

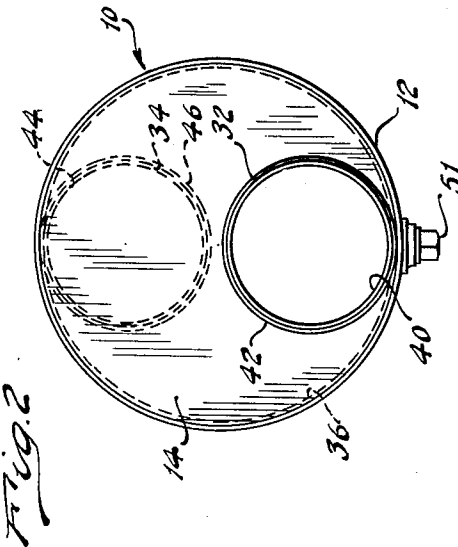
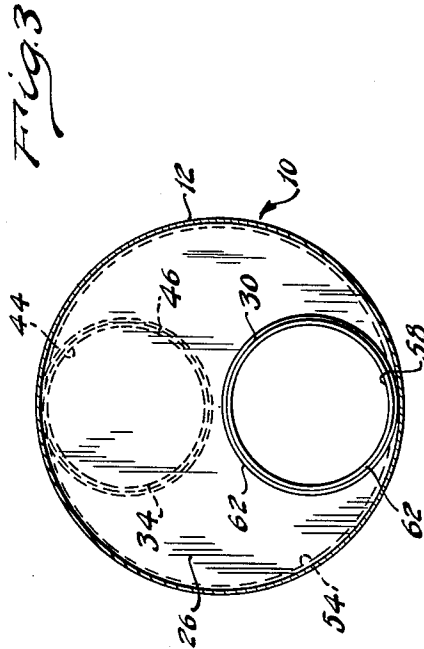
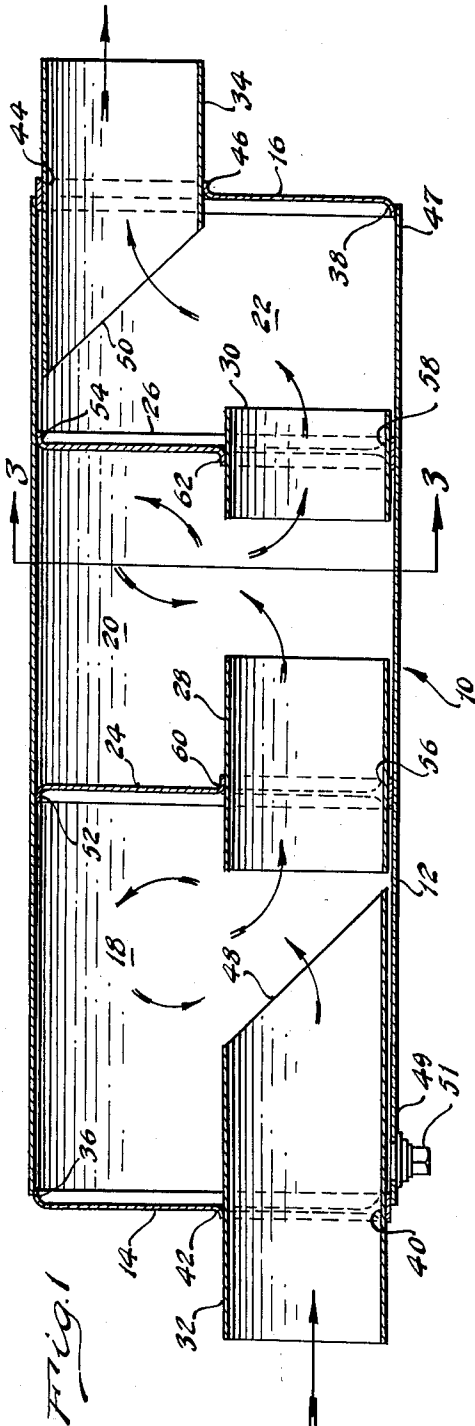
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T. N. KELLY
MARINE TYPE MUFFLER

3,080,939

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2 Sheets-Sheet 1



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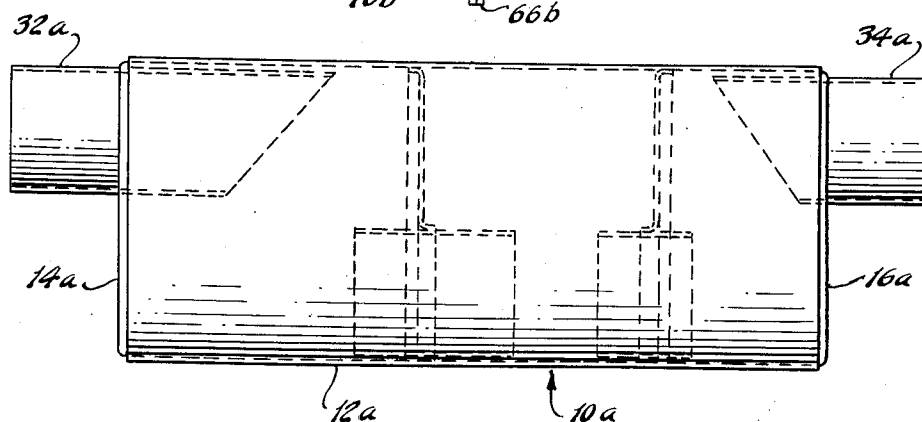
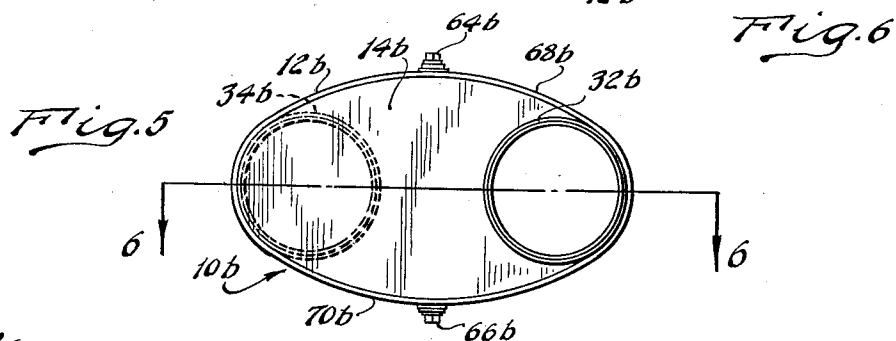
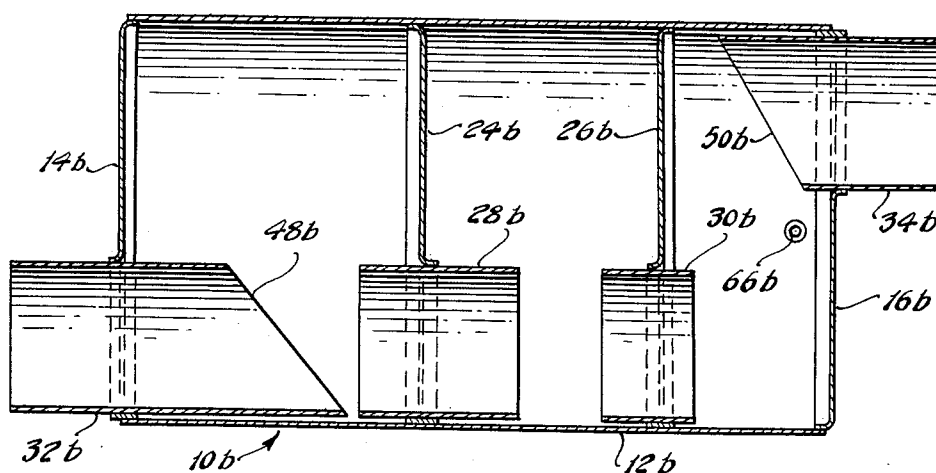


Fig. 4

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MARINE TYPE MUFFLER

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The invention relates to noise suppressors and refers more specifically to a marine type muffler constructed to discharge cooling fluid and gases from an upper portion thereof whereby the operating efficiency of the muffler is improved and particular flexibility in the mounting thereof is provided.

An object of the invention is to provide an improved muffler for mixing hot exhaust gases and cooling fluid which muffler is constructed to provide particular flexibility in the mounting thereof.

Another object is to provide an improved muffler for mixing hot exhaust gases and cooling fluid which muffler is constructed to maintain minimum back pressures.

Another object is to provide an improved muffler for mixing exhaust gases with cooling fluid including a plurality of acoustic filter sections for accomplishing noise suppression which muffler is constructed to utilize hydraulic ram principles to discharge the cooled gases and fluid from an opening adjacent the top thereof.

More specifically it is an object to provide improved muffler construction comprising a tubular housing having closures secured over both ends thereof and including an inlet tube extending through the closure at one end of the housing in a lower portion of the closure and an exhaust tube extending through the closure at the other end of the housing in an upper portion of the closure with respect to the muffler as installed.

Another object is to provide a muffler construction as set forth above wherein the inner end of the inlet tube and the exhaust tube are tapered axially inwardly of the respective tubes and radially inwardly of the housing to provide uniform expansion and exhaust respectively of the gas in the muffler.

Another object is to provide a muffler construction as set forth above wherein the housing is divided into a plurality of resonant chambers of different size for noise suppression by transverse partitions having ducts extending therethrough coaxial with the inlet tube for connecting adjacent chambers.

Another object is to provide a muffler construction as set forth above wherein the ducts have diameters approaching or exceeding their length so that the ducts will not resonate as open pipes but will function as acoustic coupling ducts.

Another object is to provide a muffler construction as set forth above wherein both the inlet and exhaust tubes extend through the respective closures in an upper portion thereof with respect to the muffler as installed and the ducts are located in the transverse partitions diametrically opposite the inlet and exhaust tubes.

Another object is to provide a muffler construction as set forth above for use with large marine engines such as diesel engines for use with tug boats wherein the housing is elliptical in cross section, a drain is provided at both the top and bottom thereof, and the inlet and exhaust tubes are positioned at opposite sides of the muffler intermediate the drains.

Another object is to provide a muffler as set forth above which is simple in construction, economical to manufacture and efficient in use.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawings,

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illustrating a preferred embodiment of the invention, wherein:

FIGURE 1 is a longitudinal section of a muffler constructed according to the invention.

FIGURE 2 is a view of the left end of the muffler illustrated in FIGURE 1.

FIGURE 3 is a cross section of the muffler illustrated in FIGURE 1 taken on the line 3-3 in FIGURE 1.

FIGURE 4 is a plan view of a modification of the muffler illustrated in FIGURES 1-3.

FIGURE 5 is an end view of a second modification of the muffler illustrated in FIGURE 1.

FIGURE 6 is a longitudinal section view of the muffler illustrated in FIGURE 5 taken on the line 6-6 in FIGURE 5.

With particular reference to the drawings a specific embodiment of the present invention will now be disclosed.

As shown best in FIGURE 1 the muffler 10 of the invention comprises a tubular housing 12, provided with closures 14 and 16 at opposite ends and which is divided into resonant chambers 18, 20 and 22 by partitions 24 and 26 located between the closures 14 and 16 at longitudinally spaced points of the housing 12. The partitions 24 and 26 have acoustic coupling ducts 28 and 30 respectively extending therethrough. An inlet tube 32 extends through closure 14 into the lower portion of the housing 12 of the muffler as installed. Exhaust tube 34 extends through closure 16 into an upper portion of the installed muffler.

The muffler 10 constructed as shown is particularly adapted to receive a mixture of water and hot exhaust gases from an internal combustion engine through inlet tube 32. The muffler 10 is operable to further mix the water and gases to cool the exhaust gases. Muffler 10 is also constructed to suppress the exhaust noise and discharge the gases and water through the exhaust tube 34 without creating objectionable back pressures. In addition since the exhaust tube 34 is located in the upper portion of the muffler as installed and water is exhausted therefrom by means of hydraulic ram principles rather than by gravity as previously greater flexibility of mounting of the muffler 10 is provided by the construction shown in FIGURE 1.

More specifically the housing 12 comprises an elongated cylinder which may be constructed of relatively light weight corrosion resistant material such as titanium-stabilized stainless steel. Closures 14 and 16 which are similar in construction are secured over the opposite ends of the housing 12 by means of the annular flanges 36 and 38 respectively by convenient means such as welding to provide a seal between the closures 14 and 16 and the housing 12.

As indicated best in FIGURE 1 the closure 14 has an opening 40 therethrough adjacent the periphery thereof through which the inlet tube 32 extends. The inlet tube 32 may be secured to the flange 42 around the opening 40 by convenient means for sealing the inlet tube 32 to the closure 14 such as welding. The inlet tube 32 is positioned adjacent the periphery of the closure 14 so that the exhaust gases and water may be introduced into a lower portion of the muffler 10 as installed.

The closure 16 is also provided with an opening 44 therethrough adjacent the periphery thereof. Flange 46 is provided around the opening 44 as shown in FIGURE 1 to which the exhaust tube 34 may be sealed by convenient means such as welding. The exhaust tube 34 as shown in FIGURE 1 extends through an upper portion of the closure 16 with respect to the muffler 10 as installed.

As will be readily recognized the placing of the exhaust tube 34 in the upper portion of the closure 16 hinders gravity drainage of the cooling water therefrom. It has however been found that with mufflers constructed as

shown in FIGURE 1 that adequate drainage is provided in operation. It is believed that drainage is accomplished due to the pulsation of the gases from the internal combustion engine (not shown) attached to the muffler. The pulsating gases apparently act on the water in chamber 22 in the manner of the driving force of the well known hydraulic ram to force the water from the exhaust tube 34. Improved silencing characteristics are found to be present in muffler 10 with the exhaust tube 34 located in the upper portion of closure 16 over mufflers having gravity water discharge with the exhaust tube located in the bottom portion of the closure.

Furthermore since the exhaust tube 34 is not required to be located at the bottom of the closure 16 in accordance with the invention as was previously the case to provide adequate drainage for the muffler the exact positioning of the muffler during installation is not required. Thus the end 47 of the muffler need not be lower than the end 49 thereof with the muffler shown in FIGURE 1 as indicated by the drain 51 in end 49 of housing 12. Also the muffler 10 may be rotated axially slightly if required in installation. In other words the flexibility in positioning of the muffler 10 constructed as shown in FIGURE 1 is greatly improved over other marine type mufflers.

The inner end 48 of the inlet tube 32 is tapered axially inwardly of the tube 32 radially inwardly of the housing 12 as shown. The tapered end of the inlet tube 32 provides uniform expansion of exhaust gas and water discharged into the chamber 18 therefrom to cause the gas and water to circulate within chamber 18 to most advantageously cool the gases and prevent generation of internal noises within the muffler.

The exhaust tube 34 is similarly provided with an inner end 50 which is tapered axially inwardly of the tube 34 radially inwardly of the housing 12. The tapered end 50 of the exhaust tube 34 permits smooth flow of the cooled exhaust gas and water from chamber 22.

Partitions 24 and 26 are circular as shown best in FIGURE 3 and include annular flanges 52 and 54 around the outer periphery thereof which are secured to the housing 12 as shown in FIGURE 1 by convenient means such as welding to provide resonant chambers 18, 20 and 22 as previously indicated. It will be noted that the partitions 24 and 26 are spaced longitudinally of housing 12 so that the chambers 18, 20 and 22 have different dimensions and therefore resonate at different frequencies to produce sound attenuation at the most objectionable frequencies.

Partitions 24 and 26 are further provided with openings 56 and 58 in the lower portion thereof with respect to the installed muffler and in line with the inlet tube 32 as shown in the figures. Flanges 60 and 62 are provided about openings 56 and 58 in partitions 24 and 26 respectively to which the acoustic coupling ducts 28 and 30 are secured by convenient means.

Ducts 28 and 30 have diameters approaching or greater than their lengths as will be evident from inspection of FIGURE 1 whereby the ducts 28 and 30 will not resonate as open pipes but will function as acoustic coupling ducts to couple the sound from chamber 18 into chamber 20 and from chamber 20 into chamber 22.

The ducts 28 and 30 also serve to provide a path through the muffler 10 from the inlet tube 32 to the chamber 22 for the exhaust gases and water discharged into the muffler 10 which is substantially unimpeded so that a low back pressure is created by muffler 10 and water in chamber 22 is discharged from exhaust tube 34 in the manner in which water is discharged from a hydraulic ram by means of the pulsating exhaust gases.

In operation it will be understood that the muffler 10 is connected with the inlet tube 32 positioned in the bottom portion thereof and the exhaust tube 34 positioned in the top portion as shown. Exact positioning of the exhaust tube is not required as with prior constructions as indicated above. The muffler 10 may either be in-

stalled level or inclined slightly toward either end 47 or 49 in accordance with the positioning of the drain 51.

A combined mixture of hot exhaust gases and water is discharged into chamber 18 through inlet tube 32. The hot gases and water are caused to expand uniformly on exit from the inlet tube 32 due to the tapered inner end thereof and are caused to intermingle in chamber 18 as indicated by the flow arrows therein whereby the gas is caused to cool and the sound at the frequency to which the chamber 18 is tuned is suppressed.

The cooled gases and water together with the unsuppressed noise frequencies are passed into chamber 20 through acoustic coupling duct 28 wherein the gas and water are again mixed as indicated by the flow arrows and the noise frequencies to which the chamber 20 is tuned are suppressed.

Similarly the cooled gas, water and unsuppressed noise frequencies from chamber 20 are passed into chamber 22 through acoustic coupling duct 30 where the gases and water are again caused to mix and the remaining undesirable noise frequencies are suppressed. The cooled exhaust gas and water then flow smoothly out of the exhaust tube 34 due to the pulsating exhaust gases as previously indicated.

The muffler structure 10 of the invention is particularly efficient in silencing the exhaust of internal combustion engines while producing a relatively low back pressure due to the alignment of coupling ducts 28 and 30 and the inlet tube 32 in the lower portion of the muffler 10 and the positioning of the exhaust tube 34 in the upper portion of the muffler 10 as shown in FIGURE 1 in conjunction with the tapered ends of the tubes 32 and 34.

The modified muffler 10a shown in FIGURE 4 is similar to muffler 10 in all respects except that the inlet tube 32a of muffler 10a as illustrated extends through the upper portion of the closure 14a when the muffler 10a is installed. In this manner more flexibility of installation of the muffler 10a may be provided at the expense of little additional back pressure and slightly diminished drainage capabilities with the exhaust tube 34a located in the upper portion of the closure 16a.

A further modification 10b of the muffler 10 is illustrated in FIGURES 5 and 6. The muffler 10b is elliptical in cross section with the inlet tube 32b and ducts 28b and 30b located at one side of the installed muffler 10b and the exhaust tube 34b located at the opposite side thereof as shown. The muffler 10b is particularly suited for installation in conjunction with large marine engines such as diesel engines on tug boats. The drains 64b and 66b are provided to permit installation of muffler 10b with either wide side 68b or 70b at the top. The muffler 10b is also suitable for installation rotated about its longitudinal axis in either direction.

What I claim as my invention is:

1. A marine type muffler comprising an elongated tubular housing, separate inner and outer end headers respectively closing the opposite ends of said housing, a pair of transversely extending partitions secured within said housing in longitudinally spaced relation to said end headers and to each other dividing said housing into first and second resonant chambers respectively adjacent said inner and outer end headers and a third resonant chamber between said first and second chambers, an inlet tube extending through said inner end header into said first chamber, an acoustical coupling duct extending through and secured to one of said partitions, a second acoustical duct extending through and secured to the other of said partitions, said ducts placing said chambers in communication with one another, said inlet tube and said ducts being in spaced axial alignment with one another and disposed adjacent to the side wall of said tubular housing in laterally offset parallel relation to the longitudinal center line of said housing, the end of said inlet tube within said first chamber lying in a plane inclined relative to the longitudinal center line of said housing in a direction toward said inner end

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header to provide for a uniform flow and expansion of exhaust gases and water into said first chamber, and an outlet tube extending through said outer end header into said second chamber, said outlet tube being in laterally offset parallel relation to the longitudinal center line of said tubular housing at the diametrically opposite side of said center line from said aligned inlet tube and ducts, the end of said outlet tube within said second chamber lying in a plane inclined relative to the longitudinal center line of said housing in a direction toward said outer end header to provide for a smooth flow of exhaust gases and water from said second chamber, the alignment of said inlet tube and ducts serving to reduce back pressure in the muffler, the ends of said ducts and the inclined ends of said tubes being open and unobstructed to further reduce back pressure.

2. The muffler defined in claim 1, wherein said third chamber is larger in volume than said second chamber and smaller in volume than said first chamber.

3. The muffler defined in claim 2, wherein each coupling

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duct is of a diameter closely approaching or exceeding the length thereof to prevent the same from resonating.

4. The muffler defined in claim 2, wherein said aligned inlet tube and ducts are vertically beneath the longitudinal center line of said housing and said outlet tube is vertically above said longitudinal center line.

5. The muffler defined in claim 2, wherein said tubular housing is elliptical and arranged so that its major diameter is horizontal, the axes of the aligned inlet tube and ducts intersect the major diameter of said housing at one side of the longitudinal center line thereof, and the axis of said outlet tube intersects the major diameter of said tubular housing at the opposite side of the longitudinal center line thereof.

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