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(54) **Sound deadening and catalyst treating system**

System zur Schalldämpfung und katalytischer Behandlung

Système à amortissement de son et traitement catalytique

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• **Statetzny, Alan Michael**  
**Royal Oak, Michigan 48067 (US)**

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(74) Representative: **Stellbrink, Axel et al**  
**Vossius & Partner**  
**Siebertstrasse 4**  
**81675 München (DE)**

(73) Proprietor: **Umicore AG & Co. KG**  
**63457 Hanau-Wolfgang (DE)**

(56) References cited:

(72) Inventors:  
• **Garr, Gregory Thomas**  
**Rochester Hills, Michigan 48039 (US)**  
• **Jenkins, Martin Robert**  
**Rochester Hills, Michigan 48037 (US)**

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**Description****BACKGROUND OF THE INVENTION**

**[0001]** Vehicles of a wide variety, including automobiles, personal trucks, motorcycles and motor bikes have quickly become the world's most popular form of daily transportation and today are both manufactured and sold at ever increasing rates. The popularity of the personal vehicle is directly related to its propulsion system, the internal combustion engine, which yields relatively efficient and inexpensive power. Harnessing and manipulating this power, however, does not come without any detrimental effects. The result of each power producing explosion occurring within the internal combustion engine is exhaust, which includes a significant combination of both noise and air pollution. Efforts to eliminate or minimize the after combustion polluting effects of internal combustion engines have become as important today as those efforts which seek to maximize the output force these engines produce.

**[0002]** Two separate units, a muffler and a catalytic converter, are conventionally employed on today's automobiles to minimize emission noise and air pollution, respectively, at two separate stages of the exhaust stream. Mufflers typically are designed in one of three ways: (a) with staggered baffles; (b) with sound defeating angling; or (c) with fiberglass packing. Staggered baffled mufflers are the most commonly used in the automobile industry because they are efficient, inexpensive and easy to manufacture.

**[0003]** Catalytic converters, on the other hand, are typically designed in two ways: (a) with a honeycomb material; or (b) with beads. Both the honeycomb material and the beads are coated with a catalytic substance which causes the undesirable and harmful compounds in the exhaust gas emission stream to be converted in a predetermined catalytic reaction into harmless components.

**[0004]** Hence, treatment of noise and air pollution within an exhaust gas emission stream is accomplished conventionally by these two separate devices, each acting independently of one another. Accordingly, the conventional catalytic converter does not substantially silence exhausting emissions and the conventional muffler does not catalytically treat exhausting emissions.

**[0005]** The need to simultaneously reduce both noise and polluting emissions is of particular importance to manufacturers of small internal combustion engines, such as those for tractors, lawn and yard maintenance equipment, motor bikes, scooters, snow and leaf blowers and other power equipment where there is an increasing demand for reducing emissions and noise levels. Most of such small engines are equipped with a small muffler to control noise levels. Since existing small engine manufacturers do not wish to change muffler design, a typical design for such a unit is to include a small metal substrate catalyst for controlling harmful emis-

sions in the existing muffler. In that case, the muffler and catalyst are not independent of each other.

**[0006]** EP-A-831 211 discloses an exhaust emission control device for internal combustion engines wherein a thin steel plate carrying catalytic metals is disposed substantially at the central portion of a cross section of an exhaust pipe.

**SUMMARY OF THE INVENTION**

**[0007]** The present invention is defined in the claims and relates to an apparatus for an internal combustion engine, particularly a small engine of that type and especially a two-cycle engine, which is capable of both reducing exhaust noise and catalytically controlling pollutant emissions simultaneously and in a single unit. More specifically, this invention relates to a canister which employs at least one perforated and catalytically coated device to simultaneously reduce noise and harmful emissions associated with the exhausting emission stream from gas or diesel engines.

**[0008]** The present invention employs several catalytically coated hollow members situated in a muffler canister to interrupt the parallel flow of the entering exhaust gas stream, thereby forcing a reduced velocity and deadening the decibel level. In the present invention, the hollow members are tubes; i.e., hollow right cylinders that can be circular or oval in cross-section. The cross-sectional configuration can however, be of any convenient shape. The tubes preferably are fabricated from a metal, but also can be fabricated from a non-metal, such as a ceramic, by conventional manufacturing techniques.

**[0009]** The catalytic coating on the surface of these tubes provides the catalyst interaction necessary to reduce the pollutant content of the emission stream. Any type of known catalytic coating suitable for conversion of the harmful compounds in exhaust streams can be used for this purpose. Examples of such catalysts are widely known; see, for example, Domesle et al., U.S. 5,496,788 and U.S. 5,516,494 of Degussa AG. The tubes can be randomly arranged or according to a regular pattern. Thus, emission noise and pollution are both treated within the same unit and by the same device, thereby obviating the need for two different types of devices.

**[0010]** The tubes are preferably situated in a random manner within the canister to additionally foster non-parallel and turbulent exhaust flow. This type of exhaust flow both effectuates sound deadening effects and promotes catalyst/emission interaction.

**[0011]** Thus, one feature of the invention is an apparatus according to claim 1 for catalytic treatment and noise reduction of an exhaust gas emission stream from an internal combustion engine for a vehicle.

**[0012]** Another feature of the invention is the use of the apparatus according to the invention for catalytic treatment and noise reduction of an exhaust gas emis-

sion stream from an internal combustion engine for a vehicle.

### **BRIEF DESCRIPTION OF THE DRAWING**

**[0013]** The present invention will be further understood with reference to the drawing, wherein:

Fig. 1 is a schematic view illustrating the internal arrangement of several tubular devices within a noise muffling and catalytically treating canister unit.

### **DETAILED DESCRIPTION OF THE DRAWING**

**[0014]** Referring to Fig. 1, a preferred embodiment of the present invention is illustrated. As the combustion process within an engine occurs, the exhaust gas emission stream is directed into an inlet pipe 20 and thereafter, into an muffler canister 10. The inlet pipe 20 and an outlet pipe 70 can be in-line or, as shown in Fig. 1, can be offset. Inside the muffler canister 10, the flow of the exhaust gas emission stream (represented by arrows in Fig. 1) is forced to change directions frequently due to plurality of tubes 30 mounted in the muffler canister 10. As illustrated, tube 30 is a hollow right cylinder; i.e. circular in cross-section. The tube is formed of a cylindrical wall and preferably has a series of perforations formed therethrough. These tubes 30 force the exhaust gas emission stream to experience turbulent flow and thus produce a silencing effect. The arrangement of the tubes 30 within the canister can include staggered, aligned or angled orientations, as well as any combination thereof. Fig. 1 illustrates the tubes 30 in an orientation that combines staggered 40, aligned 50 and angled 60 pairs of tubes 30.

**[0015]** In addition to being used to baffle the emission stream flow, the tubes 30 within the muffler canister 10 also treat the exhaust gas emission stream for pollutants. To accomplish this task, the tubes 30 are coated on their surfaces, inside and/or outside, with any suitable catalyst well known and/or conventionally used in automobile emissions treatment to, for example, catalytically convert pollutant exhaust gases into carbon dioxide and water. Thus, the interaction between the emissions stream and the tubes 30 both lower the pollutant content of the emission stream, due to the catalyst coating on the tubes 30, and at the same time lower the noise level, due to the turbulent flow and the pressure drop across the canister 10 produced by the tubes 30.

**[0016]** The perforations along the periphery of the tubes 30 help create turbulent flow streams within the muffler 10 and enhance the interaction between the emission stream and the catalytic coating.

**[0017]** After contacting the tubes 30 within the muffler canister 10, the exhaust, being treated and silenced, exits the muffler canister 10 through the exhaust outlet pipe 70.

**[0018]** The multiplicity, specific arrangement and dimensions of the tubes within the muffler all preferably are random to further promote turbulent flow, and are variable depending on the desired use, the desired degree of noise attenuation/pollution treatment and the type and size of the engine.

**[0019]** In a preferred variation, the tubes are perforated in any convenient shape in a random or regular pattern to further promote turbulent flow within the muffler canister. Thus, the exhaust gas enters the tube element and at least a portion of the gas stream exits from the perforations in the tube wall to thereby increase turbulent flow. A baffle plate 80 can be adapted to one end of a tube 30 to increase exhaust stream flow through the perforations. The dimensions and the arrangement of the perforations on each tube also preferably are random and are variable according to the above factors.

**[0020]** Thus, a muffler canister in accordance with the present invention employs tubes of equal or unequal diameter oriented in a staggered, an aligned and/or an angled relation (from 45° to 180° relative to one another), and each individual tube has similar or differing perforation patterns.

**[0021]** The tubes are secured within the noise muffler by welding the tubes to the muffler canister and/or by welding the tubes to each other, by packing the tubes within an enclosed canister, or by any conventional method known to those of ordinary skill in the art.

**[0022]** In a preferred canister arrangement, tubes having a height and length equal to the inner dimensions of the canister are packed and sealed therein. Such an arrangement provides a compact aligned, end-to-end orientation of the tubes. This forces exhaust through the tubes rather than around them, influencing both catalytic interaction and the necessary baffling effect. The canister itself can be formed of any convenient metal and can be circular, rectangular or any other shape in cross-section. Typical canister designs known in the art can be used for purposes of the present invention.

**[0023]** Also, the effects of vibration on the tubes can be reduced by employing a nonflammable material, such as vermiculite or ceramic, on any portion of the inside walls of the canister.

**[0024]** Further, an insulator can be placed on the inside walls to reduce canister heat.

**[0025]** Hence, an apparatus constructed in accordance with the present invention provides the silencing effect of a conventional small engine muffler as well as the pollution treatment aspects of a conventional catalytic converter in a single unit.

**[0026]** It is to be understood that the embodiment described herein merely represents a preferred embodiment of the present invention. Variations and modifications of the invention as herein described will be apparent to those skilled in the art, including a change in the multiplicity of tubes or the use of non-tubular elements, and are intended to be encompassed by the claims appended hereto.

**Claims**

1. An apparatus for catalytic treatment and noise reduction of an exhaust gas emission stream from an internal combustion engine, comprising:
- a canister (10) having an inlet (20) and an outlet (70); and  
 a plurality of perforated tubes (30) having an emissions catalyst coated thereon disposed inside said canister (10), **characterized in that** said perforated tubes (30) are formed of a single cylindrical wall and are arranged in a parallel aligned relation (50), a parallel staggered relation (40), or an angled relation (60) with respect to each other or any combination thereof.
2. An apparatus according to claim 1, wherein:
- said inlet (20) and said outlet (70) of said canister (10) are in line.
3. An apparatus according to claim 1, wherein:
- said inlet (20) and said outlet (70) of said canister (10) are offset.
4. An apparatus according to claim 1, 2 or 3, further comprising:
- a baffle plate member (20) engaged at one end of said tubes (30).
5. Use of the apparatus according to any one of the preceding claims for catalytic treatment and noise reduction of an exhaust gas emission stream from an internal combustion engine.

**Patentansprüche**

1. Vorrichtung zur katalytischen Behandlung und Lärminderung eines Abgasemissionsstroms aus einem Verbrennungsmotor mit:
- einem Topf (10) mit einem Einlaß (20) und einem Auslaß (70); und  
 mehreren perforierten Röhren (30), die mit einem Emissionskatalysator beschichtet und im Inneren des Topfes (10) angeordnet sind, **dadurch gekennzeichnet, daß** die perforierten Röhren (30) aus einer einzelnen zylindrischen Wand ausgebildet sind und in einer parallelen ausgerichteten Beziehung (50), einer parallelen versetzten Beziehung (40) oder einer abgewinkelten Beziehung (60) zueinander oder in jeder Kombination daraus angeordnet sind.

2. Vorrichtung nach Anspruch 1, wobei:
- der Einlaß (20) und der Auslaß (70) des Topfes (10) in einer Reihe sind.
3. Vorrichtung nach Anspruch 1, wobei:
- der Einlaß (20) und der Auslaß (70) des Topfes (10) versetzt sind.
4. Vorrichtung nach Anspruch 1, 2 oder 3, ferner mit:
- einem Prallblechteil (80), das an einem Ende der Röhren (30) in Eingriff gebracht ist.
5. Verwendung der Vorrichtung nach einem der vorstehenden Ansprüche zur katalytischen Behandlung und Lärminderung eines Abgasemissionsstroms aus einem Verbrennungsmotor.

**Revendications**

1. Dispositif de traitement catalytique et de réduction du bruit d'un courant d'émissions de gaz d'échappement sortant d'un moteur à combustion interne, comprenant :
- une boîte (10) munie d'une entrée (20) et d'une sortie (70), et
  - un certain nombre de tubes perforés (30) portant un revêtement de catalyseur d'émissions déposé sur ceux-ci, ces tubes perforés étant disposés à l'intérieur de la boîte (10),

**caractérisé en ce que**

les tubes perforés (30) sont formés d'une paroi cylindrique unique et sont disposés dans une relation parallèle alignée (50), une relation parallèle décalée (40) ou une relation d'inclinaison angulaire (60) les uns par rapport aux autres, ou encore dans une combinaison quelconque de ces relations.

2. Dispositif selon la revendication 1, dans lequel l'entrée (20) et la sortie (70) de la boîte (10) sont en ligne.
3. Dispositif selon la revendication 1, dans lequel l'entrée (20) et la sortie (70) de la boîte (10) sont décalées.
4. Dispositif selon la revendication 1, 2 ou 3, comprenant en outre un élément de plaque de déflecteur (80) engagé à une extrémité des tubes (30).

5. Utilisation du dispositif selon l'une quelconque des revendications précédentes, pour le traitement catalytique et la réduction du bruit d'un courant d'émissions de gaz d'échappement sortant d'un moteur à combustion interne.

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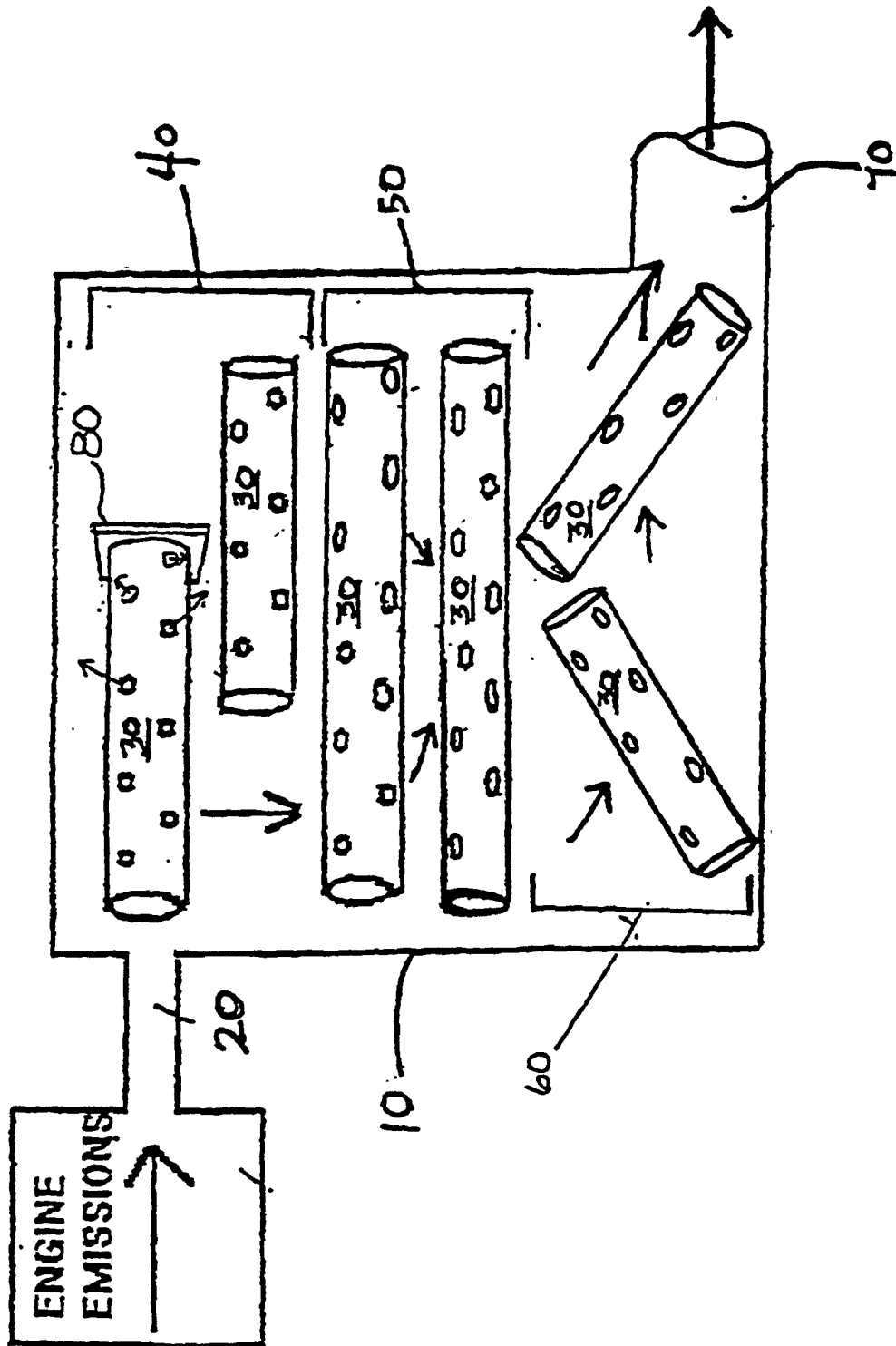


FIG 1