United States Patent

Snodgrass et al.

[15] **3,685,613**

[45] **Aug. 22, 1972**

[54] **MUFFLERS FOR INTERNAL COMBUSTION ENGINES**

[72] Inventors: **Kenneth William Snodgrass; William Henry Steele; Alan Wilson; Ross Leslie Phelps,** all of Milperra, New South Wales, Australia

[73] Assignee: **Victa Limited,** Milperra, New South Wales, Australia

[22] Filed: **May 11, 1971**

[21] Appl. No.: **142,249**

[30] **Foreign Application Priority Data**

May 12, 1970 Australia .....PA 1183

[52] **U.S. Cl.**.....**181/33 K,** 181/50, 181/53, 181/40

[51] **Int. Cl.**.....**F01n 1/10,** F01n 7/18

[58] **Field of Search**.....181/33 K, 47 B, 40, 42, 50, 181/53, 36 R, 61, 35 C, 33 E

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Primary Examiner—Robert S. Ward, Jr.

Attorney—Waters, Roditi, Schwartz & Nissen

[57] **ABSTRACT**

An exhaust muffler of compact form for use on small two-stroke internal combustion engines, and comprising a housing having an inlet and an outlet for exhaust gases and defining an indirect passage therethrough between the inlet and outlet for the exhaust gases. A wad of sound absorbing material is positioned in a part of the housing not traversed by the exhaust gases and receives the shock wave component of the exhaust gases by reflection from a plate located opposite the inlet.

7 Claims, 4 Drawing Figures

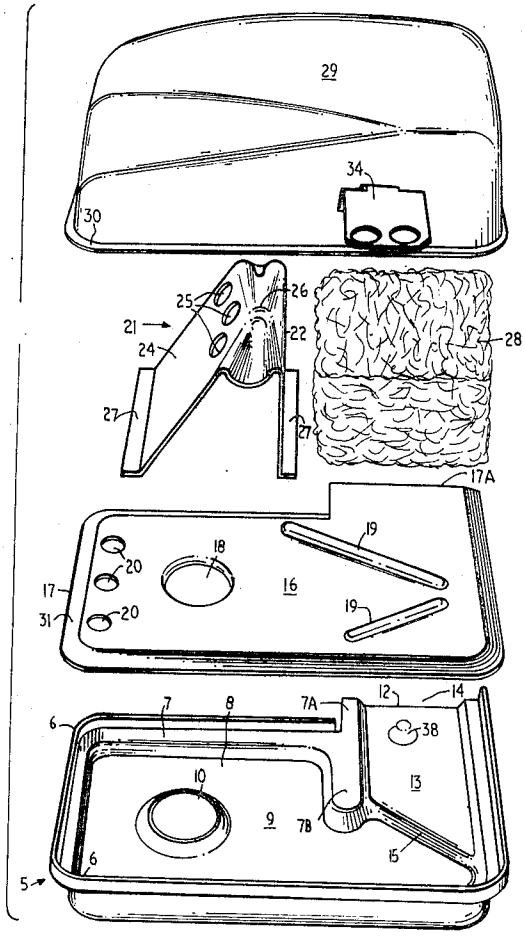


FIG. 1

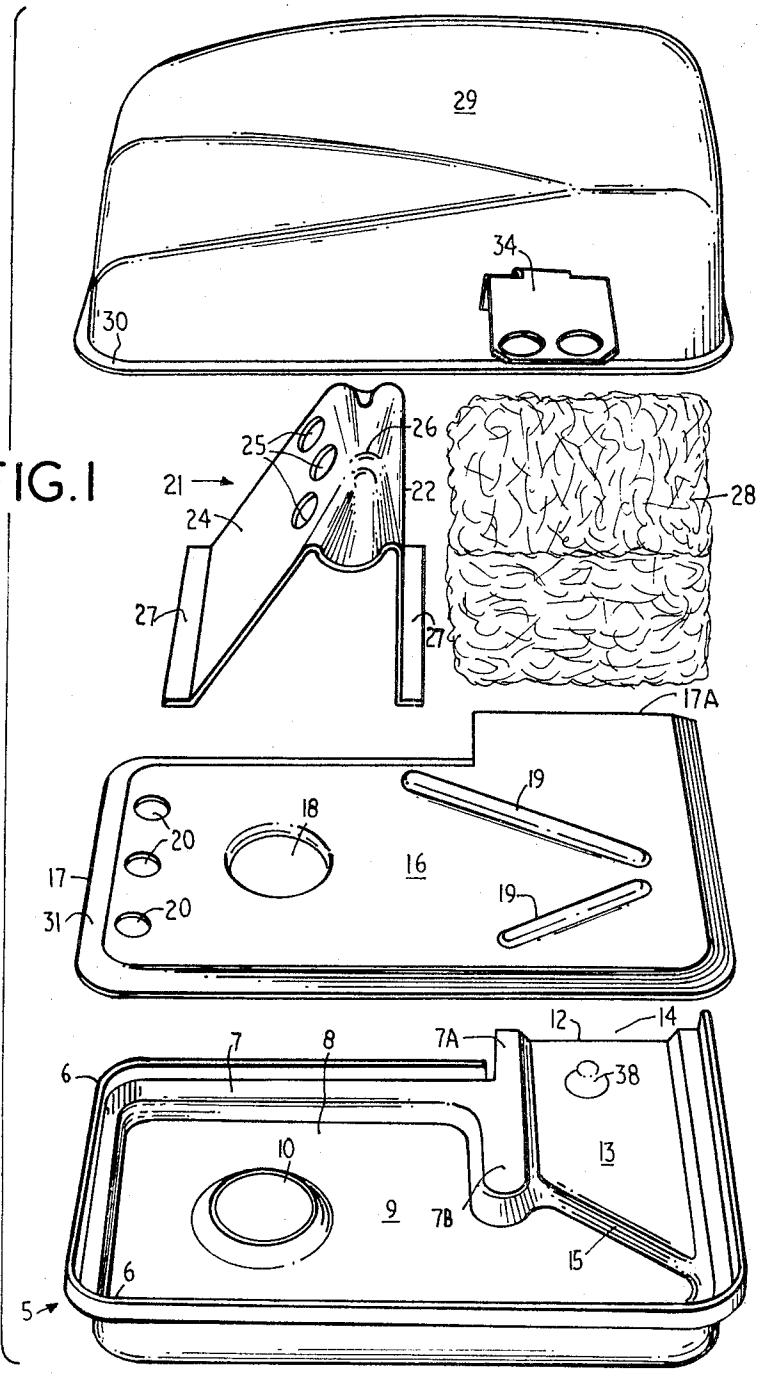

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7B
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FIG.2

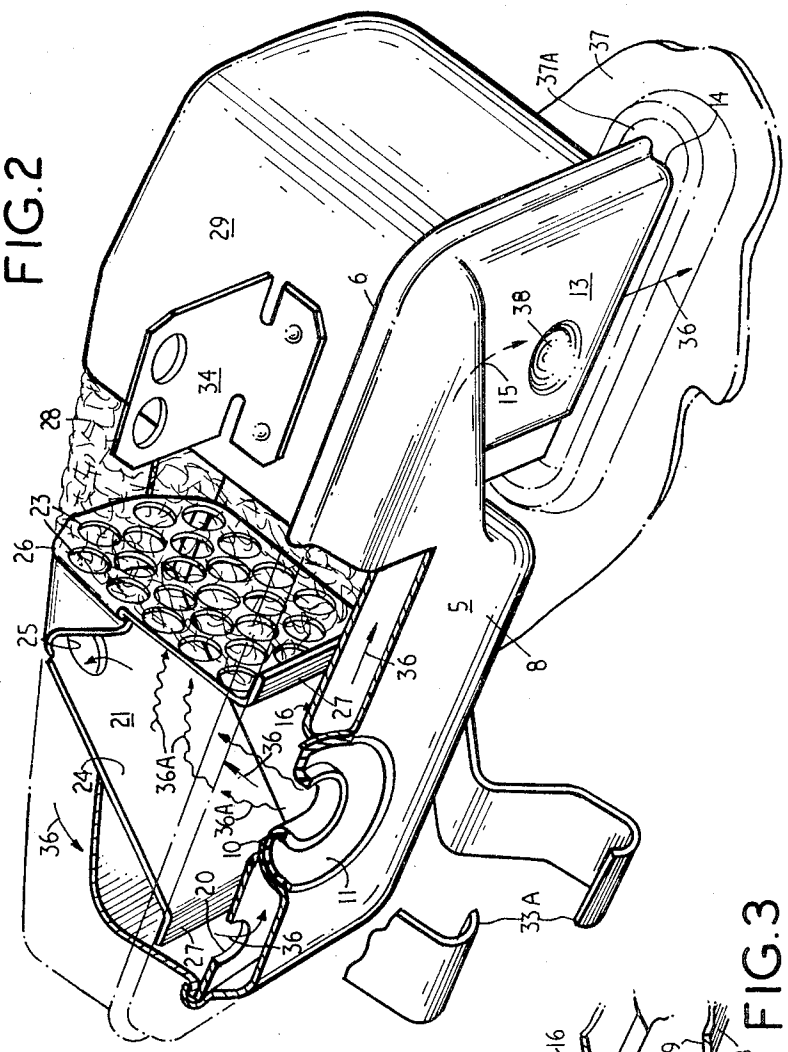
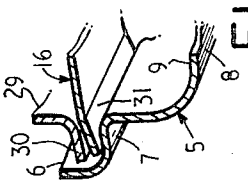

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FIG.3


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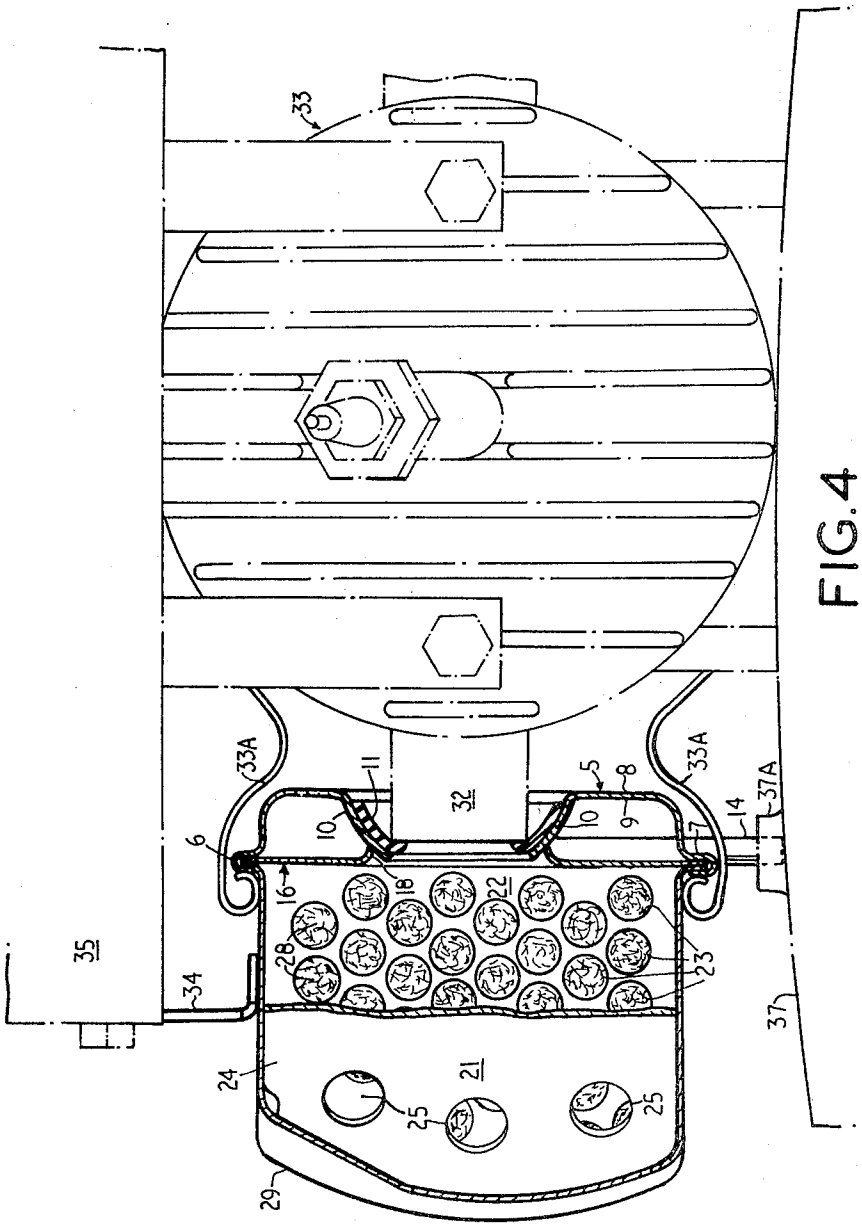

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FIG. 4

MUFFLERS FOR INTERNAL COMBUSTION ENGINES

This invention relates to engine mufflers and more particularly to mufflers for small two stroke internal combustion engines used as prime movers for lawn mowers or other small appliances.

In this application of exhaust mufflers an inexpensive, compact unit is required and for these reasons such mufflers have been constructed to provide tortuous passages for the exhaust gases. Generally these passages attenuate the pressure front component of the exhaust gases and create a back-pressure, and do not efficiently attenuate the shock wave component. Attempts have been made to replace the tortuous passages in the muffler by sound absorbing wads in the through path of the exhaust gases. However, when applied to small engines, such as two stroke engines, these wads become clogged with oil and other matter and, although continuing to absorb sound, they excessively impede the passage of exhaust gases.

One object of the invention is to provide an exhaust muffler for an internal combustion engine which is efficient and durable and of compact construction.

Other objects are to provide an exhaust muffler which is relatively inexpensive to produce, acceptably leakproof, and readily detachable from an associated engine.

A preferred form of the invention will now be described with reference to the accompanying drawings, in which:

FIG. 1 is an exploded perspective view of the component parts of a muffler constructed in accordance with the invention;

FIG. 2 is a perspective view of the assembled muffler with a portion partly cut away to show the gas and sound energy flow through the interior;

FIG. 3 is a fragmentary perspective view showing the peripheral edges of the back plate, separator plate and cover before the seaming operation has been carried out to secure them together; and,

FIG. 4 is an elevation of the muffler, in section through its inlet port; shown secured to the exhaust port of a typical engine.

With reference particularly to FIG. 1, a back plate 5 of the muffler is a pressing of metal with an upturned flange 6 and a land 7 formed about its periphery. A main wall 8 of the plate 5 is press-formed below the level of the land 7 to form a well 9. An inlet port 10 is formed in the well 9 with the circumference of said port dished to form a seating for a sealing gasket 11 (see FIGS. 2 and 4).

The land 7 in the back plate 5 is extended at one corner 7A to form an outer edge 12 from which the upturned flange 6 is omitted. A secondary well 13, shallower than the well 9, is formed at the corner 7A to constitute a discharge port 14 of the muffler.

The land 7 is also extended inwardly at 7B, to approximately the longitudinal center line of the plate 5, to form a partition between the wells 9 and 13. An integral junction wall 15 between said wells is angled approximately diagonally with respect to the general rectangular configuration of the back plate 5.

A separator plate 16 is adapted to seat upon the land 7 of the back plate 5 with its peripheral edge 17 within the flange 6. The said peripheral edge 17 is extended at

17A so as to correspond to the extension 7A in the back plate 5. The edge 17A spaced away from the well 13, completes the configuration of the exhaust port 14. An inwardly pressed aperture 18 is formed in the plate 16 so that the edge of said aperture engages the inner face of the dished inlet port 10. Diagonally disposed stiffening ribs 19 are pressed into the surface of the plate 16 to one side of the aperture 18. Three holes 20 are formed to the other side of said aperture 18.

A reflector plate 21 is secured to the plate 16 in line with the port 18. The plate 21 is approximately V-shaped with one wall 22 at right angles to the plate 16. The wall 22 is perforated over its whole surface with a series of holes 23 (FIG. 2). The other wall 24 is angularly disposed to the plate 16 and three holes 25 are formed near the conjunctional apex 26 of the two walls 22 and 24. The lower edges of the walls 22 and 24 are outwardly flanged as at 27 and said flanges 27 are spot welded to the plate 16.

A wad 28 of sound absorbing glass fibers, or other suitable material, is positioned on the plate 16, adjacent the wall 22 of the reflector plate 21. A deeply dished cover 29 is provided to enclose the wad 28 and plate 21. An outwardly turned flange 30 is formed marginally about the cover 29.

It will be seen that the marginal edge 17 of the plate 16 is set angularly away from the plane of said plate 16 to provide a formed margin 31. The flange 30 of the cover 29 rests upon said margin form 31 so that when the flange 6 on the back plate 5 is bent over in a suitable press, a seam is formed to unite the plates 5, 16 and cover 29 of the muffler. This means that the seam-binding effect of the curled flange 6 of the back plate 5 is maintained even though the curl relaxes a little after removal from the press. The form 31 in the separator plate 16 being reduced by the seaming blow, contributes a spring-back force acting to maintain an interference condition in the seam. This spring-back can be arranged to more than compensate for the relaxation in the curled flange 6. This arrangement thus ensures that oil leakage from the muffler is reduced to a minimum.

In FIG. 4 the muffler is shown secured to the exhaust port 32 of a typical internal combustion engine cylinder 33. Spring clips 33A are adapted to snap over the curled flange 6 to hold the muffler in place. In addition a bracket 34, extending from the cover 29 can be bolted to an upper cover 35 of the engine.

The paths of the gases and their sound energy component are shown in FIG. 2 and it will be seen that the wad 28 is laterally disposed with respect to the passage through the muffler for exhaust gases. The gases 36 and sound energy waves 36A pass through the ports 10 and 18 and strike the inclined wall 24 of the reflector plate 21. The sound energy waves 36A are reflected through the holes 23 in the wall 22 and are absorbed within the fiber wad 28. The gases 36 pass up into the apex 26 of the plate 21 and emerge through the holes 25. They then pass through the holes 20 in the plate 16 and travel between said plate and the well 9 in the back plate 5. They are then turned into the well 13 and emerge downwardly through the exhaust port 14 which passes through a passage 37A in the baseplate 37 of a lawn mower or other appliance driven by the engine and to which the engine cylinder 33 is mounted.

The back pressure is therefore not determined by the gas flow impedance in the sound absorbing section, nor by the state of clogging existing in the wad **28**. The back pressure depends upon the impedance to flow in the flow channels, which can be left fairly open.

For use on rotary lawn mowers, the discharge may be beneath the baseplate **37**, exploiting the additional sound attenuation possible by avoiding discharge directly into the atmosphere. The grass surface and the cuttings stream are helpful in this regard, being somewhat sound absorbent.

The ribs **19** in the plate **16**, and also a dimple **38** in the back plate **5** adjacent the exhaust port **14** prevent resonant vibrations being set up in these metallic members and thus limit the transmission of sound energy therefrom.

From the above description it will be seen that in its most general form the invention provides an exhaust muffler for an internal combustion engine comprising a housing having an inlet and an outlet for gases exhausted from an exhaust port of the engine, means for attaching the muffler housing to the engine with said inlet in communication with said exhaust port, means within said housing for defining an indirect passage for exhaust gases between said inlet and said outlet, and a wad of sound absorbing material exposed to the exhaust gases and laterally disposed with respect to at least part of said passage.

A single embodiment has been described in the above passages but it is to be understood that other forms are possible within the scope of the invention.

What we claim is:

1. An exhaust muffler for an internal combustion engine comprising a housing including a dished outer shell, an outer back plate and an internal separator plate substantially parallel with the back plate to form with said back plate an exhausting chamber and with said outer shell a muffler chamber, a wad of sound absorbing material in one part of the muffler chamber, a perforated sound reflector plate opposite to the wad in another part of the muffler chamber, an inlet and an outlet in the housing for gases exhausted from an exhaust port of the engine, said inlet being sealed from said exhausting chamber and passing through said back plate and said separator plate into said other part of the muffler chamber to direct exhaust gases onto and through said sound reflector plate, said outlet being connected with said exhausting chamber, and means for attaching the muffler housing to the engine with said inlet in communication with said exhaust port.

2. An exhaust muffler as claimed in claim **1**, wherein reinforcing ribs are formed in the separator plate to resist vibration of said plate when in use.

3. An exhaust muffler for an internal combustion engine provided with an exhaust port, comprising a housing including a dished outer shell, an outer back plate closing an open side of the shell, an internal partitioning separator plate defining together with the back plate an exhausting chamber and together with the outer shell a muffler chamber, a perforated panel between the separator plate and the shell dividing the muffler chamber into two compartments, a wad of sound absorbing material in a first one of said compartments, an inlet for exhaust gases sealed from the exhausting chamber and passing through the back plate and internal separator plate into a second one of said compartments, a reflector plate in the second compartment dividing same into two parts and having an inclined surface in a first of said compartment parts and opposite the inlet to reflect the shock wave component of exhaust gases entering the inlet towards the sound absorbing wad, means for permitting passage of exhaust gases from the inlet through the first part of the second compartment into a second of the said parts thereof and thence into the exhausting chamber, and an outlet for exhaust gases connected with the exhausting chamber.

4. An exhaust muffler as claimed in claim **3**, wherein a peripheral marginal edge area of said outer shell, back plate and separator plate are clamped together in a peripheral folded joint.

5. An exhaust muffler as claimed in claim **4**, wherein the marginal edge area of said back plate is folded around the marginal edge areas of the separator plate and the outer shell, and the marginal edge area of the separator plate is set angularly away from the plane of said separator plate to effect an interference condition in the resulting seam.

6. An exhaust muffler as claimed in claim **3**, wherein the muffler is generally rectangular and said outlet is located near one end of the muffler and directed in a direction substantially normal to that at which the inlet is directed.

7. An exhaust muffler as claimed in claim **3**, wherein the inlet is an aperture in an annular dished seat for an annular sealing gasket adapted to accept an exhaust port spigot from the engine, said muffler comprising spring clips for holding the housing to the engine with the spigot forced onto the sealing gasket on the seat.

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