

[54] EXHAUST UNIT FOR COMBUSTION
ENGINE

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[57] ABSTRACT

As disclosed, a modular arrester unit is fixed into a housing and includes a conical screen supported so that the exterior surface receives an exhaust stream, thereby passing a major part of the stream, but deflecting particles into an annular space which also receives a fragment of the stream through a vane structure to create turbulence. A cylindrical screen internally bounds the cylindrical space and passes the stream fragment back to the major stream. The housing additionally supports a silencer or muffler section downstream from the modular arrester unit.

6 Claims, 3 Drawing Figures

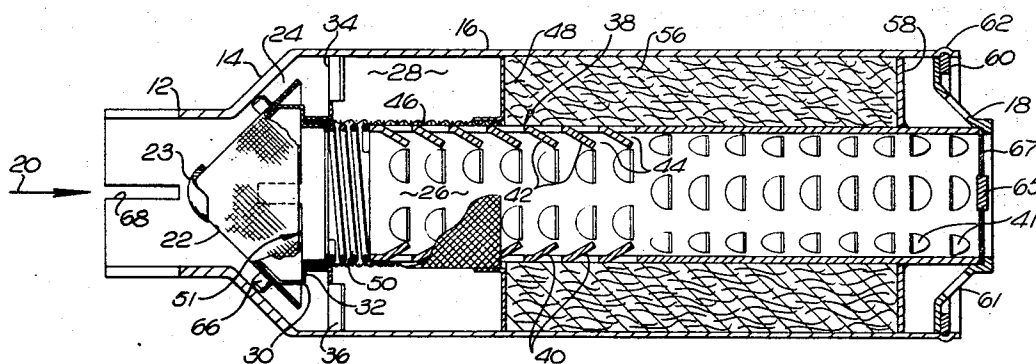


Fig. 1.

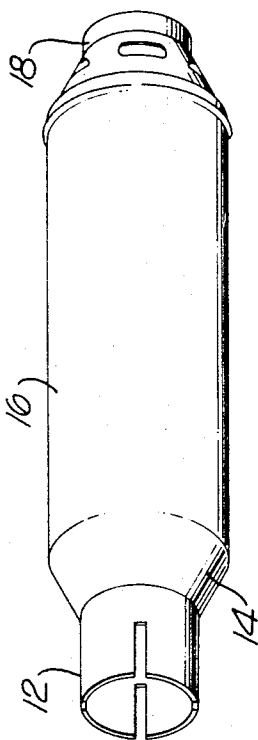


Fig. 3.

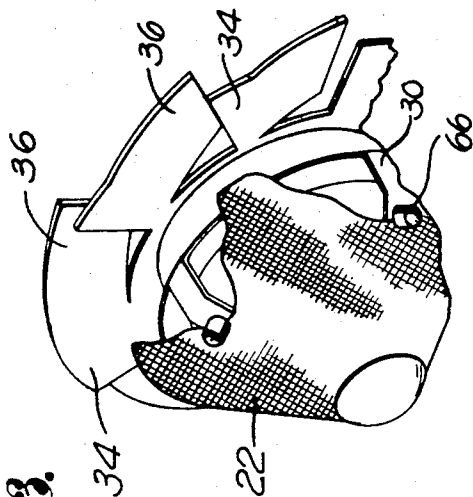
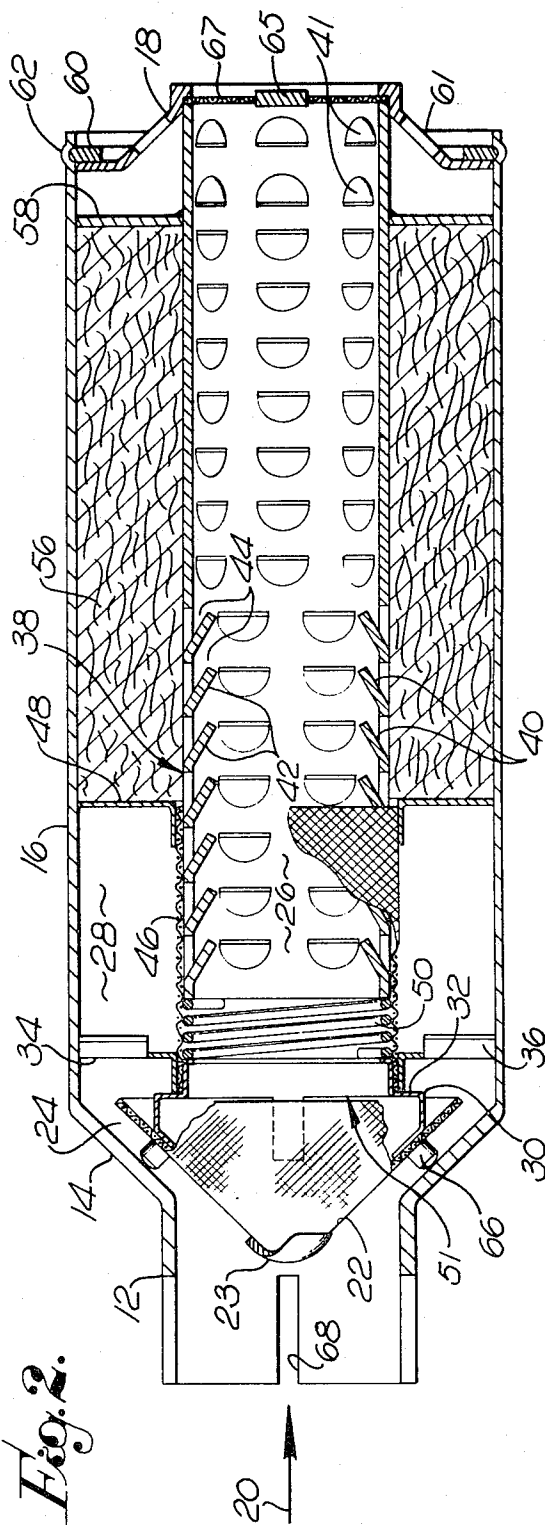


Fig. 2.



EXHAUST UNIT FOR COMBUSTION ENGINE

BACKGROUND AND SUMMARY OF THE INVENTION

Problems attendant the operation of internal combustion engines have become rather substantial. Specifically, one problem of substantial concern relates to engines (auxiliary on small vehicle) that are used in open and wooded areas that are susceptible to fire. That is, it is important that such engines do not pass hot particles or "sparks" which might ignite combustible material and result in substantial damage. In general, the total length of an exhaust system for a small vehicle is relatively short, compared to that of an automobile. Consequently, considerable danger exists that carbon particles may pass from the exhaust presenting a significant fire danger. Conventionally, screens have been incorporated in such exhaust systems to block the passage of the carbon particles. However, such screens have been troublesome and have required frequent cleaning to avoid serious reduction in the volumetric efficiency of the engine. Accordingly, a need exists for an improved unit to effectively receive particle material in an exhaust stream from an internal combustion engine.

In addition to the problem of sparks (live or hot particles) noise is also of substantial concern. Accordingly, a need exists for a combination unit that is capable of arresting the flow of hot particles and attenuating sound from an engine. It is also important to accomplish other specific objectives, including: minimizing component vibration within an exhaust unit, providing a structure that may be cleaned with relative ease, and providing a unit with economy and durability. In general, the present invention may be embodied in an exhaust unit which effectively affords these advantages. Specifically, the unit of the present invention incorporates structure for separating particle material from the main exhaust stream, and utilizing a fragment or portion of the exhaust stream to provide turbulence tending to break down the particles. Additionally, the unit incorporates a specific form of muffler section in combination with the arrester to dissipate noise.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing, which constitutes a part of this specification, an exemplary embodiment demonstrating various objectives and features hereof is set forth as follows:

FIG. 1 is a perspective view of an exhaust unit in accordance with the present invention;

FIG. 2 is a central vertical sectional view taken through the structure of FIG. 1; and

FIG. 3 is a perspective fragmentary view of a component of the unit of FIG. 2.

DESCRIPTION OF THE ILLUSTRATIVE EMBODIMENT

As required, a detailed illustrative embodiment of the invention is disclosed herein. The embodiment merely exemplifies the invention which, may be constructed in various other forms, some of which may be quite different from the disclosed illustrative embodiment. However, specific structural and functional details disclosed herein are merely representative and in that regard provide a basis for the claims herein which define the scope of the invention.

Referring initially to FIG. 1, there is shown a muffler in accordance herewith which is generally embodied in a somewhat cylindrical housing defining an intake passage 12 adapted to be connected to receive an exhaust stream from an internal combustion engine. The passage 12 terminates at a truncated conical section 14, providing a transition to the major cylindrical portion 16 of the housing. At the opposed rear end (right) the cylindrical portion 16 of the housing receives an annular member 18 affording a partial closure, and through which the exhaust stream passes. Generally, as disclosed, the unit may be embodied to be of a relatively-small size, e.g., under one foot in length, and under four inches in diameter which size includes the arrester and the muffler to pass only particles that present substantially no fire danger and effectively dissipate sonic energy.

Considering the unit hereof in somewhat-greater detail, an exhaust stream, as represented by an arrow 20 (FIG. 2) is received through the passage 12 to impinge upon a somewhat-conical or concave-convex screen 22. The screen 22 may be of stainless steel, e.g., 20 mesh woven, and has a somewhat hemispherical cap 23 of solid metal affixed at the external peak as by welding.

The screen 22 is spaced apart from, though matingly aligned with the conical section 14 of the housing to provide a somewhat conical, annular passage 24 therebetween. In general, the screen 22 functions to pass the major portion of the exhaust stream directly to a muffler section 26, while deflecting a fragment of the stream (and those particles of greater size than the screen mesh) to flow radially through the passage 24 and ultimately into an annular space 28, in which the particles may be broken down to a safe size and passed to the muffler section 26 for release from the unit.

The screen 22 is supported by four turned-back radial arms 30 of a spider 32 fixed thereto. The spider is in turn affixed to a cylindrical screen 46 and an annular collector ring 34 (FIG. 3) which is a flat circular section with raised vanes 36. The collector ring 34 is snugly fitted between the cylindrical portion 16 of the housing and the cylindrical screen 46.

The collector ring 34 defines the forward wall of the annular space 28, the rear wall of which is defined by an annular closed arrester plate 48. The collector ring 34 and the arrester plate 48 are concentrically mounted about the cylindrical screen 46 which in turn coaxially receives a coil spring 50 and the forward end of the core 38.

The cylindrical screen 46 may be of stainless steel similar to the screen 22 and is affixed by welding to: the arrester plate 48, the collector ring 34, and the spider 32 which is in turn affixed to the conical screen 22. Thus, a modular unit is provided as a spark arrester 51 which arrests the flow of hot carbon particles as described in detail below, in cooperation with a silencer structure, as including the core 38.

The core 38 is of cylindrical configuration and may comprise high-temperature resistant material, e.g., metal. Rows of louvers 40 and 41 are defined in the core 38. The louvers 40 provide forward tapered surfaces and rearward openings 44 while louvers 41 are reversed. The louvers 40 and 41, as indicated, are arranged in rows, which are radially offset. Specifically, the length of the core 38 is approximately halved, with each half defining six equally-shaped rows of louvers 40

and 41 about its circumference; however, with the rows in each half offset from the other half.

The core 38 is provided radial support as it is received within the screen 50 of the module unit 51. Axial support is provided by the coil spring 50 fitted between the spider 30 and the core 38. Thus, the core is resiliently held against vibratory motion within a cushion pack 56 which is of annular configuration and may comprise glass wool or other sound-absorbing material.

The pack 56 essentially fills the annular space between the core 38 and the internal wall of the cylindrical portion 16, while being held at its ends by the arrester plate 48 and a somewhat-similar circular plate 58 at the exhaust end (right) of the unit. The plate 58 is spaced apart from the closure member 18 (defining apertures 61) which is held in position by a retaining ring that is flexed into an annular inside groove 62 defined at the termination of the cylindrical portion 16. The terminating member 18 concentrically receives the core 38 and provides an internal shoulder 64 for mating engagement therewith. Additionally, the closure member 18 supports an obstruction disk 65 coaxially supported on radial members 67. The disk 65 in cooperation with the cap 23 tend to improve the sound attenuation characteristics of the unit.

In view of the above preliminary structural description of an embodiment of the present unit, a complete understanding thereof may now best be accomplished by pursuing an explanation of the operation. Accordingly, assume that the unit as depicted in the figures is affixed to receive the exhaust stream from an internal combustion engine, including gaseous products of combustion and hot particles (usually carbon). It is to be noted that the passage 12 defines slots 68 to facilitate clamping engagement with a duct to receive the stream.

The exhaust stream applied to the unit as disclosed herein will usually be pulsating, as from a two-cycle engine. It is noteworthy in such an application that to some extent, flow exists in both directions and additionally that by appropriately matching of the exhaust system to the engine, engine performance actually can be improved. That is, the opposed pressure patterns developed within an exhaust unit impede the free flow of exhaust gases thereby reducing engine performance and additionally creating shock waves which account to a large extent for noise from the exhaust system.

The pulsating exhaust stream which is received through the passage 12 initially impinges upon the convex forward surface of the screen 22 (FIG. 2). It is noteworthy that the cap 23 receives the most directly impinging particles which are deflected into the passage 24. Consequently, the screen life is prolonged considerably.

Generally, the gaseous products of combustion and small particles that pass through the screen 22 are received in the open chamber 26 of the core 38 and flow substantially unimpeded from the unit. Larger particles (along with a fragment of the stream) pass across the surface of the screen 22 along the passages 24 then flow through the collector ring 34 (under the vanes 36) and thereby enter the annular space 28. The vanes 36 generally impart a rotary or circumferential flow pattern to the fragment of the stream entering the space 28 with the result that particles therein are subjected to considerable turbulence. Generally, that turbulence tends to break down the particles to a smaller size so

that they may flow through the cylindrical screen 46 to enter the core 38 through an adjacent louver opening 44. The particles so reduced are also reduced to a temperature that is well below the level likely to present any fire damage. Consequently, these particles and the fragment of the stream are returned to the core 38 and the principal stream. Of course, some particles are trapped in the annular space 28; however, such may remain in a rather substantial quantity without interfering with the operation of the unit.

In general, during the operation of the unit as described above, the force of the spring 50 serves to avoid vibrations which might otherwise occur within the unit. Additionally, the internal components of the unit are readily accessible simply by removing the ring 60 and withdrawing the internal components. In that manner, the modular unit 51 and the core 38 may be cleaned and on occasion, the cushion pack 56 may be replaced.

In the construction of the unit, the housing incorporating the passage 12, the section 14 and the cylindrical portion 16 may be formed of aluminum, utilizing impact extrusion techniques. As a consequence, a lightweight rugged housing is provided. As indicated, the screens 22 and 46 may be formed of stainless steel and in that regard, any of a variety of forming techniques may be used to accomplish the cylindrical and conical shapes. Other components within the structure may be formed by various metal-shaping and tooling operations as generally well known in the prior art.

In the assembly operation, the modular unit 51 may be provided as a separate subassembly. The conical screen 22 receives the cap 23 and is affixed to the spider 32 with rivet spacers 66 which engage the interior of the section 14 to appropriately space the screen 22. The spider 32 is welded to the cylindrical screen 50 which is similarly affixed to the collector ring 34 and the annular plate 48.

The modular unit 51, so formed, next may be simply inserted into the cylindrical portion 16 in mating concentric relationship. Thereafter, the spring 50 may be dropped in place along with the core 38. The pack 56 is then placed. Subsequently, the annular wall 58 is forced into place along with the closure member 18 which provides openings 61 externally from the reverse louvers 41. Assembly is thus complete and the exhaust unit may be placed in use by affixing it to receive an exhaust stream.

In view of the above detailed explanation, it may be seen that the system hereof may be effectively employed as in cooperation with an internal combustion engine, to reduce engine sounds as well as eliminate the emission of hot particles giving rise to fire danger. The unit may be variously embodied and, accordingly, the scope hereof shall be as set forth in the following claims.

What is claimed is:

1. An exhaust unit for an engine comprising:

a housing adapted to be connected to receive an exhaust stream from said engine including gas and particles;

a screen defining an internal passage therethrough fixed in said housing to further define a space between said screen and said housing;

separation means affixed in said housing for deflecting said particles and a fragment of said stream to said space between said screen and said housing

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while passing another fragment of said stream through said internal passage of said screen; and means for providing turbulence in said space between said screen and said housing for moving said particles as to be drawn through said screen into said internal passage.

2. An exhaust unit according to claim 1 wherein said separator means comprises a concave-convex screen fixed in said housing to receive said stream at the convex side.

3. An exhaust unit according to claim 1 wherein said means for providing turbulence comprises a stream vane means for directing said fragment of said stream to move in a pattern circumferentially about the path of the other fragment of said stream.

4. An exhaust unit according to claim 1 further in-

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cluding a muffler pack comprising a metal core defining louvered passages and a cushion pack supporting said core in said housing to receive said stream.

5. An exhaust unit according to claim 1 wherein said separator means includes a conical screen member for deflecting said particles radially into said space between said screen and said housing, and wherein said means for providing turbulence comprises vane means for imparting a flow pattern to said fragment of said stream that extends circumferentially about said internal passage.

6. An exhaust unit according to claim 5 further including a muffler core affixed in said housing to receive the flow from said internal passage.

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