### EUROPEAN PATENT SPECIFICATION

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**Catalytic converter for vehicle exhaust**

- **Katalytischer Konverter für Fahrzeugabgase**
- **Pot catalytique pour gaz d’échappement de véhicule**

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**References cited:**
- WO-A-95/08702  DE-A- 4 436 754

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Description

Technical Field

[0001] The present invention relates to a catalytic converter for the exhaust system of a motor vehicle.

Background of the Invention

[0002] The use of a catalytic converter in the exhaust system of a motor vehicle is well known. The catalytic converter acts on the exhaust gases leaving the engine of the vehicle to convert carbon monoxide, the oxides of nitrogen, and hydrocarbons in the exhaust gases. A typical catalytic converter consists of a number of bricks (coated substrates) through which the exhaust gases can pass. In order to work efficiently, these bricks must be at a temperature which is above the light-off temperature - the temperature above which conversion is most effectively achieved. The temperature of the exhaust gases is used to maintain the temperature of these bricks above the light-off temperature (the threshold temperature above which the catalyst is active). However, when the engine is started from cold, there is an initial period (the cold phase or light off time) when the catalytic converter is cold and inactive but exhaust gases are passing through the converter. During this initial period, the converter is not working in an efficient manner.

[0003] EP-A-0697505 describes a catalytic converter in which a first brick (either a three-way catalyst or a light-off catalyst) is spaced upstream from a second brick (an adsorber catalyst), with the second brick being spaced upstream from a third brick (a light-off catalyst). The second brick is annular and has a through bore. DE-A-4436753 describes a catalytic converter having three adjacent bricks, the central brick providing adsorption.

Summary of the Invention

[0004] It is an object of the present invention to provide a catalytic converter with a reduced inactive period after a cold start.

[0005] A catalytic converter in accordance with the present invention is characterised over EP-A-0697505 by the features specified in Claim 1.

[0006] The catalytic converter of the present invention is such that the fourth brick is heated by exhaust gases passing through the aligned bores to its light-off temperature before the third brick reaches its threshold (desorption) temperature. Such an arrangement reduces the inactive period for the converter when compared to previously known arrangements with minimal increase in cost or complexity. In a preferred arrangement, the fourth brick is a coated metallic foam which enhances gas mixing in the brick and improves radial heat conduction.

Brief Description of the Drawings

[0007] The present invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

[0008] Figure 1 is a cross-sectional view of a catalytic converter in accordance with the present invention.

Description of the Preferred Embodiment

[0009] Referring to the drawing, the catalytic converter 10 in accordance with the present invention is for use in an exhaust system (not shown) connected to an engine of a motor vehicle. The converter 10 comprises a housing 12 having an inlet 14 and an outlet 16. The inlet 14 receives exhaust gases from the engine, and the outlet 16 directs converted exhaust gases towards the outlet of the exhaust system, so gas flow through the converter 10 is from the inlet to the outlet. The inlet 14 and outlet 16 may be substantially aligned. Positioned within the housing 12 are first, second, third, fourth and fifth bricks 18,20,22,24,26, respectively, with the first brick adjacent the inlet 14 and the fifth brick adjacent the outlet 16. The second brick 20 is positioned between, and in contact with, the first and third bricks 18,22, and the fourth brick 24 is positioned between, and spaced from, the third and fifth bricks 22,26. The bricks 18-26, which are described in more detail below, allow exhaust gases to flow through the converter 10 from the inlet 14 to the outlet 16.

[0010] The first brick 18 is a coated substrate which has the primary function of initiating the catalytic conversion of the gases when the system starts from cold (ambient) conditions. The second brick 20 is a coated substrate which has the primary function of providing three way catalytic conversion (CO to CO₂, NO to N₂O and HC to H₂O and CO₂) complementary to the first brick 18 especially after the light-off phase. The second brick 20 is meant to achieve maximum conversion in the whole engine operating range when the converter 10 is heated to its normal operating temperature. The third brick 22 is a coated substrate which has the primary functions of hydrocarbon adsorption and hydrocarbon oxidation. The fourth brick 24 is a coated foam (preferably metallic, such as stainless steel, or a material having similar characteristics) which has the primary function of rapid light-off, and rapid thermal response. The fifth brick 26 (which is optional) is a coated substrate which has the primary function of three way conversion.

The coating material(s) on the bricks 18-26, and the material(s) for the substrates for the first, second, third and fifth bricks and the foam for the fourth brick, can be any known or suitable material(s) for fulfilling the primary functions mentioned above.

[0011] The axial lengths of the first and second bricks 18,20 are predetermined to maintain the third brick 22 below its desorption temperature until after the temperature of the first brick 18 has risen above its light-off tem-
The third brick 22 is substantially annular and has a through bore 28 which opens into a closed bore 30 formed in the second brick 20. The bores 28,30 extend axially along the longitudinal axis of the converter 10. The through bore 28 also opens into the space 32 between the third brick 22 and the fourth brick 24. The fourth brick 24 has a reduced outer diameter compared to the other bricks 18-22,26 and is mounted on an annular support member 34 having an angled upstream face 36 and an angled downstream face 38. The angled faces 36,38 are provided to reduce flow restrictions.

In use, exhaust gases which flow through the first brick 18 and the second brick 20 into the bores 28,30 arrive at the fourth brick 24 with a higher temperature than the exhaust gases which flow through the first, second and third bricks 18-22 before arriving at the fourth brick. The exhaust gases which flow through the bores 28,30 induce a rate of temperature rise in the fourth brick 24 whilst the third brick 22 is being heated at a slower rate by the exhaust gases flowing through the second and third bricks 20,22. The exhaust gases flowing through the second and third bricks 20,22 are cooled down by eat transfer to the substrate. The temperature differential between these two streams of exhaust gases is dependent on the diameter D and axial length L of the bores 28,30. This has the effect of delaying the time taken for the third brick 22 to reach its desorption temperature (the threshold temperature above which the third brick releases stored hydrocarbons) until after the fourth brick 24 has been heated above its light-off temperature. As a consequence, the hydrocarbons subsequently released by the third brick 22 are converted by the fourth brick 24. The values for D and L are specific to the exhaust system to which the converter 10 is attached and are determined accordingly to ensure that the fourth brick 24 is heated to its light-off temperature before the third brick 22 reaches its desorption temperature.

The reduced passage of the fourth brick 24 forces the mixing of the exhaust gases flowing out of the third brick 22 and the bores 28,30 in the space 32. The metallic foam of the fourth brick 24 provides an open pore structure which acts as a thermally responsive element within the converter 10. Such an element provides exhaust gas flow mixing because of the random structure, and radial heat conduction. The outer diameter of the fourth brick 24 is reduced to concentrate heating from the exhaust gases flowing out of the bores 28,30 on a smaller surface area. The angled downstream face 38 of the support member 34 allows the converted exhaust gases flowing out of the fourth brick 24 to pass through the space 40 between the fourth and fifth bricks 24,26 to reach the full cross-sectional area of the fifth brick.

**Claims**

1. A catalytic converter (10) for an exhaust system of a motor vehicle comprising a housing (12) having an inlet (14) and an outlet (16); a first brick (18) positioned inside the housing adjacent the inlet for initiating catalytic light-off functions of exhaust gases flowing through the first brick; a second brick (20) positioned adjacent the first brick downstream of the inlet for three way conversion of exhaust gases flowing through the second brick; a third brick (22) positioned adjacent the second brick downstream of the inlet for hydrocarbon adsorption and oxidation of exhaust gases flowing through the third brick; and a fourth brick (24) positioned adjacent and spaced from the third brick downstream of the inlet for light-off of exhaust gases flowing through the fourth brick; wherein the third brick is substantially annular with a through bore (28) extending axially therethrough; and wherein the second brick has a closed bore (30) extending axially and opening into the through bore of the third brick; such that, during use, the fourth brick reaches its light-off temperature before the third brick reaches its desorption temperature.

2. A catalytic converter as claimed in Claim 1, wherein the fourth brick (24) is mounted on an annular support member (34) and has a reduced diameter compared to the outer diameter of the third brick (22).

3. A catalytic converter as claimed in Claim 2, wherein the annular support member (34) has an angled upstream face (36) in the space (32) between the third and fourth bricks (22,24).

4. A catalytic converter as claimed in any one of Claims 1 to 3, wherein the fourth brick (24) comprises a coated metallic or equivalent foam.

5. A catalytic converter as claimed in any one of Claims 1 to 4, further comprising a fifth brick (26) positioned adjacent and spaced from the fourth brick (24) downstream of the inlet (14) for three way conversion of exhaust gases flowing through the fifth brick.

6. A catalytic converter as claimed in Claim 5, in which the fourth brick (24) is mounted on an annular support member (34), wherein the annular support member has an angled downstream face (38) in the space (40) between the fourth and fifth bricks (24,26).

**Patentsprüche**

1. Katalytischer Konverter (10) für ein Abgassystem
eines Kraftfahrzeuges, mit:
einem Gehäuse (12), das einen Einlass (14) und einen Auslass (16) aufweist;
einem ersten Block (18), der innerhalb des Gehäuses benachbart des Einlasses positioniert ist, um katalytische Anspringfunktionen auf Abgase einleiten, die durch den ersten Block strömen;
einem zweiten Block (20), der benachbart des ersten Blockes unterstromig des Einlasses zur Dreiegeeumwandlung von Abgasen positioniert ist, die durch den dritten Block strömen;
einem vierten Block (24), der benachbart und beabstandet zu dem dritten Block unterstromig des Einlasses zum Anspringen auf Abgase positioniert ist, die durch den vierten Block strömen; wobei der dritte Block im Wesentlichen ringförmig ist und eine sich durch diesen axial erstreckende Durchgangsbohrung (28) aufweist; und wobei der zweite Block eine geschlossene Bohrung (30) aufweist, die sich axial erstreckt und sich in die Durchgangsbohrung des dritten Blockes öffnet, so dass während des Gebrauches der vierte Block seine Anspringtemperatur erreicht, bevor der dritte Block seine Desorptionstemperatur erreicht.

2. Katalytischer Konverter nach Anspruch 1, wobei der vierte Block (24) an einem ringförmigen Trägerelement (34) befestigt ist und im Vergleich zu dem Außendurchmesser des dritten Blockes (22) einen verringerten Durchmesser aufweist.


4. Katalytischer Konverter nach einem der Ansprüche 1 bis 3, wobei der vierte Block (24) einen beschichteten metallischen oder gleichwertigen Schaum umfasst.

5. Katalytischer Konverter nach einem der Ansprüche 1 bis 4, ferner mit einem fünften Block (26), der benachbart und beabstandet zu dem vierten Block (24) unterstromig des Einlasses (14) zur Dreiegeeumwandlung von Abgasen positioniert ist, die durch den fünften Block strömen.

6. Katalytischer Konverter nach Anspruch 5, wobei der vierte Block (24) an einem ringförmigen Trägerelement (34) befestigt ist, wobei das ringförmige Trägerelement eine angewinkelte unterstromige Seite (38) in dem Raum (40) zwischen den vierten und fünften Blöcken (24, 26) aufweist.

Revendications

1. Pot catalytique (10) destiné à un système d'échappement d'un véhicule à moteur comprenant un carter (12) possédant un orifice d'entrée (14) et un orifice de sortie (16) ; une première brique (18) positionnée à l'intérieur du carter attenante à l'orifice d'entrée pour initier des fonctions d'extinction catalytique des gaz d'échappement circulant à travers la première brique ; une deuxième brique (20) positionnée pour être attenante à la première brique en aval de l'orifice d'entrée destinée à la conversion à trois voies des gaz d'échappement qui circulent à travers la deuxième brique ; une troisième brique (22) positionnée pour être attenante à la deuxième brique en aval de l'orifice d'entrée destinée à l'adsorption des hydrocarbures et à l'oxydation des gaz d'échappement qui circulent à travers la troisième brique ; dans lequel la troisième brique est sensiblement annulaire, un trou traversant (28) s'étendant à travers celle-ci dans la direction axiale ; et dans lequel la deuxième brique possède un alésage borgne (30) s'étendant axialement et s'ouvrant dans le trou traversant la troisième brique ; de telle façon que, en utilisation, la quatrième brique atteint sa température d'extinction avant que la troisième brique n'atteigne sa température de désorption.

2. Pot catalytique selon la revendication 1, dans lequel la quatrième brique (24) est montée sur un élément de support annulaire (34) et possède un diamètre réduit en comparaison du diamètre extérieur de la troisième brique (22).

3. Pot catalytique selon la revendication 2, dans lequel l'élément de support annulaire (34) a une face amont inclinée (36) dans le volume (32) entre la troisième et la quatrième briques (22, 24).

4. Pot catalytique selon l'une quelconque des revendications de 1 à 3, dans lequel la quatrième brique (24) comprend une mousse métallique ou analogue revêtue.

5. Pot catalytique selon l'une quelconque des revendications de 1 à 4, comprenant en outre une cin-
quième brique (26) positionnée pour être attenante et écartée de la quatrième brique (24) en aval de l'orifice d'entrée (14) destinée à la conversion à trois voies des gaz d'échappement circulant à travers la cinquième brique.

6. **Pot catalytique selon la revendication 5, dans lequel la quatrième brique (24) est montée sur un élément annulaire formant support (34), dans lequel l'élément de support annulaire a une face aval inclinée (38) dans le volume (40) entre la quatrième et la cinquième briques (24, 26).**