Dec. 24, 1963 H. W. BIRK 3,115,210

MARINE MUFFLER

Filed April 3, 1962

FIG. 1

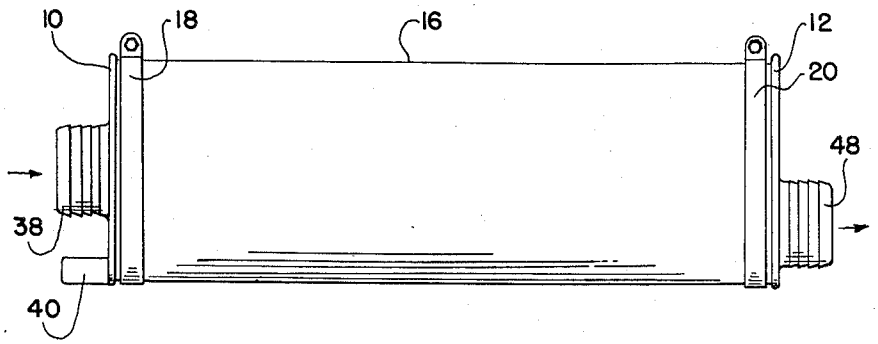


FIG. 2

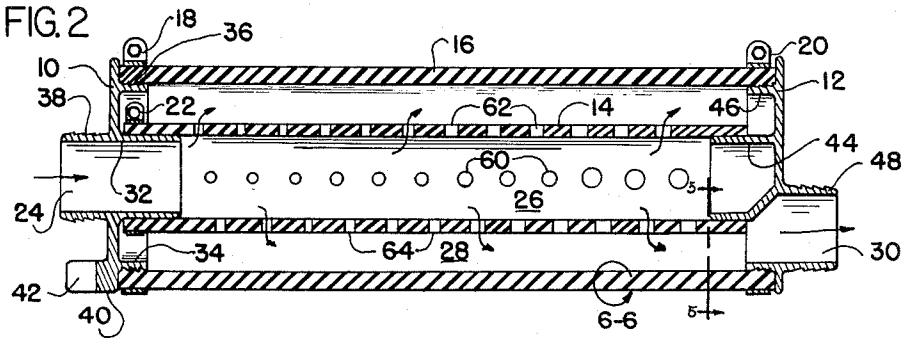


FIG. 3

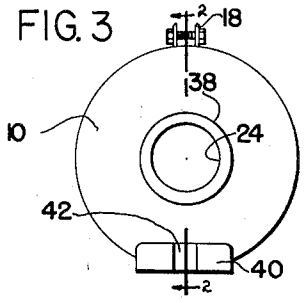


FIG. 4

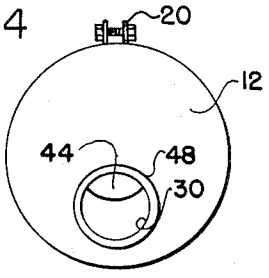


FIG. 5

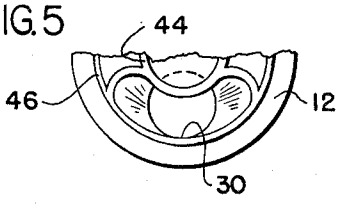
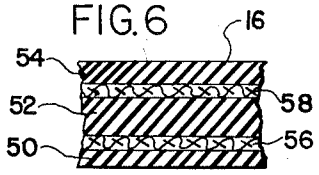


FIG. 6



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MARINE MUFFLER

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10 Claims. (Cl. 181—52)

This invention relates to engine exhaust mufflers and, more specifically, to a muffler particularly adapted for but not limited in use to internal combustion engines in marine installations.

Mufflers constructed of rubber or rubberlike material have found widespread use in marine installations and have several advantages over conventional metallic mufflers. They are immune to detrimental effects of the engine cooling water and engine exhaust chemicals which pass therethrough. They are not seriously affected by freezing, elimination of electrolysis is provided for, and they exhibit a low level of heat and vibration conductivity. Thus, rubber mufflers of known construction have been found generally satisfactory. They have not, however, been found entirely satisfactory.

More specifically, rubber mufflers of known construction are formed of rubber or rubberlike materials throughout and they are generally molded or vulcanized with a substantial degree of complexity in the formation of the internal baffle members and the like. Moreover, conventional rubber mufflers are so constructed that it is extremely difficult if not impossible to disassemble the same for cleaning, repair, and/or replacement of internal parts such as the baffle members.

It is an important object of the present invention to provide a muffler at least partially constructed of rubberlike material and which exhibits the advantages of rubber mufflers of known construction but which is yet of a desirably simple and inexpensive construction and particularly well adapted for convenient disassembly as may be required for maintenance.

Another object of the invention resides in the provision of a muffler of the type mentioned and which exhibits superior sound attenuating characteristics.

The drawing shows a preferred embodiment of the invention and such embodiment will be described, but it will be understood that various changes may be made from the construction disclosed, and that the drawing and description are not to be construed as defining or limiting the scope of the invention, the claims forming a part of this specification being relied upon for that purpose.

Of the drawing:

FIG. 1 is a side elevational view of a mufflller constructed in accordance with the present invention.

FIG. 2 is a longitudinal section taken generally as indicated at 2—2 in FIG. 3.

FIG. 3 is a left-hand end view of the muffler.

FIG. 4 is a right-hand end view of the mufflller.

FIG. 5 is a fragmentary view of the rear head member taken generally as indicated at 5—5 in FIG. 2.

FIG. 6 is an enlarged section of a portion of the outer muffler shell taken generally as indicated at 6—6 in FIG. 2.

Referring particularly to FIGS. 1 and 2, it will be observed that a muffler constructed in accordance with the present invention comprises front and rear head members 10 and 12, an inner tubular shell 14, an outer tubular shell 16, and annular clamping bands 18, 20 and 22. The muffler is assembled with the outer shell 16 disposed about and in spaced relationship with the inner shell 14 and with the two shells supported between and secured to the front and rear head members 10 and 12. An inlet port 24 in the front head member 10 provides for the introduction of engine exhaust gases and engine cooling

water to a cylindrical chamber 26 defined by and within the inner shell 14 and by the rear head member 12. The inner shell 14 is perforate, as will be described, and the cooling water and exhaust gases pass radially outwardly therefrom to an annular chamber 28 defined by and within the outer shell 16 and by the front and rear head members 10 and 12 and the inner shell 14. From the annular chamber 28 the gases and cooling water pass through a discharge or exhaust port 30 in the rear head member 12.

Considering the head members 10 and 12 in greater detail, it will be observed that each of said members comprises a generally circular plate. The head members are formed of a rigid material and it is the presently preferred practice to employ a noncorrosive metal such as bronze. It will be understood, however, that a wide variety of other materials may be employed for this purpose, aluminum, rigid plastic, and galvanized iron being contemplated as possible substitute materials.

The front head member 10 is provided with inner and outer rearwardly projecting annular flanges 32 and 34 and, as shown, the said flanges respectively enter and mount a front end portion of the inner shell 14 and a front end portion of the outer shell 16. The inner flange 32 is preferably substantially longer than the outer flange 34 as shown and the aforementioned clamping band 22 is disposed about said inner flange and about the front end portion of the sleeve 14 whereby to secure the said sleeve portion to the flange. The provision of the band 22 is preferred but optional as will be described. The aforementioned clamping band 18 secures the front end portion of the outer sleeve 16 to the outer flange 34 and, in accordance with the presently preferred practice, the said flange is provided with external serrations as at 36.

On the front face of the head member 10 there is provided a forwardly projecting annular flange 38. The said flange may be employed for connecting an exhaust conduit for the introduction of engine exhaust gases and cooling water to the aforementioned inlet port 24, the said inlet port taking the form of an axial bore within the flange 38 and within the flange 32. Finally, on the front face of the front head member 10 there is provided a small mounting lug 40 which is slotted at 42 so as to receive a mounting bolt or screw.

The rear head member 12 has a forwardly projecting inner annular flange 44 substantially identical with the flange 32 and which is employed in mounting a rear end portion of the inner sleeve 14. An outer forwardly projecting annular flange 46 on the rear head plate 12 is substantially shorter than the flange 44 and substantially identical with the outer flange 36 on the front head member 10. The flange 46 is employed for mounting a rear end portion of the outer sleeve 16, the aforementioned clamping band 20 serving to secure the said rear end portion of the sleeve 16 to the flange.

The aforementioned exhaust port 30 is formed within a rearwardly projecting annular flange 48 formed on the rear head member 12 and which may be employed in connecting the muffler with a rear section of exhaust conduit. As best shown in FIG. 5, a rear section of the exhaust port 30 is substantially cylindrical but a front section thereof is generally elliptical with a concavity in its upper wall. Said front and rear sections of the port 30 are connected by a blending wall portion which provides for the smooth outflow of exhaust gases and cooling water.

The outer sleeve 16 of the muffler is tubular in configuration as mentioned and is open at its ends with an imperforate side wall. The sleeve 16 is formed of a rubberlike material and is preferably of a laminated construction as best illustrated in FIG. 6. Three layers of rubberlike material 50, 52 and 54 are shown in FIG. 6

with layers 56 and 58 of a tough fabric interposed between the central layer 52 and the outer layers 50 and 54 of rubberlike material. The fabric employed in layers 56 and 58 may vary widely and the rubberlike material of layers 50, 52 and 54 may comprise natural rubber, synthetic rubber, and a wide variety of flexible plastics as well as other materials. Thus, it will be understood that the term "rubberlike" is used herein and in the claims which follow in a broad sense, and is meant to include a wide variety of durable flexible materials suitable for the intended purpose.

The inner sleeve 14 of the muffler may be identical with the sleeve 16 as to material and general configuration but is of a smaller diameter and slightly shorter than the said outer sleeve. Further, the inner sleeve 14 is perforate as mentioned for the outward passage of exhaust gases and cooling water from the cylindrical chamber 26 to the annular chamber 28. Preferably, there is at least one longitudinally extending series of openings provided in the sleeve 14 and, as shown, the sleeve has a series of openings 60, 60 spaced 90° from a second series of openings 62, 62 and 90° from a third series of openings 64, 64. Another series of openings not shown in the drawing is provided diammetrically opposite the series of openings 60, 60. The openings 60, 60 are shown as being substantially equally spaced longitudinally along the length of the sleeve 14, but it will be noted that the openings are progressively larger as viewed from the front to the rear end portion of said sleeve. The openings 62, 62, the openings 64, 64, and the openings not shown are similar in spacing and size to the openings 60, 60, but it will be observed that the openings in adjacent rows or series of openings are offset longitudinally so that substantially all of the openings in the sleeve are offset longitudinally with respect to each other. More specifically, the row or series of openings 60, 60 is offset rearwardly with respect to the row or series of openings 62, 62, and the row or series of openings 64, 64 is offset rearwardly with respect to the series of openings 60, 60. Similarly, the row or series of openings not shown may be offset rearwardly with respect to the openings 64, 64.

Now from the foregoing it will be readily apparent that the muffler of the present invention is of a desirably simple construction and well suited to low cost quantity production. The shells 14 and 16 may be readily severed from tubular stock and the head members 10 and 12 may be of forged or cast and machined or even of molded construction. In assembly, the flange 32 may be entered in the sleeve 14 and secured by the clamping band 22 whereupon the rear end portion of the said sleeve may be engaged with the flange 44 and the end portions of the outer sleeve 16 engaged with their respective flanges in a convenient operation. Alternatively, the clamping band 22 may be eliminated, and the sleeve 14 will nevertheless remain in assembled position on attachment of the sleeve 16 to the head members 10 and 12. The longitudinal rigidity of the sleeve 14 is such that its end portions will secure themselves and remain in engagement with the flanges 32 and 44 which are substantially longer than the flanges 36 and 46 as mentioned. In the event that disassembly of the muffler is required for maintenance, one or both of the clamping bands 18 and 20 may be released and the muffler will then be readily and conveniently disassembled for access to the inner sleeve 14.

In operation of the muffler, the exhaust gases and cooling water pass into the inlet port 24 and thence to the chamber 26 as mentioned. Expansion of the inner sleeve 14 occurs with the pulsations of the exhaust gases and a substantial degree of sound attenuation is achieved. Further, the gases and the cooling water pass through the openings 60, 62 and 64 and expansion of the sleeve 16 occurs with exhaust gas pulsations whereby additional sound attenuation is obtained. Finally, the exhaust gases and the cooling water pass from the chamber 28 through the exhaust port 30 at a low sound level.

Now referring again to the openings 60, 62 and 64, it will be observed that an increased discharge or exhaust area is provided in the chamber 26 as the gases and cooling water progress from front to rear. Thus, the manifold pressures are lowered gradually and this contributes substantially to the overall sound attenuation characteristics of the muffler. Further, a non-resonant condition is provided for in the muffler by the longitudinally offset or staggered relationship of the openings 60, 62 and 64. This arrangement provides for non-resonance irrespective of engine speed and also contributes importantly to the overall sound attenuation characteristics of the muffler.

The invention claimed is:

1. A marine muffler comprising a rubberlike tubular inner shell with a perforate side wall, a rubberlike tubular outer shell with an imperforate side wall disposed about and in spaced relationship with said inner shell, and similar rigid front and rear head members connected respectively at opposite ends of said inner and outer shells and cooperating therewith to define a cylindrical chamber within said inner shell and an annular chamber within said outer shell and about said inner shell, said chambers being in communication through the perforations in said inner shell and said front and rear head members being provided respectively with an inlet port communicating with said cylindrical chamber and with an exhaust port communicating with said annular chamber.

2. A marine muffler comprising a rubberlike tubular inner shell having open ends and a side wall with front and rear end portions and with at least one longitudinally extending series of openings, the openings in said series being progressively larger from the front end portion of the shell to the rear end portion thereof, a rubberlike tubular outer shell having open ends and an imperforate sidewall with front and rear end portions and which is disposed about and in spaced relationship with said inner shell, and similar rigid front and rear head members connected respectively at front and rear end portions of said inner and outer shells and cooperating therewith to define a cylindrical chamber within said inner shell and an annular chamber within said outer shell and about said inner shell, said chambers being in communication through the openings in said inner shell and said front and rear head members being provided respectively with an inlet port communicating with said cylindrical chamber and with an exhaust port communicating with said annular chamber.

3. A marine muffler comprising a rubberlike tubular inner shell having open ends and a side wall with front and rear end portions and with a plurality of longitudinally extending series of openings, the openings in each series of openings being progressively larger from the front end portion of the shell to the rear end portion thereof and substantially all of said openings being offset longitudinally with respect to each other, a rubberlike tubular outer shell having open ends and an imperforate side wall with front and rear end portions and which is disposed about and in spaced relationship with said inner shell, and similar rigid front and rear head members connected respectively at front and rear end portions of said inner and outer shells and cooperating therewith to define a cylindrical chamber within said inner shell and an annular chamber within said outer shell and about said inner shell, said chambers being in communication through the openings in said inner shell and said front and rear head members being provided respectively with an inlet port communicating with said cylindrical chamber and with an exhaust port communicating with said annular chamber.

4. A marine muffler comprising a rubberlike tubular inner shell having open ends and a perforate side wall with front and rear end portions, a rubberlike tubular

outer shell having open ends and an imperforate side wall with front and rear end portions and which is disposed about and in spaced relationship with said inner shell, a rigid front head member with inner and outer rearwardly projecting annular flanges respectively for mounting the front end portions of said inner and outer shells, said member also having a forwardly projecting annular flange and an inlet port within said flange and within said inner rearwardly projecting flange for communication with the interior of said inner shell, and a rigid rear head member with inner and outer forwardly projecting annular flanges respectively for mounting the rear end portions of said inner and outer shells, said member also having a rearwardly projecting annular flange and an exhaust port within said flange and communicating with the space between said inner and outer shells.

5. A marine muffler as set forth in claim 4 wherein clamping means are provided for securing said end portions of said outer shell on the said outer flanges on said head members, and wherein said inner shell is of sufficient longitudinal rigidity to secure itself on said inner flanges on said members.

6. A marine muffler as set forth in claim 5 wherein a clamping means is provided for securing one end portion of said inner shell to its corresponding inner flange.

7. A marine muffler as set forth in claim 5 wherein said inner flanges on said front and rear head members are substantially longer than said outer flanges.

8. A marine muffler comprising a rubberlike tubular inner shell having open ends and a slide wall with front and rear end portions and with at least one longitudinally extending series of openings, the openings in said series being progressively larger from the front end portion of the shell to the rear end portion thereof, a rubberlike tubular outer shell having open ends and an imperforate side wall with front and rear end portions and which is disposed about and in spaced relationship with said inner shell, a rigid front head member with inner and outer rearwardly projecting annular flanges respectively for mounting the front end portions of said inner and outer shells, said member also having a forwardly projecting annular flange and an inlet port within said flange and within said inner rearwardly projecting flange for communication with the interior of said inner shell, and a rigid rear head member with inner and outer forwardly projecting annular flanges respectively for mounting the rear end portions of said inner and outer shells, said member also having a rearwardly projecting annular flange and an exhaust port within said flange and communicating with the space between said inner and outer shells.

9. A marine muffler comprising a rubberlike tubular inner shell having open ends and a side wall with front and rear end portions and with a plurality of longitudinally extending series of openings, the openings in each series of openings being progressively larger from the front end portion of the shell to the rear end portion thereof and substantially all of said openings being offset longitudinally with respect to each other, a rubberlike tubular outer shell having open ends and an imperforate side wall with front and rear end portions and which is disposed about and in spaced relationship with said inner shell, a rigid front head member with inner and outer rearwardly projecting annular flanges respectively for mounting the front end portions of said inner and outer shells, said member also having a forwardly projecting annular flange and an inlet port within said flange and within said inner rearwardly projecting flange for communication with the interior of said inner shell, and a rigid rear head member with inner and outer forwardly projecting annular flanges respectively for mounting the rear end portions of said inner and outer shells, said member also having a rearwardly projecting annular flange and an exhaust port within said flange and communicating with the space between said inner and outer shells.

10. A marine muffler as set forth in claim 9 wherein said inner flanges on said front and rear head members are substantially longer than said outer flanges, wherein clamping means are provided for securing said end portions of said outer shell on the said outer flanges on said head members, and wherein a clamping means is provided for securing one end portion of said inner shell to its corresponding inner flange, the said inner shell being of sufficient longitudinal rigidity to secure itself on the other of said inner flanges.

References Cited in the file of this patent

UNITED STATES PATENTS

1,094,105	Waldon	Apr. 21, 1914
2,261,948	Beach	Nov. 11, 1941
2,933,148	Hendry	Apr. 19, 1960

FOREIGN PATENTS

1,129,207	France	Sept. 3, 1956