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Harris

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[54] **MUFFLERS**

[76] Inventor: **Frank N. Harris,** 4761 S.W. Martha St., Portland, Oreg. 97221

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[52] **U.S. Cl.** **181/59;** 181/49; 181/63

[51] **Int. Cl.** **F01n 1/02**

[58] **Field of Search** 181/49, 53, 54, 55, 56, 181/59, 63

[56] **References Cited**

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Primary Examiner—Richard B. Wilkinson
Assistant Examiner—Vit W. Miska
Attorney, Agent, or Firm—Klarquist, Sparkman, Campbell, Leigh, Hall & Whinston

[57] **ABSTRACT**

Mufflers having hollow toroids have perforated scrubbing plates obliquely intercepting entering exhaust gases. The toroidal chambers have partitions which divide the toroids into entrance, intermediate and exit expansion chambers and perforated tubes having central plugs extend through the intermediate chambers from the entrance chamber to the exit chamber. The gases pass through perforated scrubbing plates in the exit chambers and oblique to elongated tailpipes.

14 Claims, 3 Drawing Figures

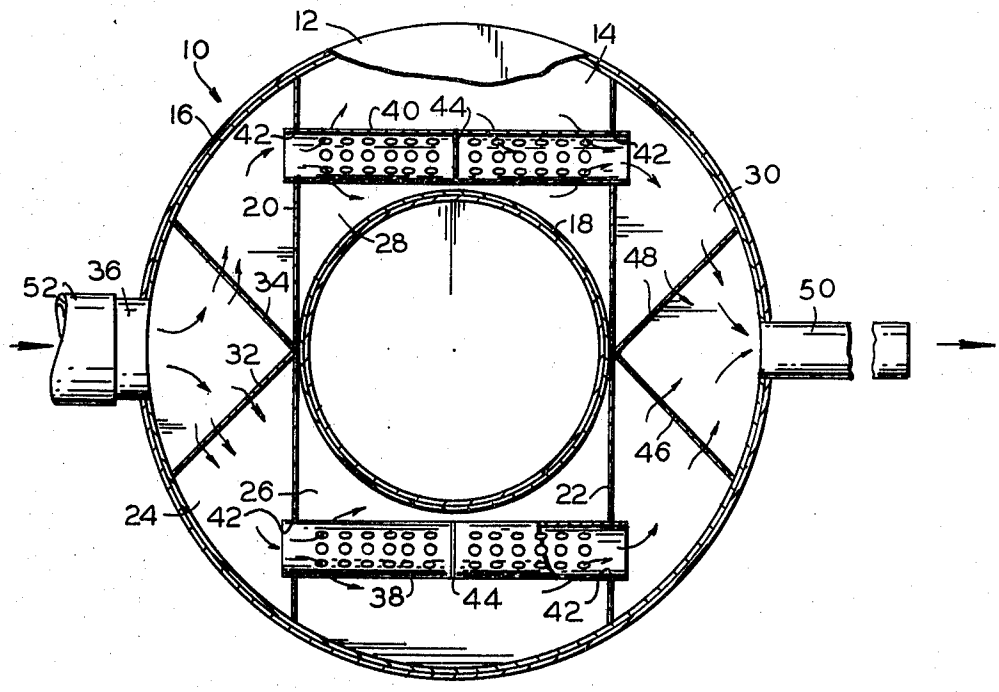


FIG. 1

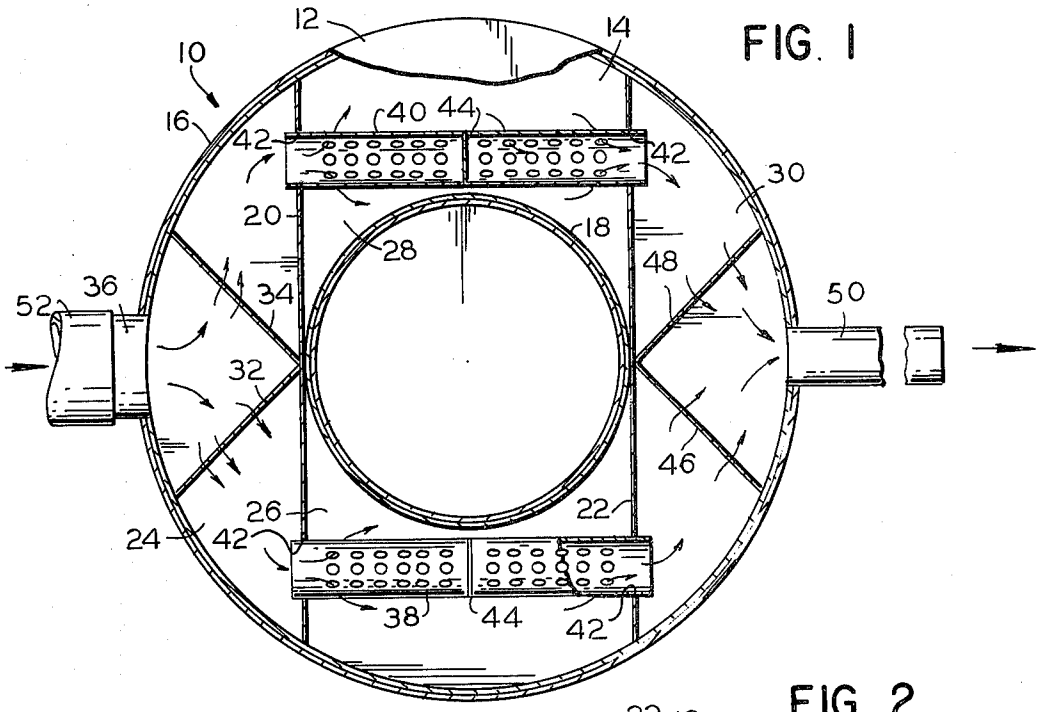


FIG. 2

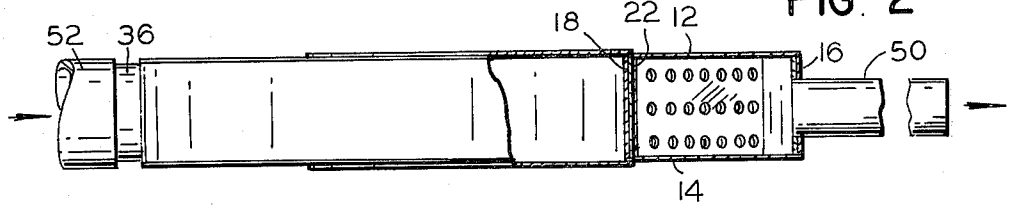
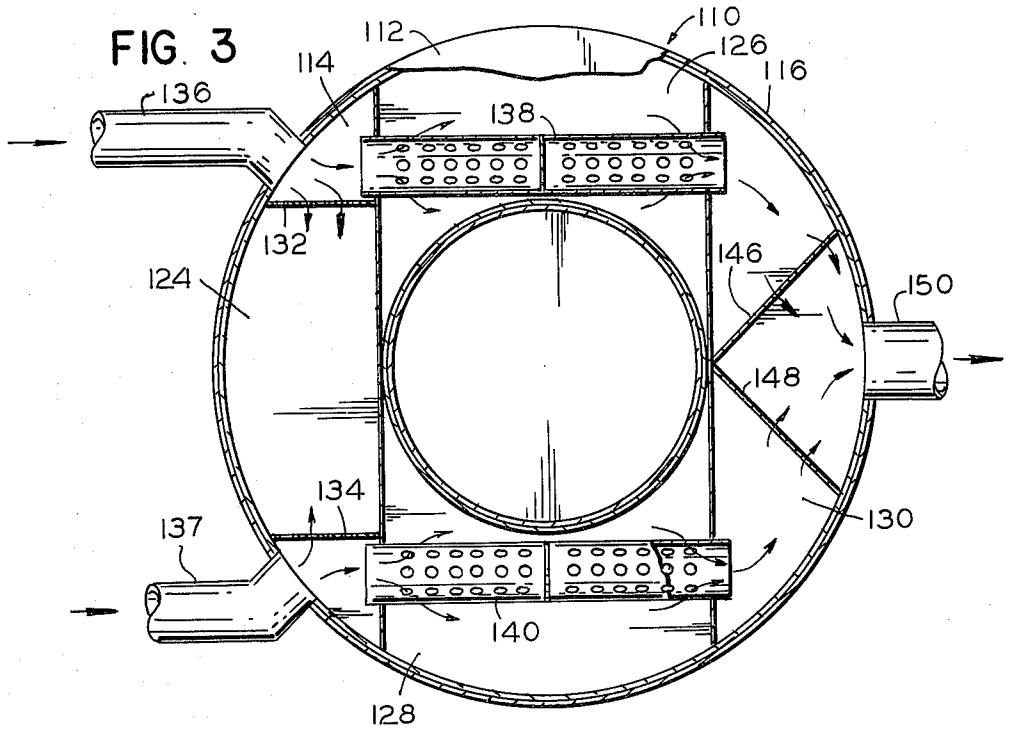


FIG. 3



MUFFLERS

This invention relates to new and improved mufflers, and has for an object thereof the provision of new and improved mufflers.

Another object of the invention is to provide a compact muffler having a series of perforated scrubbers alternating with a series of expansion chambers.

A further object of the invention is to provide a muffler having a perforated plate obliquely intercepting exhaust gases coming into an expansion chamber thereof.

Another object of the invention is to provide a muffler in the form of a toroid with two partitions dividing the interior into three expansion chambers with perforated tubes connecting the three chambers.

In the drawings:

FIG. 1 is a partially sectional, top plan view of a muffler forming one embodiment of the invention;

FIG. 2 is a partially sectional, side elevation view of the muffler of FIG. 1; and

FIG. 3 is a partially sectional, top plan view of a muffler forming an alternate embodiment of the invention.

Referring now in detail to the drawings, there is shown in FIGS. 1-2 a muffler or silencer **10** forming one specific embodiment of the invention and including annular top and bottom plates **12** and **14** welded to outer and inner, cylindrical, double walls **16** and **18** to form a hollow toroid. Partitions **20** and **22** divide the interior of the toroid into expansion chambers **24, 26,** 28 and **30,** and perforated metal plates or screens **32** and **34** both inclined to inlet **36** block off the inlet from the two halves of the chamber **24.** Perforated scrubber tubes **38** and **40** mounted in holes **42** in the partitions **20** and **22** have plugs **44** blocking their midpoints, and extend through the chambers **26** and **28.** Perforated metal scrubber plates or screens **46** and **48** inclined to directions of flow and also inclined to axis of tailpipe **50** in wall **16** separate the halves of chamber **30** from the tailpipe. The size of the perforations in the plates **32, 34, 46** and **48** and the tubes **38** and **40** may vary from one-eighth of an inch to one-half of an inch, and are sized to the engine used, and there is a multitude of perforations in these plates and tubes. The length of the tailpipe, for best muffling, should be at least about twenty times the internal diameter of the tailpipe. Additional silencing may be effected by having the size of the tailpipe somewhat smaller than the inlet, as is common in mufflers for gasoline engines. The exhaust gases come from exhaust pipe **52** of the engine to the inlet **36** and into the expansion chamber **24** and against the inclined scrubbing plates **32** and **34.** The gases pass through the scrubbing plates and travel through the halves of the expansion chamber **24,** pass through the entrance halves of the perforated scrubbing tubes **38** and **40** into the expansion chambers **26** and **28,** and flow from the expansion chambers **26** and **28** into and through the outlet halves of the tubes **38** and **40** into the halves of the expansion chamber **30.** The gases flow through the inclined scrubber plates **46** and **48** and to and through the tailpipe **50.** In one constructed embodiment, for a motorcycle, the exhaust noise was reduced from **110** to **80** decibels. The inclined scrubbing plates **32** and **34** of perforated metal prevent direct impingement of the gases on metal walls to eliminate metallic reflection of noise, and the expansions in the chambers **24, 26, 28** and **30** and the U-shaped paths from the inlet halves of the tubes **38** and **40** to the outlet halves thereof smooth out pulsations of the gases.

The diameter of the cylindrical wall **18** preferably is from about one-third to one-half of the diameter of the cylindrical wall **16.**

EMBODIMENT OF FIG. 3

A muffler or silencer **110** forming an alternate embodiment of the invention is like the muffler **10** except that the muffler **110** includes two inlets **136** and **137** leading into expansion chamber **124** and directs exhaust gases from the inlets obliquely against perforated metal scrubbing screens **132** and **134.** The gases flow from the chamber **124** through inlet halves of perforated scrubbing tubes **138** and **140** to expansion chambers **126** and **128,** through outlet halves of the tubes **138** and **140** to expansion chamber **130,** through perforated metal scrubbing plates **146** and **148** and through tailpipe **150.** The muffler **110** has the two inlets **136** and **137** for use with engines having twin exhausts as, for example, a V-8 engine. The inlets and/or tailpipe can, instead of coming through holes in outer cylindrical wall **116** come through top or bottom plates **112** and **114,** with the scrubbing plates **132, 134, 146** and **148** repositioned where necessary to provide oblique impingement thereon of the gases entering the chamber **124** and leaving the chamber **130.**

The above-described mufflers or silencers **10** and **110** effectively reduce the noise levels of the engines to which they are connected without loss of power of the engines, and utilize all known factors of silencing except centrifuging the gases against a plate having many openings. The gases enter the silencers and are immediately allowed to expand which slows the pulsations into a smoother gas flow. The gases are then scrubbed and split to flow into two perforated tubes, out of each tube into an expansion chamber, and back into the tube to, in effect, make a U-turn while being scrubbed twice in a rather short space. From the tubes, the gases enter a third expansion and expand to an even flow substantially free of all pulsations. The scrubbing plates **46, 48,** 146 and **148** further soften any remaining noise. Specific silencing factors used by the mufflers are expansion chambers, baffles, scrubber tubes, dampening, nulling, split gas flow and tailpipe length. By splitting the flows, opposing noise forces or nulling is effected. The double wall construction of the toroidal chambers also damps noises, and the scrubber tubes **38, 40, 138** and **140** eliminate resonance.

What is claimed is:

1. In an improved muffler,

toroidal chamber means,

inlet means opening into one portion of the toroidal chamber means,

outlet means opening into a second portion of the toroidal chamber means spaced around said toroidal chamber means from said one portion,

a pair of partitions dividing the toroidal chamber means into an inlet chamber, an outlet chamber, and two side chambers between the inlet chamber and the outlet chamber,

one of the partitions having inlets to the side chambers and the other partition having outlets to the outlet chamber,

and baffle means in the side chambers between the inlets and the outlets.

2. The improved muffler of claim **1** including scrubbing means positioned in the inlet chamber.

3. The improved muffler of claim 2 wherein the scrubbing means comprises perforated plate means positioned obliquely to the gases coming through the inlet means.

4. The improved muffler of claim 3 wherein the perforated plate means includes a pair of perforated plates both oblique to the gases and positioned between the inlet means and the inlets to the side chambers.

5. The improved muffler of claim 4 wherein each of the baffle means comprises a tube having perforations therein and extending from the inlet to the outlet and having a plug between the ends thereof.

6. The improved muffler of claim 4 wherein each of the baffle means comprises perforated tube means leading from the inlet into the side chamber and perforated tube means leading from that side chamber to the outlet thereof.

7. The improved muffler of claim 6 wherein the inlet means comprises a pair of inlet openings directed obliquely toward the pair of perforated plates in the inlet chamber.

8. The improved muffler of claim 4 wherein the inlet means comprises a single inlet opening positioned between and directed obliquely toward both of the perforated plates.

9. The improved muffler of claim 8 including a second pair of perforated plates in the outlet chamber positioned on opposite sides of the outlet means and obliquely relative to the outlet means.

10. In an improved muffler,

an outer cylinder of a predetermined diameter,

an inner cylinder of a diameter substantially less than that of the outer cylinder and positioned concentrically in the outer cylinder,

top and bottom plates sealed to the cylinders and forming a toroidal chamber therewith,

a pair of spaced partition plates joined tangentially to the inner cylinder and joined to the outer cylinder and the top and bottom plates to divide the chamber into an inlet chamber, an outlet chamber, and two side chambers,

the partition plates having two pairs of aligned openings,

a pair of perforated tubes blocked off at the central portions thereof extending through the pairs of aligned openings,

inlet means leading into the inlet chamber,

and outlet means leading out of the outlet chamber.

11. The improved muffler of claim 10 including inlet scrubbing means positioned in the inlet chamber obliquely to the inlet means.

12. The improved muffler of claim 11 including outlet scrubbing means positioned in the outlet chamber between the tubes and the outlet means.

13. The improved muffler of claim 12 wherein the inlet scrubbing means comprises a pair of perforated plates bracketing the inlet means.

14. The improved muffler of claim 11 wherein the inlet scrubbing means comprises a pair of perforated plates bracketing the inlet means.

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