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OUTBOARD MOTOR HAVING SOUND ABSORBING CONSTRUCTION WITHIN ENGINE HOUSING

Filed May 31, 1962

Fig. 2.

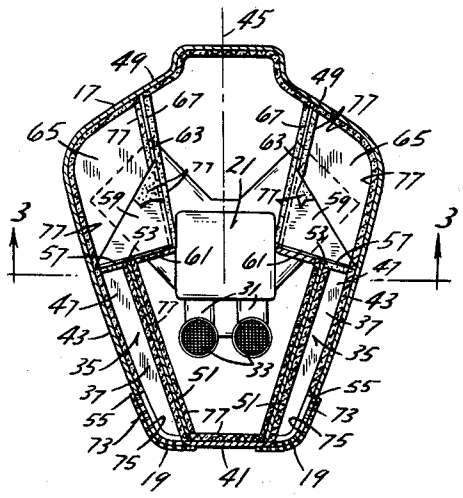


Fig. 1.

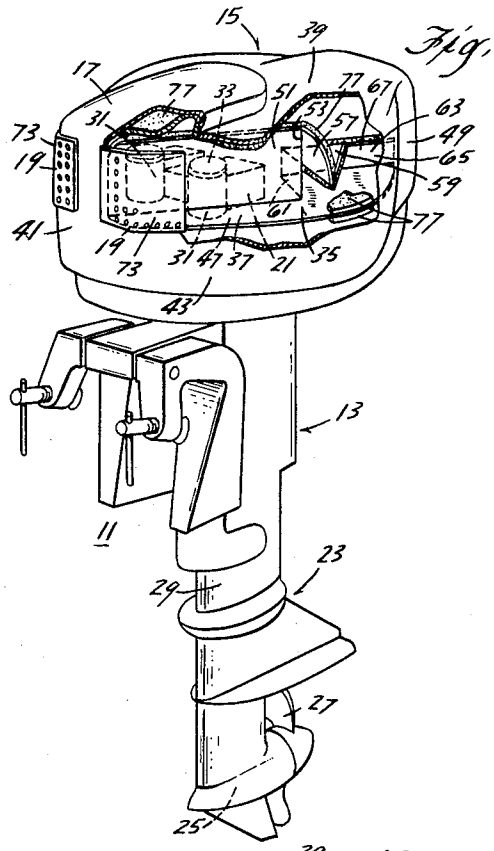
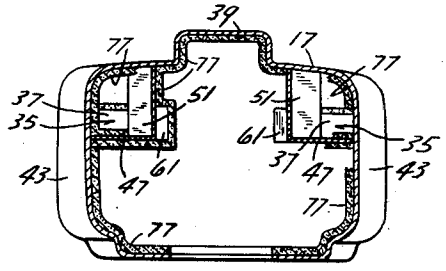


Fig. 3.



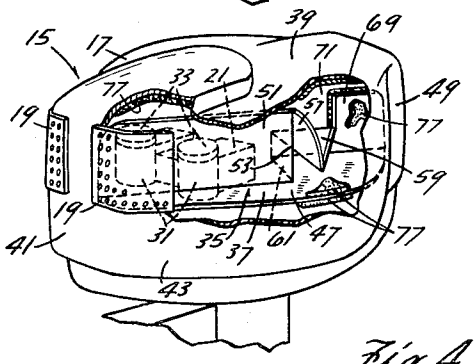


Fig. 4.

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OUTBOARD MOTOR HAVING SOUND ABSORBING CONSTRUCTION WITHIN ENGINE HOUSING

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The invention relates generally to internal combustion engines and for arrangements for reducing noise transmission from such engines. More particularly, the invention relates to internal combustion engines located in a housing or cover which substantially totally encloses such engine except for a combustion air entrance opening in the housing or cover. Still more particularly, the invention relates to the reduction of noise emitted from an outboard motor through a combustion air passageway leading from a carburetor or the like to the exterior of the housing or cover.

The invention contemplates a combustion air passageway which is lined with sound absorbing material and which is arranged to necessitate at least one change in the direction of transmission of sound waves traveling from the engine to the air entrance opening, thereby to insure striking by the sound waves of at least one surface lined with sound absorbing material. Phrased in other terms, the combustion air passageway is arranged to prevent direct linear transmission of sound waves from the engine through the air entrance opening to the surrounding atmosphere. Preferably, several sound absorbing baffles or walls are employed in the combustion air passageway to effect several changes in direction, thereby to reduce to a minimum the emission of sound through the combustion air passageway.

In the preferred embodiment, a perforated member or baffle is disposed in the combustion air passageway at, or adjacent to, the air entrance opening, and at an angle to the plane of minimum passageway cross sectional area so as to afford ample opportunity for air entry through the openings in the perforated member, while at the same time, affording a further baffle for sound waves traveling through the combustion air passageway. If desired, the inwardly facing side of the perforated member can also be lined with sound absorbing material.

Preferably, the combustion air passageway is also arranged to include a vertical portion which, under normal operating conditions, is effective to prevent entry of water into the housing or into the carburetor and which may comprise a part of a gooseneck arrangement. In addition, the air entrance opening is preferably forwardly facing to further reduce the possibility of water entering into the housing or into the carburetor under normal operating conditions.

The principal object of the invention is the provision, in the combination of an internal combustion engine and a substantially totally enclosing housing therefor, of a combustion air passageway which is effective to substantially reduce, if not essentially eliminate, emission of sound therethrough. Other objects and advantages of the invention will become known by reference to the following description and the accompanying drawings, in which:

FIGURE 1 is a perspective view, partially broken away and in section, of an outboard motor 11 incorporating various of the features of the invention;

FIGURE 2 is a horizontal sectional view taken through the motor 11 at a level just below the roof of the engine housing;

FIGURE 3 is a sectional view taken generally along line 3—3 of FIGURE 2; and

FIGURE 4 is a fragmentary, perspective view, similar to FIGURE 1, of another embodiment of an outboard motor in accordance with the invention.

The outboard motor 11 conventionally includes a dirigibly mounted propulsion unit 13 which incorporates a power head 15 including an engine housing or cover 17 which, except for at least one air entrance opening 19, totally encloses an internal combustion engine 21. Also included in the propulsion unit 13 is a lower unit 23 including a propeller shaft 25 carrying a propeller 27 and a strut or driveshaft housing 29 unitarily connecting the power head 15 to the lower unit 23 and including drive transmission means (not shown) connecting the engine 21 and the propeller shaft 25.

The engine 21 can be of any conventional construction and includes at least one carburetor 31 having an air intake opening 33 in communication with a combustion air passageway 35 leading from the air entrance opening 19. The disclosed construction employs dual carburetors 31 and generally identical dual combustion air passageways 35, only one of which will be described. However, the features of the invention are equally applicable to engines having a single carburetor or other air intake means.

In past constructions, apart from a perforated baffle across the air entrance opening 19 to keep unwanted solid materials out of the engine housing 17, combustion air was free to flow directly from the air entrance opening 19 to the carburetor air intake 33, which intake was usually located in closely spaced, adjacent relation to the air entrance opening. This arrangement, however, also permitted transmission of sound waves emitted from the carburetor, and from adjacent portions of the engine, along linear paths through the air entrance opening to the surrounding environment.

Such unwanted sound transmission can be substantially muffled, and in some cases substantially eliminated, by causing such sound waves to strike at least one sound absorbing wall surface during travel toward the air entrance opening. This can be accomplished, if the passageway is long enough, by at least partially lining the combustion air passageway with a sound absorbing material. In addition, if desired, one or more baffles can be interposed in the path of travel of the sound waves from the engine 21 to the air entrance opening 19.

Although a single sound absorbing baffle located transversely across the sum of the linear paths between the engine 21 and the air entrance opening 19 will provide some of the advantages of the invention, it is preferred that the combustion air passageway 35 include a defined duct beginning at the air entrance opening 19 and extending a substantial distance therefrom. In addition, the duct portion preferably provides a tortuous flow path, which path necessarily causes striking by the sound waves emitted from the engine 21, of several sound absorbing surfaces during travel toward the air entrance opening 19. The duct portion of the combustion air passageway 35 is also preferably designed to prevent the entry of water into the engine housing 17 under normal conditions.

More specifically, the combustion air passageway 35 includes a duct portion 37 extending from the air entrance opening 19 which is disposed, adjacent the top wall or roof 39 of the housing 17, at the junction of the front and side walls 41 and 43, respectively, of the housing. As the side wall 43 of the housing extends in rearwardly and outwardly oblique relation to the center line 45 of the housing, the air entrance opening 19 extends rearwardly in the side wall 43 a considerable distance, thereby providing an air entrance opening of considerably larger area than the cross section of the duct portion 37 immediately rearwardly of the air entrance opening 19.

The duct portion 37 extends rearwardly from the air entrance opening 19 and is, at least partially, lined with a sound absorbing material such as fiberglass or polyurethane foam. In the particularly disclosed construction, the duct portion is lined throughout its length. The duct portion 37 is defined, in part, by a bottom wall or floor 47 which may extend horizontally and preferably extends at a slight upward and rearward incline from the bottom edge of the air entrance opening 19, and from the inner surface of the side and rear walls 43 and 49, respectively, of the engine housing. The provision of an upward and rearward incline acts to assist in preventing the entry of water into the housing 17. The duct portion 37 is further defined by a generally vertical wall 51 extending from the air entrance opening in roughly parallel relation to the inner surface of a side wall 43 of the housing, and from the inner surface of the roof 39 of the housing 17, to the bottom wall 47. As already noted, the side wall 43 extends in rearward and outward oblique relation to the center line 45 of the housing 17, and in this connection, the vertical wall 51 preferably extends, such that its rearward edge 53 lies at a greater distance from the center line 45 of the housing 17 than the outermost vertical edge 55 of the air entrance opening.

Rearwardly spaced from the air entrance opening 19 is a vertical transverse wall or baffle having one portion 57 which extends across the duct portion 37 of the combustion air passageway 35 from the vertical wall 51 to the side wall 43 of the housing 17 downwardly from the housing roof 39 so as to block approximately the upper half of the available cross sectional area. Extending rearwardly from the lower margin of the transverse vertical baffle portion 57 in a generally horizontal disposition, i.e., parallel to the bottom wall 47, is an intermediate horizontal baffle or wall 59 of generally right triangular outline.

The horizontal baffle wall 59 projects inwardly along its forward side edge toward the center line 45 of the engine housing 17 beyond the longitudinal vertical wall 51. Inwardly of the longitudinally vertical wall 51, the baffle wall 59 is connected with another portion 61 of the transverse vertical baffle extending from the lower portion of the rearward edge 53 of the longitudinally vertical wall 51 inwardly toward the center line 45 of the engine housing 17. The transverse vertical wall portion 61 extends vertically between the bottom wall 47 and the intermediate horizontal baffle 59 and terminates at the inner end of the forward side edge of the intermediate horizontal baffle 59.

The other or longitudinal side edge of the intermediate horizontal baffle 59 is joined to another longitudinal vertical wall 63 which extends downwardly to the bottom wall 47 and rearwardly from the inner margin of the vertical transverse baffle portion 61, beyond the rearward end of the longitudinal side edge of the intermediate horizontal baffle 59 and to the inner surface of the rear wall 49 of the housing 17. This construction defines a generally horizontally open exit 65 from the duct portion 37 of the combustion air passageway, which exit 65 is defined by the hypotenuse edge of the intermediate horizontal baffle 59, the rearward portion 67 of the top edge of the longitudinal vertical wall 63, and the inner surface of the engine housing 17. The horizontal disposition of the exit opening 65, in generally perpendicular relation to the sides of the engine 21, minimizes the likelihood of direct linear transmission of sound waves from the engine 21 through the exit opening 65 of the duct portion.

If desired, as shown in FIGURE 4, the rearward portion of the vertical wall 63 can include an upward extension 69 to the roof 39 of the housing, thereby effectively lengthening the duct portion 37. In this instance, the exit opening 71 lies in a vertical plane connecting the forward edge of the vertical wall extension 69 with the upper portion of the rearward edge 53 of the vertical

wall. After passage through the exit opening 71, sound waves emanating from the engine 21 would still have to pass through the opening 65.

As the air intake 33 of the carburetor 31 is disposed, in the disclosed construction, in relatively closely spaced relation rearwardly of the front wall 43 of the engine housing 17, air flowing from the exit openings (either 65 or 71) subsequently travels along the inner surface of the vertical wall 51 at a level generally above the level of the air flow confined between the intermediate horizontal baffle 59 and the bottom wall 47.

A further sound absorbing baffle is provided, while simultaneously affording ample opportunity for air entry, and at the same time excluding unwanted solids, by extension across the air entrance opening 19 of a perforated baffle or member 73 which is preferably lined on its inner side with a sound absorbing lining 75 such as fiberglass or polyurethane foam. The projection of the baffle 73 at an acute angle to the plane of minimum duct cross sectional area immediately rearwardly of the air entrance opening 19 presents substantial obstruction to passage of sound waves traveling the length of the duct portion 37 in the assumed principal direction of air flow, i.e., perpendicular to the plane of minimum cross sectional area, while the perforated condition of the baffle 73 provides ample area for air entrance in a direction extending transversely of the length of the adjacent part of the duct portion 37.

Still further increased absorption of sound waves emitted from the engine 21 can be achieved by lining the entire inner surface of the housing 17, as well as the surfaces exposed to the engine of the walls 47, 51, 61, and 63, with a sound absorbing material 77 such as fiberglass or polyurethane foam. As a result, such sound waves which pass through the exit opening (either 65 or 71) after having previously struck the inner surface of the housing 17, or the surfaces exposed to the engine of the walls 47, 51, 61, and 63, have already been partially absorbed, i.e., have undergone diminution in their volume or amplitude.

The disclosed construction effectively reduces to a minimum transmission through the air entrance opening 19 of sound waves emitted from the engine 21. Any sound waves entering the duct exit opening (either 65 or 71) must change direction at least once and will, in all likelihood, strike more than one wall surface lined with sound absorbing material, in addition to encountering the sound absorbing material 75 disposed along the inner surface of the perforated baffle 73 at the air entrance opening 19. Moreover, as any water which may enter the air entrance opening 19 must travel up the upwardly and rearwardly inclined bottom floor 47 and rise above the level of the intermediate horizontal baffle 59 before entering the housing 17, the duct portion 37 is essentially self-draining, thereby reducing to a minimum, any possibility of the entry of water into the housing. In addition, the location of the air entrance opening 19 at the front of the engine housing 17 and near the roof 39 thereof at maximum distance from the water also serves to aid in the exclusion of the entry of water into the housing 17 through the combustion air passageway 35.

Various of the features of the invention are set forth in the appended claims.

What is claimed is:

1. The combination of an internal combustion engine having a combustion air intake and an engine housing substantially totally enclosing said engine from the surrounding atmosphere except for an air entrance opening, said housing including means defining a combustion air passageway extending from said entrance opening to said air intake and including a duct portion leading from said air entrance opening, said air passageway being lined at least partially with sound absorbing material, and a perforated member extending transversely across said duct portion adjacent to said air entrance opening to afford

air flow therethrough and being lined on its inner side with sound absorbing material.

2. The combination of an internal combustion engine having a combustion air intake and an engine housing substantially totally enclosing said engine from the surrounding atmosphere except for an air entrance opening, said housing including means defining a combustion air passageway extending from said entrance opening to said air intake and including a duct portion leading from said air entrance opening, said air passageway being lined at least partially with sound absorbing material, and a perforated member extending transversely across said duct portion adjacent to said air entrance opening, and at an acute angle to the line of principal direction of air flow in said duct portion adjacent to said entrance opening to provide sound wave transmission baffle means without impeding air flow therethrough.

3. The combination of an internal combustion engine having a combustion air intake and an engine housing substantially totally enclosing said engine from the surrounding atmosphere except for an air entrance opening, said housing including means defining a combustion air passageway extending from said entrance opening to said air intake and including a duct portion leading from said air entrance opening, said air passageway being lined at least partially with sound absorbing material, and a perforated member extending transversely across said duct portion adjacent to said air entrance opening and at an acute angle to the line of principal direction of air flow in said duct portion adjacent to said entrance opening and being lined on its inner side with sound absorbing material, whereby to provide sound wave transmission baffle means without impeding air flow therethrough.

4. An outboard motor comprising an engine having a combustion air intake, a housing substantially totally enclosing said engine from the surrounding atmosphere except for a combustion air entrance, a duct leading from said combustion air entrance and communicating with said air intake, said duct being defined by wall means disposed in position to be struck at least once by every sound wave passing through said duct, said wall means being lined with a sound absorbing material to effect sound wave diminution incident to sound wave striking thereof, and a perforated baffle extending transversely across said duct adjacent said air entrance to afford air flow therethrough, said baffle being lined on its inner side with sound absorbing material.

5. An outboard motor comprising an engine having a combustion air intake, a housing substantially totally enclosing said engine from the surrounding atmosphere except for a combustion air entrance opening, a duct leading from said combustion air entrance opening and communicating with said air intake, said duct being defined by wall means disposed in position to be struck at least once by every sound wave passing through said duct, said wall means being lined with a sound absorbing material to effect sound wave diminution incident to sound wave striking thereof, and a perforated baffle extending transversely across said duct adjacent said air entrance opening and at an acute angle to the principal direction of air flow through the adjacent part of said duct, whereby to afford baffling without substantially impeding air flow.

6. An outboard motor comprising an engine having a combustion air intake, a housing substantially totally enclosing said engine from the surrounding atmosphere except for a combustion air entrance opening, a duct leading from said combustion air entrance opening and communicating with said air intake, said duct being defined by wall means disposed in position to be struck at least once by every sound wave passing through said duct, said wall means being lined with a sound absorbing material to effect sound wave diminution incident to sound wave striking thereof, and a perforated baffle extending transversely across said duct adjacent said air entrance opening, said baffle being lined on its inner side with sound absorbing material and being disposed at an acute angle to the principal direction of air flow through the adjacent part of said duct, whereby to afford sound wave transmission baffling without substantially impeding air flow therethrough.

7. An outboard motor comprising an engine having a combustion air intake, a housing substantially totally enclosing said engine from the surrounding atmosphere except for a combustion air entrance opening, said air entrance opening being forwardly facing and being located below said air intake to afford prevention of entry of water into said air intake when said engine is in a normal operating, upright condition, a duct leading from said combustion air entrance opening and communicating with said air intake, said duct being defined by wall means disposed in position to be struck at least once by every sound wave passing through said duct, said wall means being lined with a sound absorbing material to effect sound wave diminution incident to sound wave striking thereof, said duct including a vertical change in direction requiring upward flow from said air entrance opening to said air intake when said engine is in a normal operating, upright position, thereby also to prevent entry of water into said housing, and a perforated member extending transversely across said duct portion adjacent to said air entrance opening and affording air flow therethrough.

8. An outboard motor comprising an engine having a combustion air intake, a housing substantially totally enclosing said engine from the surrounding atmosphere except for a combustion air entrance opening, a duct leading from said combustion air entrance opening and communicating with said air intake, said duct being defined by wall means disposed in position to be struck at least once by every sound wave passing through said duct and being lined with a sound absorbing material to effect sound wave diminution incident to sound wave striking thereof, said air entrance opening being forwardly facing and being located below said air itake to prevent entry of water into said air intake when said engine is in a normal operating, upright condition, said duct including a vertical change in direction requiring upward flow from said air entrance opening to said air intake when said engine is in a normal operating, upright position, thereby also to prevent entry of water into said housing, and a perforated baffle extending transversely across said duct adjacent said air entrance opening, said baffle being lined on its inner side with sound absorbing material and being disposed at an acute angle to the principal direction of air flow through the adjacent part of said duct, whereby to afford sound wave transmission baffling without substantially impeding air flow therethrough.

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