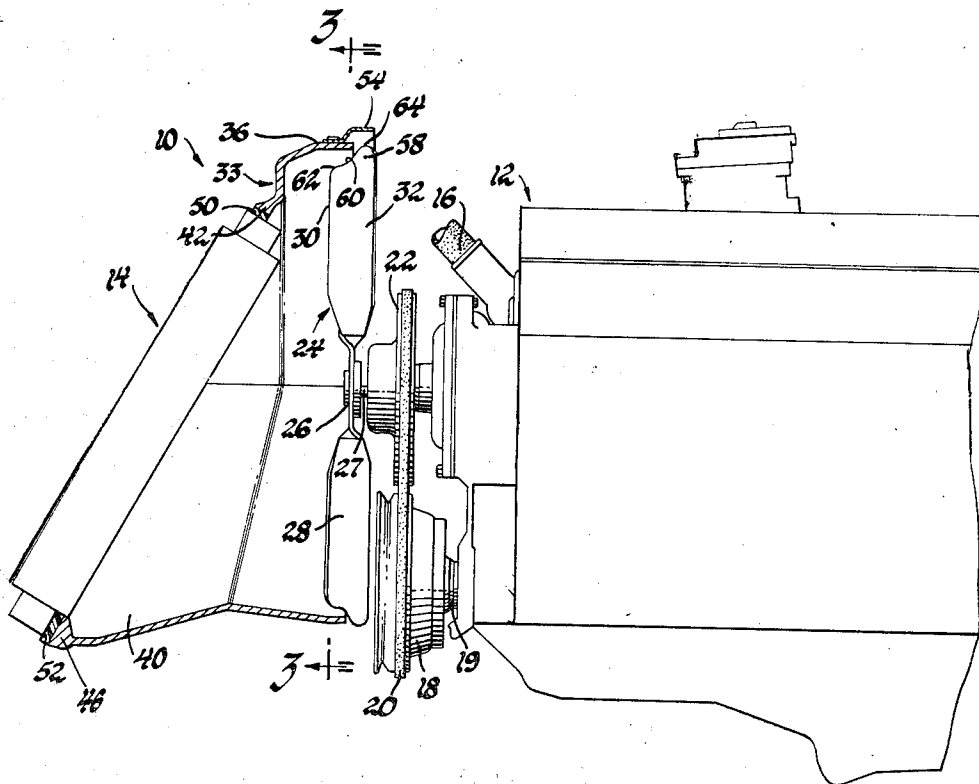
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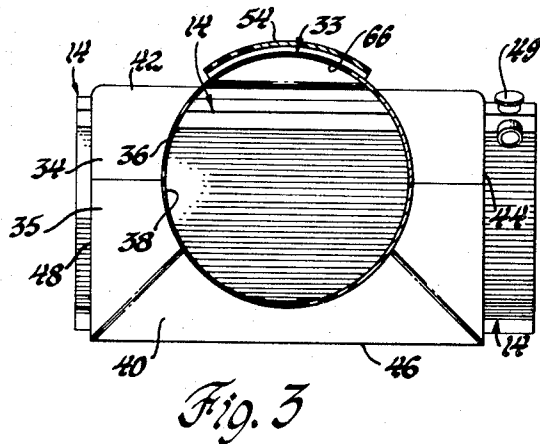
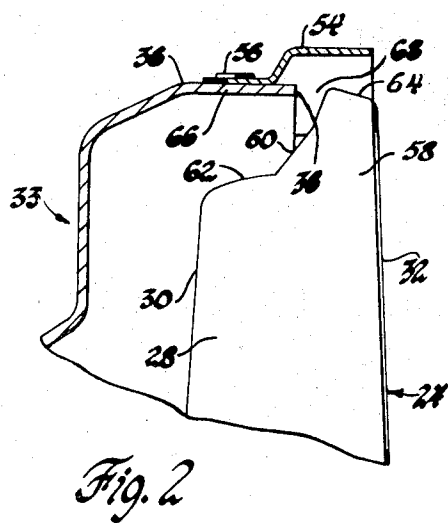
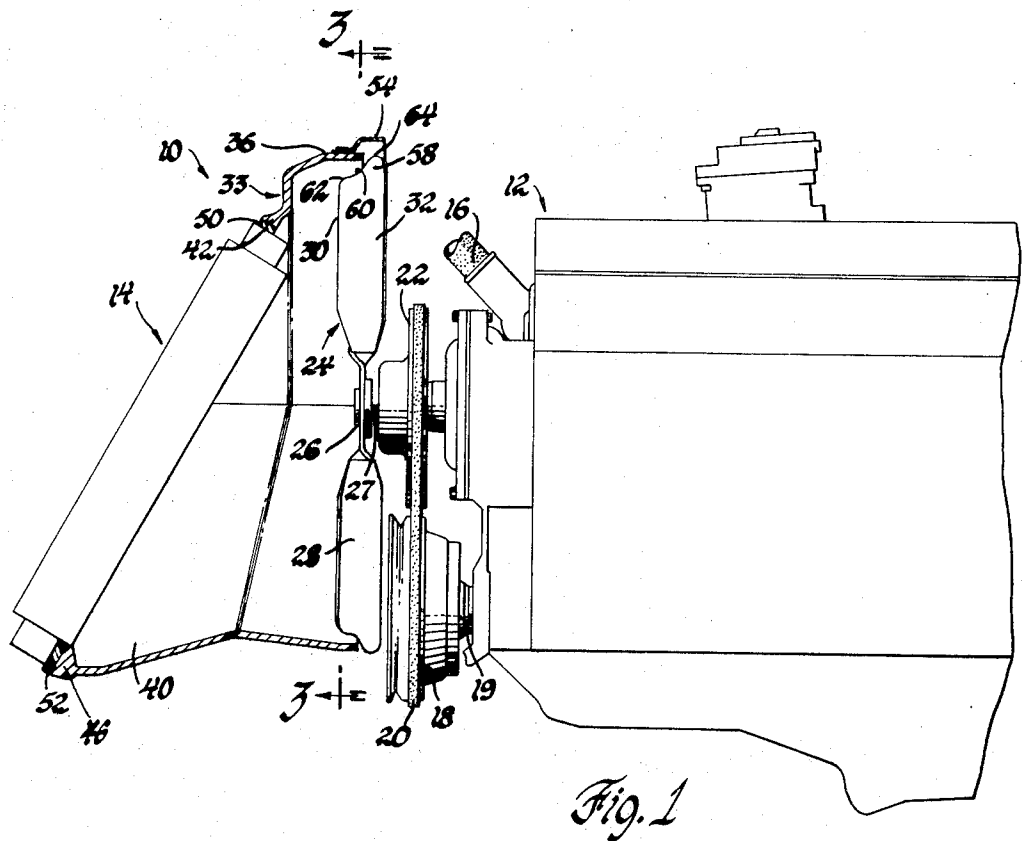
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ABSTRACT

A fan-cooling system wherein the fan and shroud arrangement is such that the rearwardly extending cylindrical portion of the shroud encompasses only substantially the forward half of a fan assembly, there being a radially outwardly extending continuation formed adjacent the trailing edge of each of the fan blades and extending radially outwardly of the inner surface of the shroud, thereby effectively enlarging the fan in a given engine compartment. This causes the tip of each blade to include a generally radially outwardly extending contoured central segment intermediate two generally transversely extending forward and rear segments, both tapering slightly inwardly from their respective points of juncture with the intermediate central segment, resulting in the formation of a generally conically shaped clearance between the rear edge of the shroud and the generally radially extending central segment of the fan blades. Recirculation of air through the clearance is thus diminished, as a result of the edge of the shroud serving to directly block the air from flowing into the vacuum area created between the radiator and the fan, and the now larger diameter fan producing a radially extending circumferential "wall" of air adjacent the shroud edge because of the increased action of centrifugal force.

2 Claims, 3 Drawing Figures





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COOLING FAN

This invention relates to fan-cooling systems for internal combustion engines and more particularly to a fan and shroud arrangement therefor.

It is apparent that the larger the fan used in any engine-cooling application, the greater the resultant volume of air pulled through the radiator and projected rearwardly to cool the engine. It is also well known that low-hood configurations in many current automobile body designs dimensionally preclude the use of such larger fans, thus, in some applications, hindering the efficient inclusion of equipment capable of handling greater loads, such as the combination of a large engine and multiple accessories, including an air conditioner, for example, along with an automatic transmission.

Accordingly, an object of the invention is to provide an improved fan and shroud arrangement which is more efficient than the conventional shroud and enclosed fan arrangement in a given engine compartment.

A further object of the invention is to provide an improved fan and shroud arrangement wherein the relationship between the shroud and fan is such that an effective restrictive barrier is formed to oppose recirculation of the air into the space between the fan and the radiator, thereby making more air available to be projected rearwardly by the fan for cooling the engine.

Another object of the invention is to provide a fan and shroud arrangement wherein a portion of the fan is increased in diameter and coordinated with the rear edge of the shroud to effectively prevent recirculation of air and enhance direct cooling of the engine.

A still further object of the invention is to provide a fan and shroud arrangement wherein the rear edge of the shroud extends to a plane intermediate the leading and trailing edges of the fan blades, and each fan blade has the portion adjacent the trailing edge extended radially outwardly to a location behind the rear edge of the shroud.

These and other objects and advantages of the invention will become apparent when reference is made to the following description and accompanying drawings, wherein:

FIG. 1 is a fan-cooling system for an internal combustion engine embodying the invention;

FIG. 2 is an enlarged fragmentary portion of FIG. 1; and

FIG. 3 is an end view taken along the plane of line 3—3 of FIG. 1, with the cooling fan omitted, and looking in the direction of the arrows.

Referring to the drawings in greater detail, FIG. 1 illustrated a fan-cooling system 10 for use with an internal combustion engine 12 and a radiator 14. A cooling medium is circulated through the radiator 14 and the engine 12 via a conventional conduit system, including the usual plurality of interconnecting hoses 16 between the engine 12 and the radiator 14. A pulley 18 is driven by the crankshaft extension 19 of the engine 12. An endless V-belt 20 is mounted around the pulley 18 and a second pulley 22 for driving a cooling fan 24, whose hub portion 26 is secured to the hub 27 of the pulley 22. The fan 24 includes a plurality of blades 28 extending from the hub 27 and each having a leading edge 30 and a trailing edge 32.

A shroud 33 is secured to the radiator 14 which may be mounted vertically or on an angle, depending upon the vehicle model involved. Specifically, the shroud 33 may be formed of upper and lower halves 34 and 35, which, when mounted together, include a rearwardly extending cylindrical portion 36, better seen in FIG. 3, terminating in an annular edge 38 and having a gradually forwardly tapering front portion 40, the latter terminating in a rectangular shape suitable for being mounted at the four (4) sides or edges 42, 44, 46 and 48 thereof on the radiator 14. The right sides edge 44 (FIG. 3) need not extend as close to an end of the radiator 14 as the left side edge 48, allowing access to the cooling medium inlet and radiator cap assembly 49. Suitable strip seals 50 and 52 may be confined between the exterior of the radiator 14 and the respective upper and lower edges 42 and 46 of the shroud 33. For those vehicles whose hoods open at the front, a safety shield 54 may be mounted along a portion of the uppermost

surface of the circular portion 36 of the shroud 33 by any suitable means, such as rivets 56 (FIG. 2), but positioned a sufficient distance above the adjacent fan blades 28 that there is no interference with the features of the invention described hereinafter.

While a preferred fan and shroud arrangement would be one wherein the O.D. of the fan is substantially the same as the I.D. of an encompassing shroud, such an arrangement is not a practical one since some clearance is required between the rotating fan blades and the fixed shroud. Providing for such clearance not only results generally in having to use a smaller diameter fan in a given engine compartment, but also enhances the recirculation of air therethrough, due to the vacuum created between the radiator and the fan, thus diminishing the volume of air available to be projected rearwardly for cooling the engine.

Referring now to FIG. 2, it may be noted that each fan blade 28 encompassed by the invention has an outwardly radially extending blade portion 58 formed adjacent the trailing edge 32 thereof, such that the outermost tip of the blade 28 is no longer arcuate in the usual manner, but comprises a contoured, generally radially extending central segment 60, with adjacent generally transversely extending segments 62 and 64 formed forward and rearward thereof, respectively, both tapering slightly radially inward from their respective juncture points with the central segment 60.

It may be noted in FIGS. 1 and 2 that the segment 64 and a portion of the central segment 60 of the extended portion 58 of the blade 28 extends radially outward of the inner surface 66 of the circular shroud portion 36, and is located rearward of the plane of the edge 38 of the cylindrical shroud portion 36, there being a predetermined annular conically shaped space 68 remaining between the circular shroud edge 38 and the contoured, generally radially extending segment 60 of the fan blade extension 58.

It may now be realized that the above-described fan structure and cooperating shroud arrangement results in several important advantages. It is apparent that, by virtue of the blade extension 58 being formed on the blade 28, a larger diameter fan is made available in a given engine compartment, thus enhancing the pulling of more air through the radiator 14 for cooling the engine 12. Additionally, it may be realized that, by virtue of the conically shaped clearance 68 between the rear edge 38 of the shroud 33 and the upper portion of the rotating contoured fan edge segment 60, a substantially more restrictive barrier has been formed to prevent the tendency of the air to recirculate by flowing forwardly toward the vacuum in the space between the radiator 14 and the fan 24. More specifically, air which may tend to flow forwardly through the clearance 68 will be impeded directly by the edge 38 of the shroud 33 which is now behind the outermost tip 64 and a portion of the generally contoured radially extending segment 60 of each blade 28. Furthermore, there will result a more effective radially extending circumferential "wall" of air than heretofore, as a result of the increased action of centrifugal force off the outer edge of the now larger diameter fan 24, such wall of air adjacent the shroud edge 38 helping to block the flow of air toward the vacuum area, thus increasing the overall efficiency of the fan 24 in its providing air coolant for the engine 12. As a result, larger engines for use with additional accessories, such as air conditioners, may be effectively employed.

While but one embodiment of the invention has been shown and described, other modifications thereof are possible.

I claim:

1. A fan-cooling system for use in flowing air from a radiator to an engine, said system comprising a shroud secured at the forward end thereof to said radiator and having a rearwardly extending cylindrical portion, a fan assembly mounted for rotation on said engine and including a plurality of fan blades, the leading edge of each of said blades being surrounded by said cylindrical shroud portion and sloping away therefrom toward said radiator, the trailing edge thereof being exterior of

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said cylindrical shroud portion, a generally radially outward extension formed on each of said blades adjacent said trailing edge so as to extend substantially radially outward of the inner surface of said cylindrical shroud portion and rearward of said shroud edge and forming a substantially narrow clearance with said shroud edge, with said narrow clearance serving to prevent the reverse flow of air back into the vacuum area between said leading edge and said radiator.

2. A fan-cooling system for use in flowing air from a radiator to an engine, said system comprising a shroud secured at the forward end thereof to said radiator and having a cylindrical portion extending axially toward said engine, a fan assembly mounted for rotation on said engine and including a plurality of fan blades each having a leading edge adjacent said radiator and a trailing edge adjacent said engine, the rearmost edge of said cylindrical portion forming a plane through said fan blades intermediate the leading and trailing edges thereof, a generally radially outwardly extending trailing portion of each

of said blades rearward of said plane and formed adjacent said trailing edge so as to extend substantially radially outward of the inner surface of said cylindrical shroud portion and rearward of said shroud edge and forming a substantially narrow, generally conically shaped clearance with said shroud edge, the leading portion of each of said blades forward of said plane being spaced-apart from said inner surface of said cylindrical shroud portion a substantially greater distance than that of said generally conically shaped clearance such that air flow rearwardly therethrough is unimpeded and said conically shaped clearance serves as the only seal area for preventing the tendency of said air to recirculate therethrough toward said radiator, with said seal area being immediately adjacent the radially extending circumferential wall of air resulting from the action of centrifugal force outward of said generally radially outwardly extending trailing portion.

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