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Losch

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[54] **AIR MOTOR**

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[73] Assignee: **Susquehanna Air Motors, Inc.**, Mechanicsburg, Pa.

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[52] **U.S. Cl.** ..... **115/34 R**, 115/1 R, 416/247

[51] **Int. Cl.** **B63h 7/02**

[58] **Field of Search** ..... 115/34 R, 42, 1 R, 3, 35; 114/66.5 R, 43; 180/116, 117, 3 R; 416/247; 220/19

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[57] **ABSTRACT**

A guard structure for the air-moving propeller of a marine air motor for over-water propulsion utilizing a combustion engine operatively connected to such propeller for rotating the same, in which the guard structure is constructed from wire stock and provided with a configuration to operatively enclose the propeller at opposite sides and at the outer ends of the propeller as it rotates, the guard being constructed from wire stock formed into a plurality of convolutions connected by radially extending reinforcing ribs of wire stock, with the ribs being rigidly secured to the respective convolutions at their intersections therewith, the convolutions of the guard structure comprising at least two groups, each having a plurality of convolutions, with the convolutions of each group being formed from a respective single length of wire stock to form a vibration-resistant structure, the convolutions and ribs of the guard structure being provided with a coating of suitable material operable to protect the wire stock forming the structure from exposure to the elements and simultaneously therewith reduce noise resulting from the flow of air through the guard structure.

12 Claims, 4 Drawing Figures

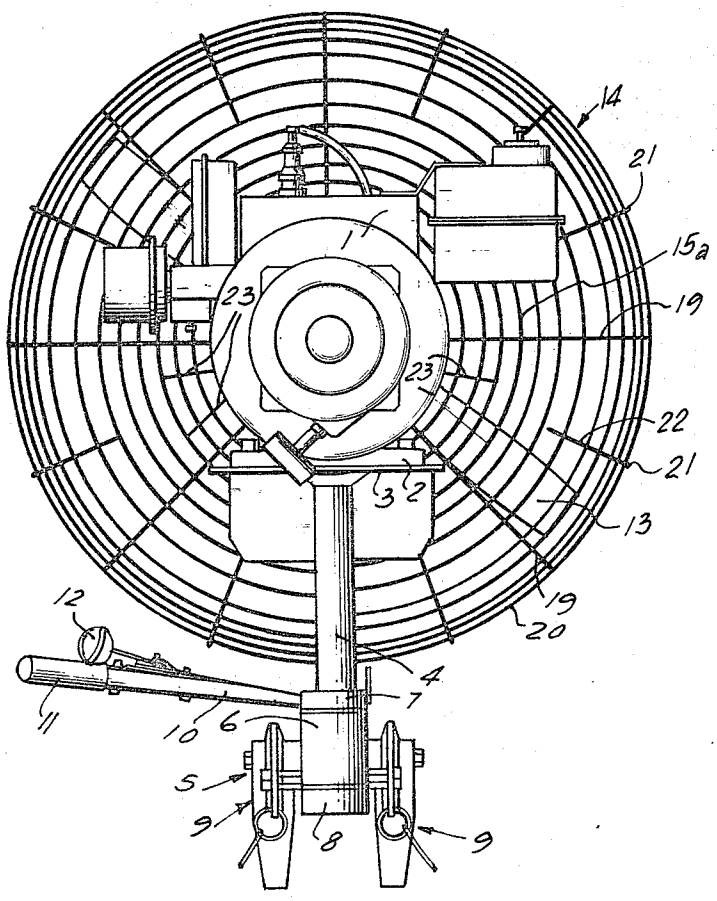
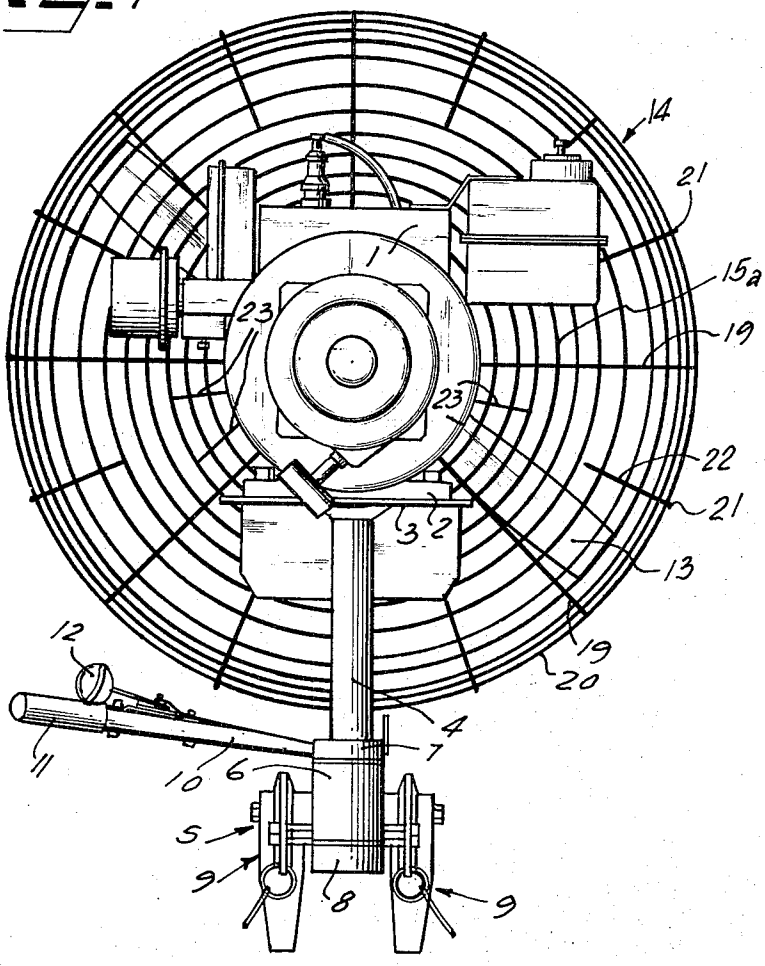


Fig. 1



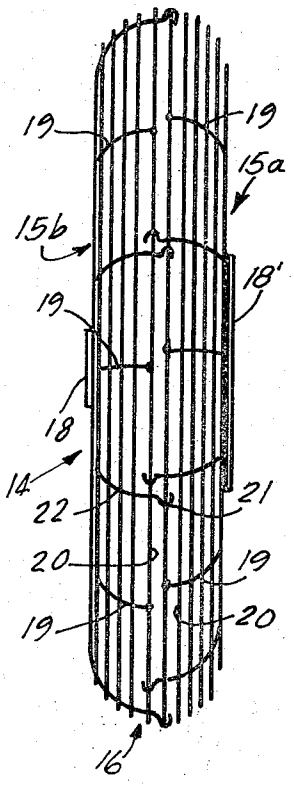


Fig. 3

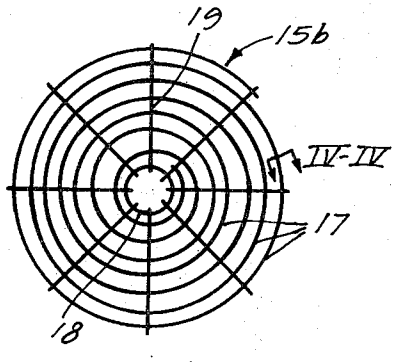


Fig. 2

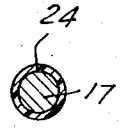


Fig. 4

AIR MOTOR

BACKGROUND OF THE INVENTION

The invention is directed generally to air motors of the type adapted to be placed on boats, particularly relatively small boats for use in shallow water locations where the usual type of outboard motor or the like is comparatively impractical.

While air-propelled water vehicles have been in use for many years, they have all been of similar construction in which the motor and boat were designed as an integral unit. In such cases a relatively large propeller was utilized with a motor of adequate horsepower, normally involving multiple cylinders.

It has been only comparatively recently that the small portable type of air motor, for example, designed for light-weight boats with a length of from 10 to 18 feet, normally adapted to receive the usual outboard motor. A in motors for small boats of this type, and thus designed for portability, may be powered by relatively small combustion engines as for example on the order of from 4 to 12 horsepower for boats of the size range referred to, and thus may readily employ single cylinder motors.

A vital part of an air motor of this type, from a safety standpoint, is the guard structure for the propeller blade necessary to prevent any possibility of accidental engagement of the propeller blade with other objects or persons. As low horsepower motors of the type here involved, normally employ a single cylinder, and the requirements of portability require light-weight etc., the propeller guard structure has presented problems in its design.

The requirement of a guard structure that is open as possible, i.e., presenting as little impedance to air flow produced by the propeller, coupled with weight requirements, substantially dictate the use of a structure formed from suitable wire or light rod stock, generally similar in overall construction to guard structures employed with other air moving devices such as electric fans and the like, and normally have followed a general pattern of construction employing a plurality of wire rings arranged in concentric relation and secured into a unitary structure by a plurality of radially extending wire ribs. Such type of guard structure has been in use for many years and proved to be very efficient on electric fans and the like.

It will be appreciated, however, that the usual type of fan structure is powered by an electric motor providing relatively substantailly vibrationless operation. In contrast thereto, air motors of the type here involved, employing a single cylinder combustion engine will develop relatively very large vibrational forces, as compared with such an electric motor, and while the large air-powered boat installations can, if deemed necessary, provide guard structures which are mounted independently of the motor, in the case of a small portable unit of the present type, practical considerations substantially dictate the utilization of a unitary structure in which the propeller guard will normally be mounted on or associated directly with the engine whereby vibrational forces are transmitted substantially directly to the guard structure. As the guard structure, as previously mentioned, will normally be fabricated from wire or light rod stock vibrations may be readily transmitted throughout the guard structure.

Experience has proved that guard structures employing a plurality of concentrically arranged wire rings assembled into a unitary structure by means of radially extending wire ribs welded to the rings at their intersections are subject to damage from developed vibrations when used with small, single cylinder engines. Such damage usually will initially comprise the breaking of a joint between a ring and an associated rib, and upon separation therebetween the increased vibration in the ring so severed will readily result in comparatively rapid separation between such ring and the adjacent ribs. In view of the protective function of the guard structure with respect to the rotating propeller the existence of loose elements directly adjacent a propeller present a very serious hazard, not only to possible damage to the propeller and associated structure but more important the danger of physical injury, and thus damage of this type essentially dictates taking the motor out of operation until the guard can be repaired or replaced.

Two other problems arise in connection with portable air motors of the type here involved, the first being that of possible rust and corrosion of the guard structure, for example as a result of exposure to the elements, including salt spray etc., which rust or corrosion could again affect the strength of the welded joints between the wire rings and ribs of the guard structure, thus possibly accelerating vibrational break down thereof. The other problem pertains to noise produced by the rotating propeller and air flow through the guard structure, it natuarlly being desirable to reduce the noise to as low a level as possible.

The present invention is directed to a portable type air motor, particularly designed for small boat shallow-water operation, which substantially eliminates the problems of vibration with respect to the propeller guard structure, at the same time eliminating problems of rust and corrosion of the guard structure with a reduction in the operational noise level.

BRIEF SUMMARY OF THE INVENTION

I have found that the destructive effect of developed vibrational forces in a portable air motor of the type described can be drastically reduced, as compared with previous devices, by the elimination of the concentric ring type construction in the guard structure and employing in lieu thereof a guard construction fabricated from wire stock, formed into a plurality of convolutions which are connected by radially extending reinforcing ribs, likewise fabricated from wire stock, with the ribs being rigidly secured to the respective convolutions at their intersections but employing, in contrast to the concentric ring type construction, a single length of wire stock to form a plurality of spaced convolutions, preferably forming at least one whole section or side of the guard structure from a single length of wire stock. In its most simple form, the convolutions may have a spiral configuration with one end of the wore stock being disposed at the central portion of the structure and then spirally curved with desired spacing between adjacent convolutions and the opposite end of the wire stock disposed adjacent the periphery of the guard structure. In most cases it will be expedient to form the guard structure in two sections, preferably two generally similar "halves" with the two sections having their meeting edges disposed at the peripheral centerline of the guard structure. This construction readily enables the fabrication of the guard structure from two lengths of wire stock, one for each section, and expediently the

radially extending reinforcing ribs may be utilized to secure the two sections in assembled relation.

In some cases it may be desirable to form the convolutions from a greater number of lengths of wire stock, but in most cases it is preferable to employ as few lengths as possible commensurate with practical constructional considerations.

I have also found that by suitably coating the guard structure with a non-metallic coating of suitable plastic, real or synthetic rubber, or the like, not only is the metallic guard structure protected from rust, corrosion, etc. but at the same time a material reduction in noise resulting from air flow through the guard structure, is effected. The exact reason for this is not apparent but it is believed that it may be the result of a dampening action of the coating on the wire elements of the guard structure reducing noise-producing vibration in the guard structure as well as from a possible change in air flow characteristics over the surface of the structure. At the same time, it would appear that in addition to the protection of the guard, the dampening action may also have an advantageous effect with respect to vibrational destruction of the guard structure by reducing the vibrational transmission or action on the convolutions thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings wherein like reference characters indicate like or corresponding elements,

FIG. 1 is a front elevational view (looking stern wise as mounted on a boat) of an air motor embodying the present invention;

FIG. 2 is a similar view of a portion of a guard structure such as illustrated in FIG. 1, as viewed from the opposite direction;

FIG. 3 is a side elevational view of an unmounted guard structure such as illustrated in FIG. 1; and

FIG. 4 is a cross section through the wire stock employed in the guard structure taken approximately on the line IV—IV of FIG. 2.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Referring to the drawing, and more particularly to FIG. 1, the reference numeral 1 indicates generally a small gasoline engine, illustrated as a single cylinder engine of standard construction, having a base 2 bolted or otherwise secured to a mounting bracket 3 and which if desired may be suitably constructed to provide a cushioned mount for the motor, which in turn is carried by a generally vertically extending supporting column or shaft 4 attached at its upper end to the bracket 3. The lower end of the column 4 may be suitably supported in a base structure, indicated generally by the numeral 5, having a sleeve member 6 in which the column 4 is supported for pivotal movement about its axis. In the construction illustrated, the column 4 carries an upper collar 7 and a lower collar 8 operative to maintain the column or support shaft 4 in operative position. The supporting structure 5 also includes suitable clamp means, indicated generally by the numeral 9, by means of which the mounting structure 5 may be rigidly clamped to the transom of a boat, in a manner similar to the mounting of the usual outboard motor. Steering is accomplished with a motor, such as that illustrated, by rotating the column 4 about its axis and thus rotating the motor, propeller and guard structure as a unit to direct the air flow in a desired direction. Such steering is adapted to be accomplished by a steering shaft or arm 10, illustrated as being rigidly connected to the collar 7, which may be provided with a manually engageable handle grip 11, the shaft also carrying, if desired a throttle control 12 for the engine.

Mounted on and rotatable with the drive shaft of the engine 1 is a propeller blade 13 which is enclosed in a protective guard structure indicated generally by the numeral 14, details of which are illustrated in FIGS. 2 and 3. The guard structure is provided with a configuration to operatively enclose the propeller at opposite sides thereof as well as at the outer ends of the propeller as the latter rotates and is constructed from suitable wire stock formed to provide a pair of spaced, relatively flat portions 15*a* and 15*b*, connected by an intermediate portion 16 of generally annular shape, having an arcuate or more or less semicircular transverse cross-section, whereby the spaced relatively flat portions 15*a* and 15*b* are disposed at opposite sides of the propeller blade 13 with the intermediate portion 16 extending between the two side portions in spaced relation with respect to the ends of the propeller blades, completely enclosing the same.

As will be particularly apparent from a reference to FIG. 2, the side portion 15*b* is constructed from a single length of wire stock arranged in a plurality of convolutions 17 with the inner end of the wire stock being disposed adjacent to or secured to a centrally positioned annularly shaped member or ring 18 with the convolutions 17 extending around the ring 18 in ever-increasing radius to provide a spiral configuration. The respective convolutions thereof may be secured in operative position by a plurality of reinforcing ribs 19 which are welded or otherwise suitably secured to the respective convolutions 17 at their intersections therewith to form a unitary structure.

As will be apparent from a reference to FIG. 3, in the particular embodiment illustrated, the guard structure is fabricated in two sections, having the dividing line between the two sections disposed at the outer peripheral centerline of the intermediate portion 16, with the adjacent abutting edge of each section being defined by a respective annular ring 20 to which the adjacent end of the wire stock forming the last convolution 17 may be secured. Likwise, as will be apparent from a reference to FIG. 3, the end of each rib 19 is suitably welded or otherwise secured to the associated ring 20 with the respective reinforcing ribs 19 being disposed at the interior of the guard structure. In the construction illustrated the section 15*a* is provided at its central portion with an annular shaped plate or ring member 18′ to which the inner end of the wire stock forming the innermost convolutions 17 may be secured in a manner corresponding to that previously described for the ring 18, the member 18′ however, being illustrated as of a size to permit its direct attachment to an adjacent portion of the engine 1 whereby the latter forms the support for the guard structure. such attachment may employ any suitable means, for example, screws or bolts extending through the member 18′ and threaded into a suitable portion of the motor or a cooperable mounting member attached to the motor, specific details of which attachment will depend upon the particular motor involved. Such details of attachment thus form no part of the specific invention herein described.

In the embodiment of the invention illustrated, the two sections or halves 15*a* and 15*b* are retained in assembled relation by hook-like members 21 formed on the outermost ends of respective radially extending rib members 22, which in the present embodiment of the invention as illustrated in FIG. 1, are of relatively short length and secured to merely the outermost convolutions of the associated section. The hook portions 21 are so proportioned and shaped that they may be interlocked with the adjacent ring member 20 of the other section, such operation being accomplished by effecting a slight springing of the guard structure sufficient to permit the desired interlock thus achieving very simple yet highly effective connection between the two sections. If desired, additional short ribs 23 may be provided as a further reinforcement for the centrally disposed convolutions of the respective sections.

As illustrated in FIG. 4, the wire stock forming the guard structure may be provided with a coating 24 of suitable non-metallic material, as for example, a suitable plastic or natural or synthetic rubber etc. applied in any suitable manner. I have found that excellent results may be achieved by dipping the fabricated guard sections in the coating material, thus ensuring a complete coverage of all portions of the guard structure. The specific composition of the coating material is not critical, one of the requirements therefore, being that it is highly corrosive-resistant to material with which the guard might come into contact during normal usage of the air motor. It should also have good adherence characteristics with respect to the wire stock and suitable characteristics with respect to ease of application. Preferably, it should further provide the reduction in noise previously referred to. The first mentioned characteristics of such type of material are usually readily available with respect to any specific commercial material, and its sound reducing properties may be readily determined by test. I have found that a very efficient material for the coating 24 is a commercial plastic known under the trade name of "Plastisol."

It will be appreciated from the above disclosure that the present invention provides a relatively very simple construction for achieving the desired results, enabling the production of a small portable air motor having exceptional characteristics with respect to guard deterioration and vibration resistance, as well as a guard structure having a relatively low air-flow noise level.

Having thus described my invention, it will be apparent from the above description that various immaterial modifications may be made in the same without departing from the spirit and scope of the invention.

I claim:

1. A guard structure for the air-moving propeller of a marine air motor for over-water propulsion utilizing a combustion engine operatively connected to such propeller for rotating the same, in which the guard structure is constructed from wire stock and provided with a configuration to operatively enclose the propeller at opposite sides and at the outer ends of the propeller as it rotates, said guard being constructed from wire stock formed into a plurality of convolutions connected by radially extending reinforcing ribs of wire stock with the ribs being rigidly secured to the respective convolutions at their intersections therewith, the convolutions of said guard structure comprising at least two groups, each having a plurality of convolutions, with the convolutions of each group being formed from a respective single length of wire stock, to provide a relatively vibration-resistant structure.

2. A guard structure according to claim 1, wherein the convolutions and ribs of said guard structure are provided with a coating of suitable material operable to protect the wire stock forming the structure from exposure to the elements and simultaneously therewith reduce noise resulting from the flow of air through the guard structure.

3. A guard structure according to claim 1, wherein said guard structure is divided into two separable sections, the meeting edges of the respective sections being defined by respective close annularly shaped members of wire stock, and means for securing the two sections in assembled relation.

4. A guard structure according to claim 3, wherein said securing means comprises elements on adjacent ends of respective radially extending ribs, arranged to be interlocked with the adjacent annularly shaped member of the other section.

5. A guard structure according to claim 4, wherein said convolutions of each section are disposed in spiral configuration.

6. A guard structure for the air-moving propeller of a marine air motor for over-water propulsion utilizing a combustion engine operatively connected to such propeller for rotating the same, in which the guard structure is constructed from wire stock and provided with a configuration to operatively enclose the propeller at opposite sides and at the outer ends of the propeller as it rotates, said guard being constructed from wire stock formed into a plurality of convolutions connected by radially extending reinforcing ribs of wire stock with the ribs being rigidly secured to the respective convolutions at their intersections therewith, the convolutions and ribs of said guard structure being provided with a coating of suitable material operable to protect the wire stock forming the structure from exposure to the elements and simultaneously therewith reduce noise resulting from the flow of air through the guard structure.

7. In a marine air motor for over-water propulsion utilizing a combustion engine operatively connected to an air-moving propeller, said engine and propeller forming a unitary structure adapted to be mounted adjacent the stern of a boat for pivotal movement about a generally vertical axis with the plane of rotation of said propeller extending transverse to said pivotal axis, the combination of a guard structure for said propeller, constructed from wire stock formed to provide a pair of relatively flat portions disposed in spaced opposed relation at opposite sides of the plane of rotation of said propeller with one os such portions disposed adjacent such engine, and an intermediate relatively annularly shaped portion extending from the relatively flat portions and across the plane of rotation of said propeller in outwardly spaced relation from the ends of the latter as it rotates, whereby said guard structure completely encircles and protects said propeller, the relatively flat portion adjacent the combustion engine having its central portion secured thereto, said relatively flat portions being formed by a plurality of radially spaced convolutions of wire stock and a plurality of cooperable generally radially extending reinforcing ribs formed from wire stock, with said ribs being rigidly secured to the respective convolutions at their intersections therewith, the convolutions of said guard structure compris-

ing at least two groups, each having a plurality of convolutions, the convolutions of each such group being formed from a single length of wire stock.

8. A device according to claim **7**, wherein said convolutions and reinforcing ribs are provided with a non-metallic coating thereon operative to protect the wire stock forming said guard structure from exposure to the elements and simultaneously therewith reduce noise resulting from the flow of air through the guard structure.

9. A device according to claim **7**, wherein said guard structure is divided at the peripheral centerline of said intermediate portion to form a pair of separable, generally similarly shaped sections, the meeting edges of which are formed by respective closed annularly shaped members of wire stock, the convolutions extending from each annular member to adjacent the central part of the associated relatively flat portion being formed from a single piece of wire, and means for securing the two sections in assembled relation.

10. A device according to claim **9**, wherein each relatively flat portion is provided with a centrally disposed closed annularly shaped member to which the inner end of the wire stock forming the adjacent convolutions is secured, and the adjacent ends of a plurality of said reinforcing ribs are rigidly secured, the opposite ends of the wire stock forming the outermost convolution and the adjacent ends of a plurality of said reinforcing ribs being secured to the adjacent annular shaped member defining said meeting edges of the respective sections.

11. A device according to claim **10**, wherein said convolutions and reinforcing ribs are provided with a non-metallic coating thereon operative to protect the wire stock forming said guard structure from exposure to the elements and simultaneously therewith reduce noise resulting from the flow of air through the guard structure.

12. In a marine air motor for over-water propulsion utilizing a combustion engine operatively connected to an air-moving propeller, said engine and propeller forming a unitary structure adapted to be mounted adjacent the stern of a boat for pivotal movement about a generally vertical axis with the plane of rotation of said propeller extending transverse to said pivotal axis, the combination of a guard structure for said propeller, constructed from wire stock formed to provide a pair of relatively flat portions disposed in spaced opposed relation at opposite sides of the plane of rotation of said propeller with one of such flat portions disposed adjacent such engine, and an intermediate relatively annularly-shaped portion extending from the relatively flat portions and across the plane of rotation of said propeller in outwardly spaced relation from the ends of the latter as it rotates, whereby, said guard structure completely encircles and protects said propeller, the relatively flat portion adjacent the combustion engine having its central portion secured thereto, said relatively flat portions being formed by a plurality of radially spaced convolutions of wire stock and a plurality of cooperable generally radially extending reinforcing ribs formed from wire stock, with said ribs being rigidly secured to the respective convolutions at their intersections therewith, said convolutions and reinforcing ribs being provided with a non-metallic coating thereon operative to protect the wire stock forming said guard structure from exposure to the elements and simultaneously therewith reduce noise resulting from the flow of air through the guard structure.

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