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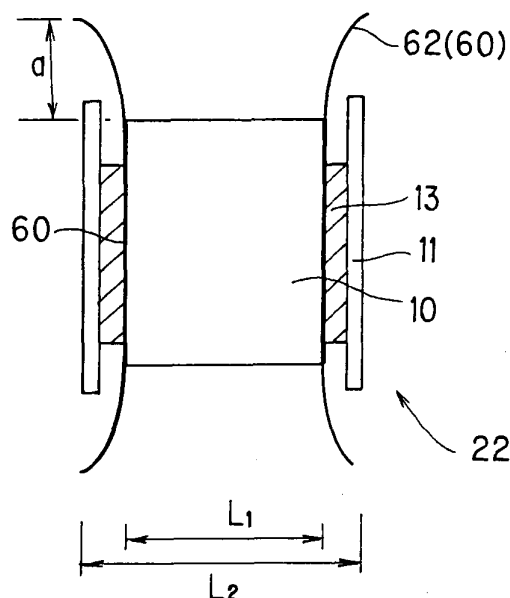
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(54) **Canning structure and catalyst carrying method thereof**

(57) A canning structure comprises a ceramic honeycomb structure (10) which is to be loaded with a catalyst, canned in a metal case (11) and being held by holding material (13). An impermeable film (60) is provided between the ceramic honeycomb structure and the holding material. To load a catalyst, a catalyst slurry is poured in only on the ceramic honeycomb structure side of the impermeable film, thereby preventing the holding material from carrying the catalyst. Thus, the holding material does not carry expensive catalyst. Chipping and cracking of the ceramic honeycomb structure can be prevented during transport, during loading of catalyst, during canning, and during handling.

FIG. 1 (C)



Description

BACKGROUND OF THE INVENTION

Field of the invention

[0001] The present invention relates to a canning structure for a catalytic converter which is a device for purifying harmful combustion gases exhausted from internal combustion engines and the like, and to a catalyst carrying method thereof.

Description of the Related Art

[0002] Currently, ceramic honeycomb catalytic converters are widely used as automobile exhaust gas purifying devices.

[0003] Environmental issues in recent years along with even stricter exhaust gas restrictions are requiring that catalysts be able to function immediately following starting the engine when the exhaust gas is still cool, i.e., cold starts.

[0004] Accordingly, a step being taken is to reduce the thickness of the partitions of the catalyst carrier to 1/2 to 1/6 of the conventional thickness, so as to lower the thermal capacity of the catalyst carrier and speed up the temperature rising of the catalyst carrier, along with improving engine performance due to decrease of pressure loss.

[0005] Normally, a ceramic honeycomb catalytic converter is manufactured as shown in Fig. 3.

[0006] First, the carrier manufacturer packages a ceramic carrier 10 (ceramic honeycomb structure) which has passed inspection, and sends it to a catalyst manufacturer.

[0007] The catalyst manufacturer unpacks this, performs processes such as causing the ceramic carrier 10 (ceramic honeycomb structure) to hold the catalyst (i.e., catalyst coating), thermal processing, inspection, etc., thereby forming a catalyst carrier 25 (ceramic honeycomb catalyst carrier), which is then packaged and sent to a canning manufacturer.

[0008] The canning manufacturer unpacks this and attaches a holding material 13 to the catalyst carrier 25 so as to fix within a metal case 11 by compressed fixing (canning), thus forming a canning catalyst carrier 30, following which joining parts such as a cone portion 17 and flange 18 and the like are welded to the canning catalyst carrier 30 as necessary, thus completing a catalytic converter 1 (ceramic honeycomb catalytic converter) (see Fig. 4).

[0009] Now, in the event that a ceramic honeycomb structure having the thickness of the partitions at around 1/2 to 1/6 of the conventional thickness is used as the above catalyst carrier, there has been the problem that the ceramic honeycomb structure easily cracks or chips during transporting, the catalyst carrying process, the canning process, and handling in each of the processes

(e.g., packaging, unpacking, placing on or taking off of the mechanical facilities (conveyers, chucking, canning, etc.)).

[0010] In order to solve this problem, the present Inventors have proposed a new ceramic honeycomb catalytic converter manufacturing process using a canning structure (an article wherein a ceramic honeycomb structure before carrying the catalyst is fixed inside a metal case beforehand, using a holding material).

[0011] However, the above canning structure has been uneconomical, since at the time of carrying the catalyst (i.e., catalyst coating), expensive catalyst is carried by not only the ceramic honeycomb structure but also the holding material which does not take part in the catalytic reaction with the exhaust gas.

SUMMARY OF THE INVENTION

[0012] The present invention has been made in light of the present situation, and accordingly, it is an object thereof to provide a canning structure and a catalyst carrying method thereof, capable of preventing chipping and cracking of the ceramic honeycomb structure at the time of transporting, the catalyst carrying process, the canning process, and handling in each of the processes, without allowing the holding material to carry expensive catalyst at the time of carrying the catalyst.

[0013] According to the present invention, a canning structure is provided which comprises a ceramic honeycomb structure before carrying a catalyst fixed beforehand within a metal case by a holding material; wherein an impermeable film is provided between the ceramic honeycomb structure and the holding material.

[0014] At this time, the impermeable film preferably circles at least the portion where the ceramic honeycomb structure and the holding material are in contact.

[0015] Also, according to the present invention, the impermeable film preferably has protrusions protruding from both edge planes of the ceramic honeycomb structure by 10 mm or more (preferably 20 mm or more, and more preferably 30 mm or more), with the outer diameter of the protrusions of the impermeable film being greater than the outer diameter of the ceramic honeycomb structure.

[0016] Further, according to the present invention, the shape of the impermeable film is preferably cylindrical, and the thickness of the impermeable film is preferably 0.1 mm or less (preferably 0.05 mm or less, and more preferably 0.03 mm or less).

[0017] Here, the impermeable film is preferably combustible and also water-repellent.

[0018] Further, according to the present invention, the holding material is preferably a non-intumescent ceramic fiber mat.

[0019] Also, according to the present invention, a catalyst carrying method is provided for a canning structure comprises a ceramic honeycomb structure; said honeycomb structure having been not loaded with a catalyst,

a metal case and a holding material, and said ceramic honeycomb structure being canned in said metal case and being held by said holding material thereto; wherein an impermeable film is provided between the ceramic honeycomb structure and the holding material, and then a catalyst slurry is poured in only on the ceramic honeycomb structure side of the impermeable film, thereby preventing the holding material from carrying the catalyst, such that only the ceramic honeycomb structure carries the catalyst.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

Fig. 1A is a schematic perspective view illustrating an example of the canning structure according to the present invention;

Fig. 1B is a plan view of that shown in Fig. 1A;

Fig. 1C is a longitudinal-sectional view of that shown in Fig. 1a;

Fig. 2 is a schematic diagram illustrating an example of the manufacturing process of the ceramic honeycomb catalytic converter using the canning structure according to the present invention;

Fig. 3 is a schematic diagram illustrating an example of the manufacturing process of a conventional ceramic honeycomb catalytic converter; and

Fig. 4 is a schematic explanatory diagram illustrating an example of a ceramic honeycomb catalytic converter.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0021] The canning structure according to the present invention is a canning structure comprises a ceramic honeycomb structure; said honeycomb structure having been not loaded with a catalyst, a metal case and a holding material, and said ceramic honeycomb structure being canned in said metal case and being held by said holding material thereto, wherein an impermeable film is provided between the ceramic honeycomb structure and the holding material.

[0022] Thus, chipping and cracking of the ceramic honeycomb structure can be prevented at the time of transporting, the catalyst carrying process, the canning process, and handling in each of the processes, without allowing the holding material to carry expensive catalyst at the time of carrying the catalyst.

[0023] The present invention will be described in further detail with reference to the drawings.

[0024] Figs. 1A through 1C illustrate an example of the canning structure according to the present invention, wherein Fig. 1A is a schematic perspective view, Fig. 1B is a plan view, and Fig. 1C is a longitudinal-sectional view.

[0025] As shown in Figs. 1A through 1C, the canning

structure according to the present invention comprises a canning structure comprises a ceramic honeycomb structure 10; said honeycomb structure having been not loaded with a catalyst, a metal case 11 and a holding material 13, and said ceramic honeycomb structure being canned in said metal case and being held by said holding material thereto, wherein an impermeable film 60 is provided between the ceramic honeycomb structure 10 and the holding material 13.

[0026] At this time, with the canning structure according to the present invention, the impermeable film 60 preferably circles at least the portion where the ceramic honeycomb structure 10 and the holding material 13 are in contact, as shown in Figs. 1A through 1C.

[0027] This is to prevent the catalyst slurry containing the catalyst component from flowing to the holding material in the event that the above canning structure is caused to hold the catalyst (i.e., subjected to catalyst coating).

[0028] Also, with the canning structure according to the present invention, the impermeable film preferably has protrusions 62 protruding from both edge planes of the ceramic honeycomb structure 10 by a length "a" which is 10 mm or more (preferably 20 mm or more, and more preferably 30 mm or more), as shown in Fig. 1C.

[0029] Also, the outer diameter L_2 of the protrusions of the impermeable film are preferably greater than the outer diameter L_1 of the ceramic honeycomb structure.

[0030] Thus, the catalyst slurry can be readily prevented from flowing to the holding material in the catalyst carrying process, causing the canning structure to hold the catalyst (i.e., catalyst coating) can be performed in a sure manner, and the catalyst carrying process can be optimized.

[0031] Also, the shape of the impermeable film used in the present invention is preferably cylindrical.

[0032] This is to allow the impermeable film to be easily provided so as to circle the ceramic honeycomb structure, so the canning process can be simplified, and also the perimeter of the ceramic honeycomb structure can be seamlessly circled, so catalyst slurry can be readily prevented from flowing out from the ceramic honeycomb structure in a sure manner.

[0033] Also, the impermeable film used in the present invention may be a sheet formed integrally with the ceramic fiber mat which serves as the holding material.

[0034] Thus, the impermeable film and the holding material can be wound onto the perimeter surface of the ceramic honeycomb structure at the same time, so the canning process can be simplified.

[0035] Further, the thickness of the impermeable film used with the present invention is preferably 0.1 mm or less (preferably 0.05 mm or less, and more preferably 0.03 mm or less).

[0036] This is due to the fact that the thickness of the impermeable film must be as thin as possible, in order to fix the ceramic honeycomb structure in the metal case in a secure manner with the holding material, in the

event that the impermeable film is removed from the canning structure which has carried the catalyst (coated with the catalyst).

[0037] Here, the impermeable film used with the present invention is preferably combustible.

[0038] This is in order to easily remove the impermeable film which has become no longer necessary, by a thermal process (500 to 700° C) following carrying the catalyst (catalyst coating).

[0039] Also, the impermeable film used with the present invention is preferably water-repellent, in order to prevent the catalyst slurry from flowing to the holding material in a sure manner.

[0040] Now, while the material of the impermeable film used with the present invention is not particularly restricted as long as the above conditions are all met, polyethylene, nylon, etc., are preferably used.

[0041] Further, in addition to the above advantages, the canning structure according to the present invention is capable of protecting the ceramic honeycomb structure from external shock and vibrations, and accordingly chipping and cracking of ceramic honeycomb structures (particularly of those with thin walls (thickness of partitions; 0.10 mm or thinner)) can be prevented at the time of transporting, the catalyst carrying process, the canning process, and handling in each of the processes.

[0042] The canning structure according to the present invention is preferably of an arrangement wherein the metal case has a stuffing structure or a tourniquet structure.

[0043] This is because the plane pressure distribution at the time of canning is uniform, which allows prevention of engine exhaust gasses leaking, corrosion of the holding material due to the exhaust gasses, and rattling, damage, etc., of the ceramic honeycomb structure due to engine vibrations, thereby improving reliability.

[0044] Particularly, in the event that the metal case has a tourniquet structure, not only is the plane pressure distribution uniform, but canning can be performed at a constant plane pressure regardless of irregularities in the diameter of the ceramic honeycomb structure, which is particularly preferable for ceramic honeycomb structures with low mechanical strengths (particularly, those with thin walls).

[0045] Also, the holding material used with the present invention is preferably a non-intumescent ceramic fiber mat.

[0046] This allows the maximum plane pressure at the time of canning due to irregularities in the diameter of the ceramic honeycomb structure to be reduced, and further to prevent damage to ceramic honeycomb structures (particularly, those with thin walls), since an excessive pressure is not generated at the time of heating as with intumescent mats.

[0047] Now, the non-intumescent ceramic fiber mat used with the present invention is made up of at least one selected from the following group; alumina, mullite, silicon carbide, silicon nitride, and zirconia. This non-

intumescent ceramic fiber mat is formed of ceramic fibers wherein the fiber diameter is 2 μm or greater by less than 6 μm , such that application of an initial plane pressure of 2 kgf/cm² at room temperature and then raising the temperature to 1,000°C results in generation of a plane pressure of at least 1 kgf/cm², and also has the compression properties in that there is little increase or decrease within the actual usage temperature range of the catalytic converter.

[0048] The partition thickness of the ceramic honeycomb structure used with the present invention is preferably 0.10 mm or thinner (more preferably, 0.08 mm or thinner).

[0049] This is in order to cause the catalyst to function at cold starts as well, by lowering the thermal capacity of the catalyst carrier and speeding up the temperature rising of the catalyst carrier, along with improving engine performance due to decreasing pressure loss.

[0050] Next, an example of a manufacturing processing for the ceramic honeycomb catalytic converter using the canning structure according to the present invention will be described with reference to Fig. 2.

[0051] First, the carrier manufacturer provides an impermeable film 60 to the perimeter of a ceramic carrier 10 (ceramic honeycomb structure) which has passed inspection, further wraps the holding material 13, and fixes the ceramic carrier 10 within a metal case 11 (i.e., performs canning), thereby forming a canning structure 22 (See Figs. 1A through 1C), which is then packaged and sent to a catalyst manufacturer.

[0052] The catalyst manufacturer unpacks this, performs the processes such as causing the canning structure 22 to carry the catalyst (i.e., catalyst coating), thermal processing, inspection, etc., thereby forming a canning catalyst carrier, which is then packaged and sent to a canning manufacturer.

[0053] Incidentally, the catalyst carrying is performed by pouring a catalyst slurry in from the upper part of the canning structure 22 while suctioning the catalyst slurry out from the lower part of the canning structure 22, thereby causing the ceramic honeycomb structure to be dipped in catalyst slurry such that the canning structure 22 carries the catalyst.

[0054] At this time, the impermeable film provided to the perimeter of the ceramic honeycomb structure not only prevents the catalyst slurry from flowing out to the holding material, but also can be easily removed in the thermal process.

[0055] The canning manufacturer unpacks this and welds joining parts such as a cone portion 17 and flange 18 and the like to the canning catalyst carrier 30 as necessary, thereby completing the catalytic converter (ceramic honeycomb catalytic converter 1) (see Fig. 4).

[0056] As described above, method for manufacturing the ceramic honeycomb catalytic converter according to the present invention is capable of protecting the ceramic honeycomb structure from external shock and vibrations as compared with conventional manufactur-

ing methods (see Fig. 3), and accordingly chipping and cracking of ceramic honeycomb structures can be markedly prevented at the time of transporting, the catalyst carrying process, the canning process, and handling in each of the processes.

[0057] Next, the present invention will be described in further detail with reference to embodiments, but it should be noted that the present invention is by no means restricted to these embodiments.

Embodiment

[0058] A ceramic carrier (ceramic honeycomb structure) manufactured of cordierite, with a diameter of 106 mm, length of 114 mm, partition thickness of 0.03 mm, and 233 cells/cm², was prepared. An impermeable film (material: polyethylene) 0.03 mm in thickness was wrapped on the perimeter thereof, following which a non-intumescent ceramic fiber mat ("MAFTEC" (product name), manufactured by MITSUBISHI CHEMICAL CORPORATION) of 1,200 g per 1 m² was further wrapped thereupon, as a holding material.

[0059] The ceramic honeycomb structure upon which the impermeable film and holding material have been wrapped was pressed into a stainless-steel can (metal case) with an inner diameter of 114 mm, length of 124 mm, and thickness of 1.5 mm, using a tapered jig for pressing, thereby manufacturing the canning structure 22 shown in Fig. 1.

[0060] Incidentally, the impermeable film 60 has protrusions 62 which protrude from both edge planes of the ceramic honeycomb structure 10 by a length "a" which is 10 mm.

[0061] Next, twenty of such canning structures 22 obtained with the embodiment were placed in the ceramic honeycomb catalytic converter manufacturing process shown in Fig. 2.

[0062] Consequently, the catalyst slurry was completely prevented from flowing out to the holding material in the catalyst carrying (catalyst coating) process, and loss of expensive catalyst slurry was prevented.

[0063] Also, absolutely no cracking or chipping of the ceramic honeycomb structures was observed at any point in the above manufacturing process.

First Comparative Example

[0064] A canning structure was manufactured under the same conditions as the above embodiment, without using the impermeable film 60, and twenty of such were placed in the ceramic honeycomb catalytic converter manufacturing process shown in Fig. 2.

[0065] Consequently, the catalyst slurry flowed out to the holding material in the catalyst carrying process, such that 8% of the catalyst slurry used was carried by the holding material and hence wasted.

[0066] Incidentally, absolutely no cracking or chipping of the ceramic honeycomb structures was observed at

any point in the above manufacturing process.

Second Comparative Example

[0067] Twenty ceramic carriers (ceramic honeycomb structures) manufactured of cordierite, with a diameter of 106 mm, length of 114 mm, partition thickness of 0.06 mm, and 140 cells/cm², were prepared, and were placed in the ceramic honeycomb catalytic converter (pressing canning) manufacturing process shown in Fig. 3.

[0068] Consequently, the rate of cracking or chipping of the ceramic honeycomb structures throughout the above manufacturing process reached 25%.

[0069] Thus, according to the canning structure and catalyst carrying method thereof according to the present invention, the holding material does not carry expensive catalyst at the time of carrying catalyst, and accordingly chipping and cracking of ceramic honeycomb structures can be prevented at the time of transporting, the catalyst carrying process, the canning process, and handling in each of the processes.

Claims

1. A canning structure comprising a ceramic honeycomb structure which has not been loaded with a catalyst, a metal case and a holding material, said ceramic honeycomb structure being canned in said metal case and being held by said holding material therein;

wherein an impermeable film is provided between said ceramic honeycomb structure and said holding material.

2. A canning structure according to Claim 1, wherein said impermeable film circles at least the portion where said ceramic honeycomb structure and said holding material are in contact.

3. A canning structure according to either Claim 1 or Claim 2, wherein said impermeable film protrudes from both end faces of said ceramic honeycomb structure in the gas flow direction by 10 mm or more.

4. A canning structure according to Claim 3 wherein the outer diameter of said protrusions of said impermeable film is greater than the outer diameter of said ceramic honeycomb structure.

5. A canning structure according to any of the Claims 1 through 4, wherein the shape of said impermeable film is cylindrical.

6. A canning structure according to any of the Claims 1 through 5, wherein the thickness of said impermeable film is 0.1 mm or less.

7. A canning structure according to any of the Claims 1 through 6, wherein said impermeable film is combustible.
8. A canning structure according to any of the Claims 1 through 7, wherein said impermeable film is water-repellent. 5
9. A canning structure according to any of the Claims 1 through 8, wherein said holding material is a non-intumescent ceramic fiber mat. 10
10. A method of providing a catalyst on a ceramic honeycomb structure which is canned in a metal case and held by holding material therein; 15
wherein an impermeable film is provided between said ceramic honeycomb structure and said holding material, and a catalyst slurry is poured in only on the ceramic honeycomb structure side of said impermeable film, thereby preventing said holding material from carrying the catalyst, such that only said ceramic honeycomb structure carries the catalyst. 20

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FIG. 1 (A)

FIG. 1 (B)

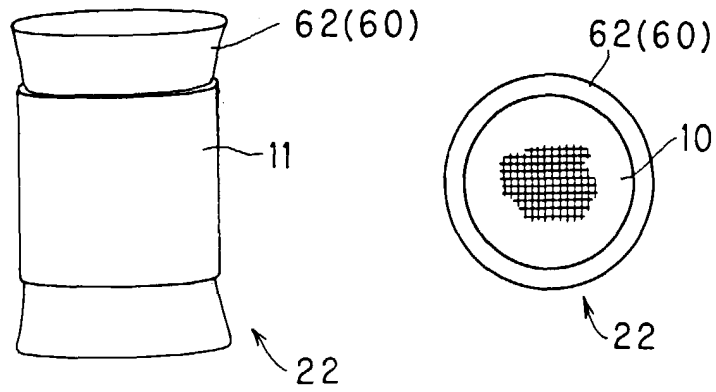


FIG. 1 (C)

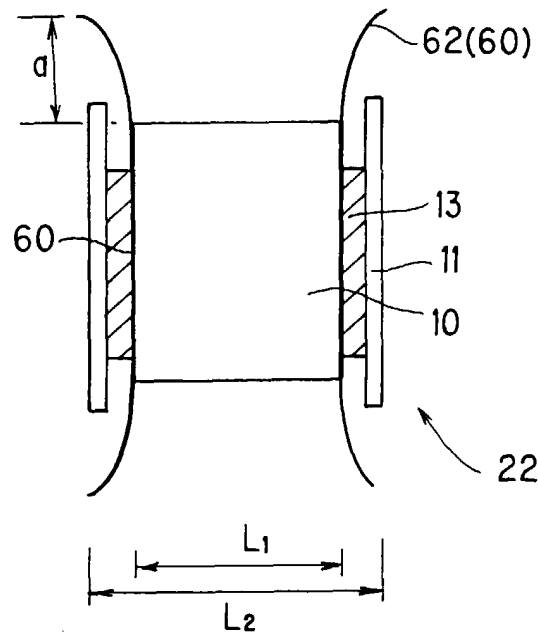


FIG. 2

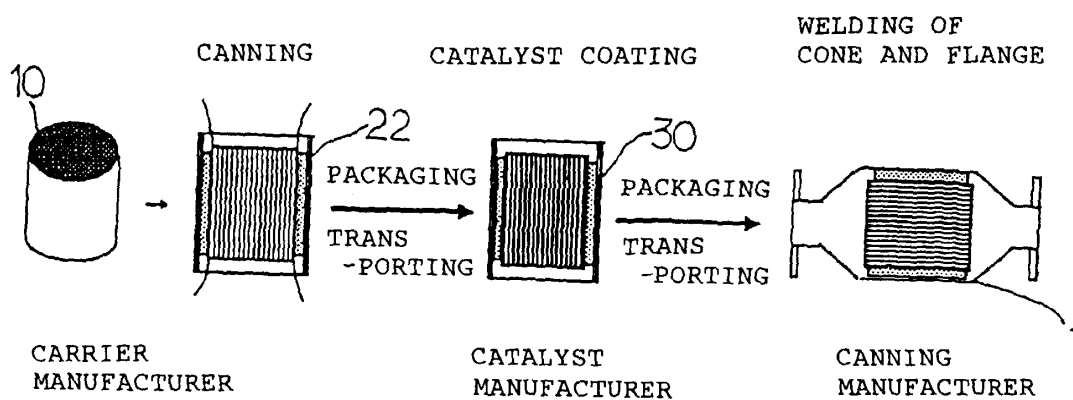


FIG. 3

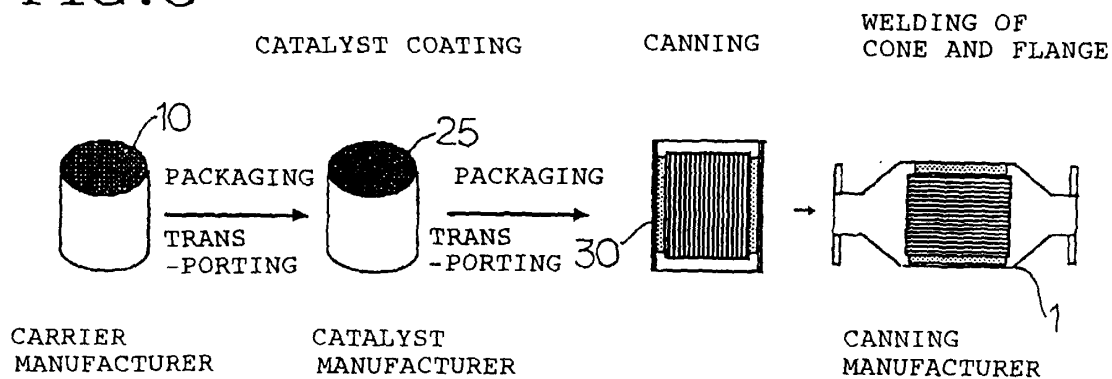


FIG. 4

