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UNDERWATER EXHAUST MUFFLER
John S. Davis, Vancouver, British Columbia, Canada, assignor to A. C. Rubber Manufacturing Co., Ltd., Van
couver, British Columbia, Canada

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12 Claims. (Cl. 181—39)

This invention relates to an exhaust muffler adapted to be mounted on the transom of a boat over the end of the exhaust pipe thereof.

This muffler when mounted on the transom of a boat over the exhaust pipe of the boat extends down into the water so that exhaust from the boat engine is discharged under water. The exhaust noises of the boat engine are muffled in this manner, and if cooling water flows through the exhaust pipe, it also is discharged mainly under water.

The muffler comprises a body having an upper section and a lower section depending therefrom. The upper section has a horizontal passage with an entrance at an end thereof into which an end of the exhaust pipe extends when the body is secured to the stern or transom of the boat. Passage means in the vertical section communicates at the upper end thereof with the horizontal passage and opens outwardly from the lower end of said vertical section. This lower section extends down into the water.

A muffler of this type has been on the market for some time, but the present exhaust muffler is a definite improvement over it. The cross sectional shape of the prior muffler is intended to reduce the resistance to movement through the water, but there still is considerable resistance. The vertical passage means of the prior muffler is of a shape which creates turbulence therein, thus creating undue back pressure in the exhaust system of the boat. Another disadvantage of the prior muffler is that when the vertical section moves through the water with the boat, a cavity is formed in the water extending rearwardly from the unit and into which sound travels, thereby greatly reducing the sound muffling capacity of the device.

The present exhaust muffler has a vertical section of a cross sectional shape which offers negligible resistance to movement through the water, the vertical section has two passages of circular cross section extending therethrough which eliminate turbulence in the exhaust gases passing therethrough. The lower end of the vertical section is shaped to produce a low pressure area at the lower or discharge end of the vertical passages which helps to improve the exhausting of the gases by reducing back pressure. The muffler is further improved by providing port means for each of the passages of the vertical section near the lower end of said section angularly arranged to direct water into the passages in a rearward direction, thereby preventing the formation of a cavity behind the muffler. The muffler is improved by the provision of vertical shoulders along the sides of the vertical section facing rearwardly in order to permit air to travel downstream along said section into the water to help eliminate turbulence. If desired, a stabilizer fin is provided, this fin surrounding the lower section of the muffler spaced above the lower end thereof.

An exhaust muffler according to the present invention comprises a body having an upper section and a lower section depending therefrom, a horizontal passage in the upper section having an entrance at an end thereof opening out from the upper section and into which an end of the exhaust pipe extends when the body is secured to a boat transom, and passage means in the vertical section communicating at an upper end thereof with the horizon-

tal passage and opening outwardly from a lower end of said vertical section, said lower section being of substantially triangular cross section and having a vertical leading edge with substantially flat sides diverging rearwardly therefrom and ending at a maximum width of the lower section and a rear wall of substantially circular cross section extending between ends of said sides.

An example of this invention is illustrated in the accompanying drawings, in which,

FIGURE 1 is a diagrammatic section through the stern of a boat with an exhaust muffler according to this invention mounted thereon,

FIGURE 2 is a diagrammatic plan view of the stern of the boat and the muffler,

FIGURE 3 is a side elevation partly in section of the improved muffler,

FIGURE 4 is a front elevation of this muffler, and

FIGURE 5 is a horizontal section taken on the line 5—5 of FIGURE 3.

Referring to FIGURES 1 and 2, 10 is an exhaust muffler according to the present invention mounted on the stern or transom 11 of a boat 12, said boat having a bottom 13. An exhaust pipe 15 extending from the boat engine, not shown, extends through transom 11 and has an outer or discharge end 16.

FIGURE 2 diagrammatically illustrates muffler 10 mounted on the transom 11 of a boat near one side of said transom. When the transom is curved transversely of the boat, as shown, it is desirable to insert a wedge block 18 between the muffler and the transom in order to have the longitudinal centre line 20 of the muffler parallel with the keel 21 of the boat. Wedge block 18 does not appear in FIGURE 1, the mounting of the latter figure being as it would if the muffler were mounted at the centre of the transom, or if the transom were not curved transversely of the boat.

FIGURES 3 to 5 show muffler 10 in detail. This muffler is made up generally of a body 25 which may be formed of any suitable material, but which is preferably made of a slightly resilient material, such as heat-resistant neoprene, which will not deform but will return to its original shape after a degree of stretching or bending.

Body 25 includes an upper section 28 and a lower section 30 depending from said upper section.

Upper section 28 generally extends horizontally when the muffler is in use, and is of generally circular cross section, as indicated at 32 in FIGURE 4. Section 28 has therein a horizontal passage 34 which opens out of the section at an end thereof to form an entrance 36. The opposite end of the upper section is closed by a dome-shaped rear wall 38. A flange 40 is secured to the forward end 41 of section 28 surrounding entrance 36. This flange may be formed of the same material as the upper section and moulded therewith, or as preferred, it may be formed of a suitable metal, such as brass suitably secured to the section. Flange 40 has a plurality of holes 42 therethrough with bolts or the like 43 may extend to secure muffler 10 to transom 11 of the boat, see FIG-

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Lower section 39 of body 25 is formed of such cross section as to reduce resistance to movement of said section through the water. In the preferred form of the invention, said lower section is of substantially triangular cross section, see FIGURE 5. This section has a vertical leading edge 47 and substantially flat sides 48 and 49 diverging rearwardly from edge 47 and having rear edges 51 and 52 at the maximum width of lower section 39. A rear wall 55 of substantially circular cross section extends between ends 51 and 52 of sides 48 and 49. In the preferred form of the invention, rear wall 55 is arranged so that vertical shoulders 57 and 58 are formed at ends.
Passage means is provided in vertical section 30 communicating at the upper end thereof with horizontal passage 34 and opening out through the lower end of said lower section. Although this passage means may be in the form of a single passage, it is preferable to have said passage means in the form of two passages 62 and 63 of circular cross section, as clearly shown in FIGURE 5. Passage 62 is in front of or closer to leading edge 47 than passage 63, and because of the triangular cross sectional shape of section 30, said passage 62 is of smaller cross sectional diameter than passage 63. These passages open out at their upper ends into horizontal passage 34 of upper section 28, said horizontal passage preferably having an inclined bottom 65 near the rear end thereof and through which said vertical passages open. Inclined bottom 65 causes the upper ends of passages 62 and 63 to open towards entrance 36, see FIGURE 5.

The lower end of vertical section 30 has an inclined portion 68 which extends downwardly and rearwardly from leading edge 47 to approximately where passage 62 opens out from said vertical section. The lower end of the section is also formed with a portion 68 which is inclined upwardly to rear wall 55. It will be noted that the incline of end portion 68 of the lower section is steeper than that of end portion 69 so that the length of leading edge 47 is a little less than the length of rear wall 55.

Ports are provided in lower section 30 near the lower end thereof and are angularly arranged to direct water into the passage means of the muffler. When there are two passages, it is preferable to provide at least one of these ports for each passage. In this example, ports 72 and 73 are formed in section side 48 and are inclined inwardly and downwardly into passages 62 and 63, respectively. Similarly, ports 75 and 76 are formed in section side 49 and extend downwardly and inwardly into passages 62 and 63.

Although not absolutely necessary, it is preferable to provide a substantially horizontal stabilizer fin 79 surrounding and slidable mounted on lower section 30, said fin having a flange 80 at its forward end adapted to be secured to transom 11 of a boat in any suitable manner, such as by means of bolts 81, see FIGURE 1. By referring to FIGURE 5, it will be seen that fin 79 has a cutout 83 therein of the same size and shape as the cross sectional shape of lower section 30.

If desired, upper section 28 may be provided with at least one orifice 89 in rear wall 38 through which water can flow if cooling water flows through exhaust pipe 15 of boat 12. This orifice also releases the pressure of the exhaust gases when the engine starts, prevents any siphoning, and provides a visual inspection of the water pump operation since a stream of water through the orifice indicates that the pump is functioning properly.

When exhaust muffler 10 is manufactured, it preferably has a lower end 92, shown in broken lines in FIGURE 3, which makes lower section 30 longer than necessary. When muffler 10 is secured to transom 11 of boat 12, the lower end of section 30 is cut to form the bevel portions 68 and 69, the forward end of said portion 68 preferably being at about the level of bottom 13 of the boat. Ports 72, 73, 75 and 76 are drilled in the lower end of section 30, and fin 79 is shifted to a level about the newly-formed lower edge of section 30 and is then secured to transom 11. As boat 12 travels through the water, exhaust gases are directed through exhaust pipe 15 into passage 35 of the muffler. This gas is directed downwardly into and through vertical passages 62 and 63. As these passages are of circular cross section, there is very little if any turbulence in the gases travelling downwardly therethrough. As the muffler moves through the water, water is directed by inclined lower portion 68 of section 30 downwardly across the lower ends of passages 62 and 63, tending to form low pressure areas at the lower ends of said passages. This helps to draw the gases downwardly through the passages and into the water. Ports 72, 73, 75 and 76 direct water downwardly and rearwardly across the lower ends of passages 62 and 63 forming a noise barrier. The streams of water from these ports prevent a cavity from being formed in the water extending back from the lower end of section 30 into which sound could travel. The jet streams of water close off this cavity to prevent noise, and the streams also tend to take gases with them to help remove the gases from the vertical passages. The combined cross sectional area of passages 62 and 63 is preferably at least equal to the cross sectional area of entrance 37 of the muffler.

As vertical shoulders 57 and 58 face rearwardly of section 30 at the maximum width thereof, low pressure areas are formed behind the portions of these shouldars in the water beneath the fin 79 so that air can travel downwardly along the shoulders to the lower end of section 30. This air helps to reduce turbulence in the water at the lower end of the section.

The muffler is improved by stabilizer fin 79 which helps to keep spray down at the stern of the boat around the muffler, and it prevents section 30 from bending when the boat turns, at which time the boat leans inwardly of the turn.

What I claim as my invention is:
1. An exhaust muffler adapted to be mounted on the transom of a boat over an exhaust pipe thereof and to extend down into the water, comprising a body having an upper section and a lower section depending therefrom, a horizontal passage in the upper section having an entrance at an end thereof opening out from the upper section and into which an end of the exhaust pipe extends when the body is secured to a boat transom, and passage means in the vertical section communicating at an upper end thereof with the horizontal passage and opening outwardly from a lower end of said vertical section, said lower section being of substantially triangular cross section and having a vertical leading edge with substantially flat sides diverging rearwardly therefrom and ending at a maximum width of the lower section and a rear wall of substantially circular cross section extending between ends of said sides.
2. A muffler as claimed in claim 1 including port means in at least one of said sides near the lower end of the lower section angularly arranged to direct water into the passage means in a rearward direction.
3. A muffler as claimed in claim 1 in which said passage means comprises two passages of circular cross section.
4. A muffler as claimed in claim 3 including port means for each of said passages in at least one of said sides near the lower end of the lower section and angularly arranged to direct water into said each passage in a rearward direction.
5. A muffler as claimed in claim 1 in which the lower end of the vertical section is inclined downwardly from said leading edge to approximately where said passage means opens out from the vertical section and then is inclined upwardly to said rear wall.
6. A muffler as claimed in claim 1 including outwardly-extending vertical shoulders between ends of said side walls and the adjacent rear wall.
7. A muffler as claimed in claim 1 including a substantially horizontal stabilizer fin surrounding said lower section spaced above the lower end thereof.
8. An exhaust muffler adapted to be mounted on the transom of a boat over an exhaust pipe thereof and to extend down into the water, comprising a body having an upper section and a lower section depending therefrom, a horizontal passage in the upper section having an entrance at an end thereof opening out from the upper section and into which an end of the exhaust pipe extends when the body is secured to a boat transom, two passages of circular cross section in the vertical section com-
municating at upper ends thereof with the horizontal passage and opening outwardly from a lower end of said vertical section, the combined cross sectional area of the two passages being substantially equal to the area of said entrance, said lower section having a vertical leading edge and diverging in cross section rearwardly from said leading edge to a maximum width and converging rearwardly from said width.

9. A muffler as claimed in claim 8 including port means for each of said passages near the lower end of the lower section and angularly arranged to direct water into said each passage in a rearward direction.

10. A muffler as claimed in claim 8 in which one of said passages is a first passage positioned nearer to the leading edge than the other of said passages, and the lower end of the vertical section is inclined downwardly from said leading edge to approximately where said first passage opens out from the vertical section and then is inclined upwardly in a rearward direction.

11. A muffler as claimed in claim 8 including a substantially horizontal stabilizer fin surrounding said lower section spaced above the lower end thereof.

12. A muffler as claimed in claim 8 in which said vertical section is formed with vertical shoulders on opposite sides of the maximum width thereof and facing in a rearward direction.

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