Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2316211 C 2006/07/11

(11)(21) 2 316 211

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(86) Date de dépôt PCT/PCT Filing Date: 1999/01/25
(87) Date publication PCT/PCT Publication Date: 1999/07/29
(45) Date de délivrance/Issue Date: 2006/07/11
(85) Entrée phase nationale/National Entry: 2000/06/22
(86) N° demande PCT/PCT Application No.: SE 1999/000095
(87) N° publication PCT/PCT Publication No.: 1999/037897
(30) Priorité/Priority: 1998/01/26 (SE9800197-7)

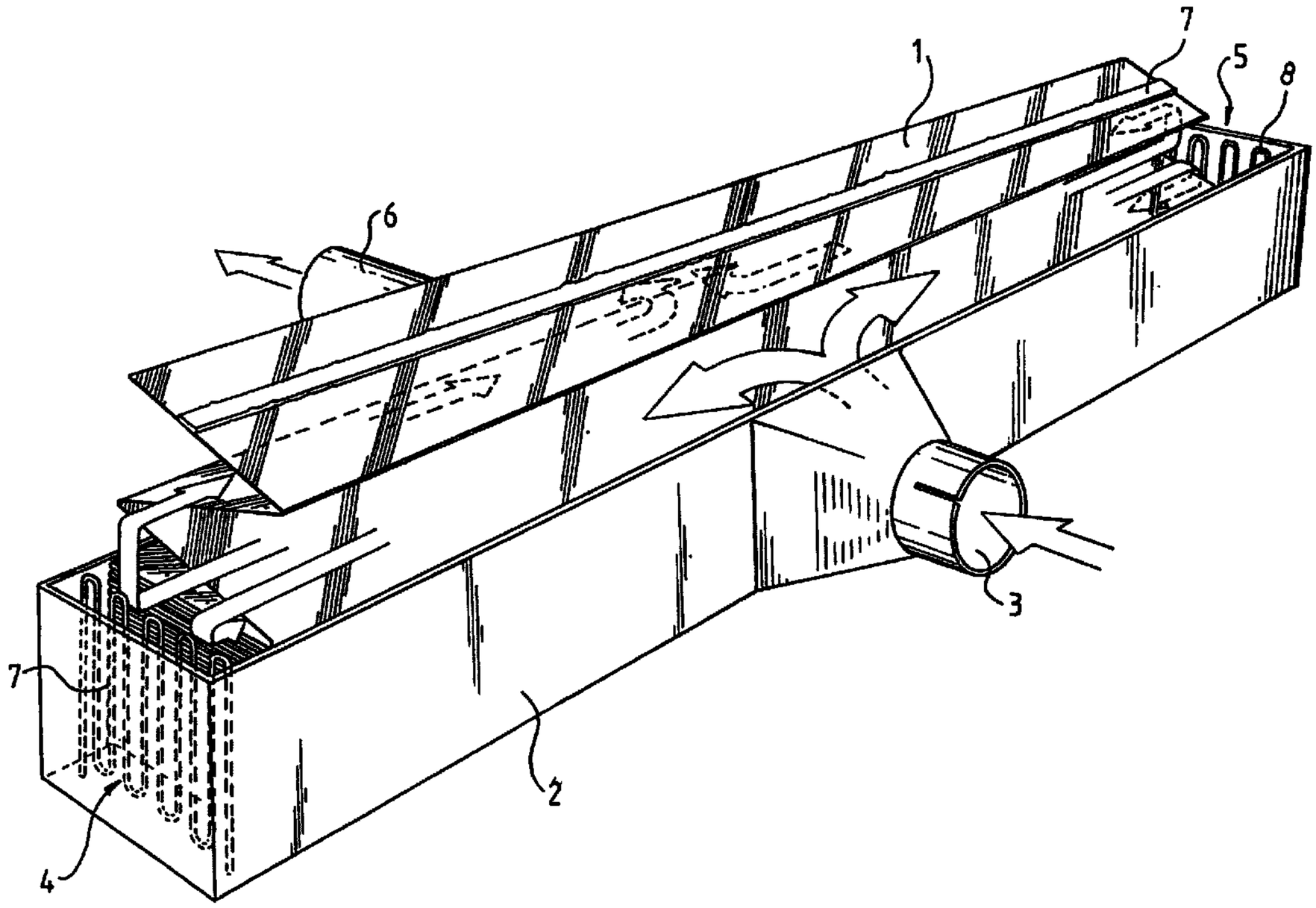
(51) Cl.Int./Int.Cl. *F01N 3/28* (2006.01), *F23G 7/06* (2006.01), *F01N 7/18* (2006.01), *F01N 3/20* (2006.01), *F01N 7/02* (2006.01)

(72) Inventeur/Inventor:
HEED, BJORN, SE

(73) Propriétaire/Owner:
HEED, BJORN, SE

(74) Agent: FETHERSTONHAUGH & CO.

(54) Titre : DISPOSITIF DE TRAITEMENT CATALYTIQUE DES GAZ
(54) Title: CATALYTIC GAS TREATMENT DEVICE



(57) Abrégé/Abstract:
A device for catalytic treatment of air or gases. The catalyst is carried on a shaped patterned band. The band is folded into a package (1), which, when received in a casing (2), forms two groups of parallel flow channels having a single connection (9, 10) for incoming and exiting flows at the sides of the package (1), and gas reversal chambers (4, 5) at the package ends. The gas reversal chambers may enclose heating or cooling devices. The exchange of heat between the incoming flow and the exiting flow provides excellent heat economy.

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :
F01N 3/28, F23G 7/06

A1

(11) International Publication Number: **WO 99/37897**

(43) International Publication Date: 29 July 1999 (29.07.99)

(21) International Application Number: PCT/SE99/00095

(22) International Filing Date: 25 January 1999 (25.01.99)

(30) Priority Data:
9800197-7 26 January 1998 (26.01.98) SE

(71)(72) Applicant and Inventor: HEED, Björn [SE/SE]; Utlandagatan 19, S-412 61 Göteborg (SE).

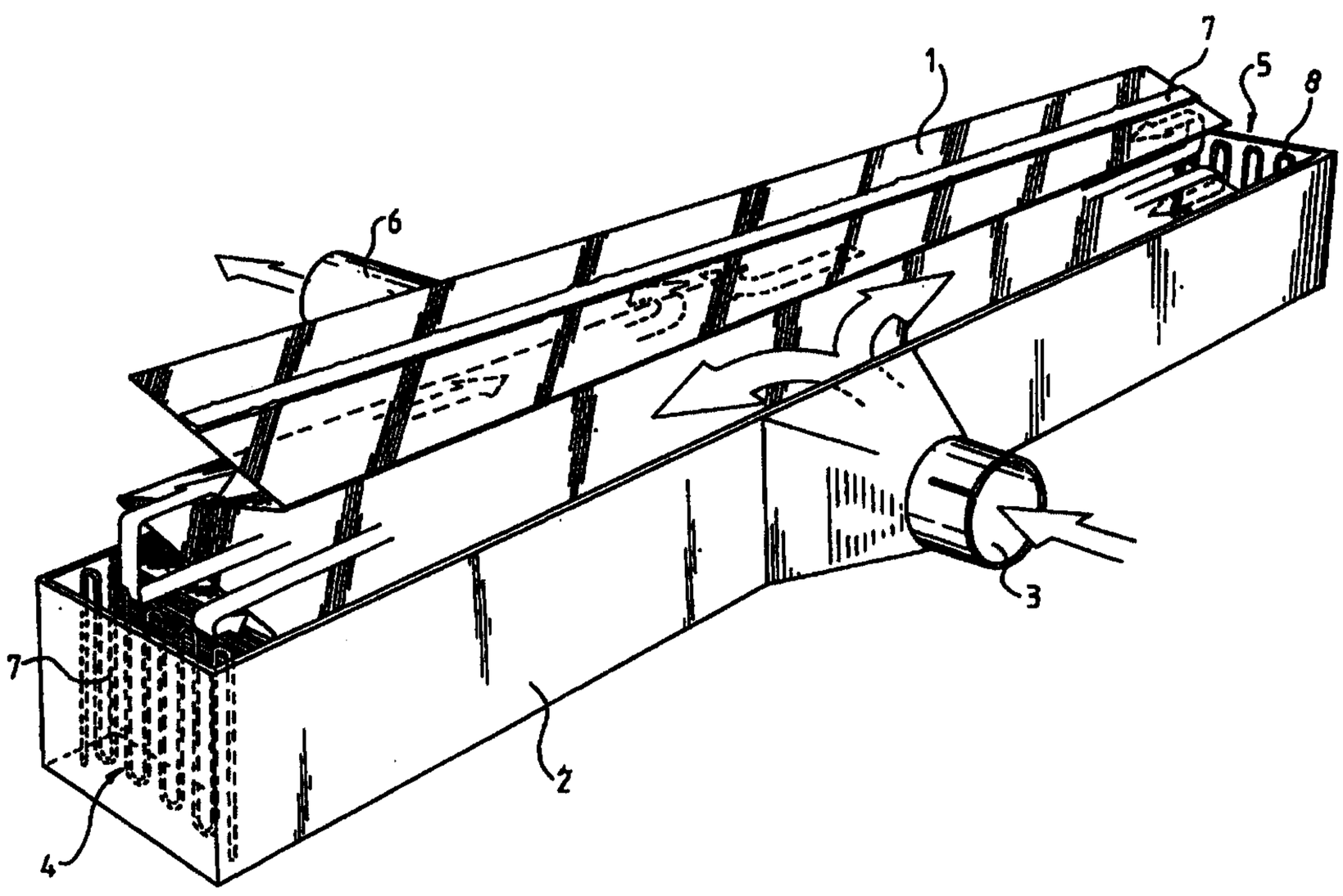
(74) Agent: AWAPATENT AB; P.O. Box 11394, S-404 28 Göteborg (SE).

(81) Designated States: AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published

With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.
In English translation (filed in Swedish).

(54) Title: CATALYTIC GAS TREATMENT DEVICE



(57) Abstract

A device for catalytic treatment of air or gases. The catalyst is carried on a shaped patterned band. The band is folded into a package (1), which, when received in a casing (2), forms two groups of parallel flow channels having a single connection (9, 10) for incoming and exiting flows at the sides of the package (1), and gas reversal chambers (4, 5) at the package ends. The gas reversal chambers may enclose heating or cooling devices. The exchange of heat between the incoming flow and the exiting flow provides excellent heat economy.

CATALYTIC GAS TREATMENT DEVICE

The present invention relates to a catalytic gas-mixture treatment device of the kind defined in the preamble of the appended claim 1.

The Swedish Patent No. 503 172 describes a catalytic device comprising a catalyst-coated, patterned band, which is folded into a package for the purpose of simultaneously achieving heat exchange and catalytic treatment of a flow of gas. In the process, the flow may be divided into several parallel part flows, which are again united into one single flow. This is effected by blowing the gas flow into and withdrawing it from the package at opposite package sides at one of the package ends. There is no need for a separate gas-distributing device of manifold type and as long as the temperature is moderate, there is no difficulty in sealing the band-package end against the end wall of the enclosure or casing. Such sealing is necessary to prevent untreated gas from leaking past the heat exchange-catalyst unit.

When the temperature of the entering gas is high, which sometimes is the case in the treatment of motor vehicle exhaust gases, it may be difficult to achieve efficient sealing of this kind. Conventional sealing materials or sealing compounds of rubber or plastics cannot withstand the high temperatures involved. A sheet of ceramic fibrous felt may be used as the seal along the sides of the band package, where considerable surfaces of contact exist. On the other hand, at the end walls, the seal is to be applied against the thin edges of the band, which makes efficient sealing much more difficult to achieve.

In accordance with the present invention a solution to this sealing problem has been found in that the channels in the package alternately are connected to inlets or outlets located at the sides of the package and to gas

reversal chambers located one at both ends of the package, whereby as the gas flows through the device, heat will be exchanged between the incoming and exiting flows as the flow direction changes from a direction of entry at an angle to the band folds to mutually opposite directions along one side of the band in the package, and from there, following reversal externally of the package ends in the respective gas reversal chamber, to the opposite side of the band in the pack while flowing in the opposite direction along the edges of the band folds, and from there towards a direction of exit at an angle to said edges.

One embodiment of the invention is illustrated in the accompanying drawing figure. For the sake of clarity, the drawing figure illustrates the inventive object in an unassembled condition and without the top of the casing 2. A package 1 of a patterned and folded band is received inside a casing 2. Gas enters through an inlet port 3, in the example shown centrally on one side of the band package. The gas flow divides into two oppositely directed part flows, each flowing towards its respective package end and the gas reversal chambers 4 and 5 located there. In the gas reversal chambers the gas may be heated by the heating elements 7 and 8, respectively, alternatively by hot gas or hot air supplied to the gas reversal chambers, and from these chambers the gas reverses, flowing along the opposite side of the band, towards the centre of the band package and exits through the outlet port 6.

As the gas passes through the device, recuperative exchange of heat takes place via the band material between gas on its way to and gas on its way from, respectively, the gas reversal chambers. The band constituting the band package consequently serves both as a heat-exchange partition wall between the incoming and exiting flows and as a catalyst carrier. In this manner, the heat-exchange process is made independent of the temperature of the incoming gas and the catalytic

treatment may be carried out at an high temperature without considerable amounts of energy having to be supplied in the gas reversal chambers.

Owing to the division of the incoming flow into two part flows, one to each gas reversal chamber 4, 5, sealing against the end walls is not necessary. The only seals needed are the seal positioned between the bottom face of the package 1 and the casing bottom (not shown in the drawing figure) and the seal 7 required between the upper face of the package 1 and the casing top, not included in the drawing figure. Owing to the considerable surface of contact, these seals may both consist of ceramic fibrous felt. No sealing is required at the two package ends and the gas reversal chambers 4, 5. This feature makes the inventive device highly suitable for treatment of gas entering the device at a high temperature. In some cases, for example to prevent damage to the catalyst coating, it may be necessary to cool the gas in the gas reversal chambers rather than heating it. Advantageously, cooling is effected by supply of cool air or gas to the gas reversal chambers 4, 5 or, alternatively, by means of refrigerating coils or refrigerating elements located therein. As a result of the heat exchange taking place between the gas flowing towards the gas reversal chambers and the gas mixture flowing towards the outlet port, the major part of the band package will have a lower temperature than the incoming gas.

A further advantage of the invention is that for a given width and height of the band package the pressure drop of the gas passing through the device is smaller than it would have been, had the entire gas flow been forced to pass through a package in one direction only.

In the manner described in the Swedish Patent No 503 172 it may be advantageous, depending on the prevailing circumstances, to coat both band sides or only one side thereof with a catalyst. As described in that publication, it may also in some instances be advan-

tageous to coat the two band sides with a different catalyst. Furthermore, as also described therein, it may sometimes be advantageous to coat only the parts of the band closest to the gas reversal chambers with a catalyst.

The design and arrangement of the temperature-modifying and temperature-controlling devices, such as heating and/or refrigerating devices, that are located in the gas reversal chambers, may be altered in many different ways without departure from the inventive idea. Also, the devices in the two chambers may be of a mutually different nature.

CLAIMS

1. A device for catalytic treatment of gas mixtures, wherein:

a) the catalyst is spread on a carrier, which also forms a partition wall in a recuperative heat exchanger,

b) the partition wall consists of a shaped patterned band of metal or ceramic, which is folded in an accordion-like manner into a package (1), and

c) the package forms alternately disposed channels with exchange of heat taking place between the channels through the band material, the geometry of the channels being determined by the folding and the shaped pattern of the band, c h a r a c t e r i s e d in that the alternately disposed channels in the package (1) are connected to inlets or outlets (3, 6) located at the sides of the package (1) and to gas reversal chambers (4, 5) located one at both ends of the package, whereby as the gas flows through the device, heat will be exchanged between the incoming and exiting flows as the flow direction changes from a direction of entry at an angle to the band folds to mutually opposite directions along one side of the band in the package, and from there, following reversal externally of the package ends in the respective gas reversal chamber, to the opposite side of the band in the pack while flowing in the opposite direction along the edges of the band folds, and from there towards a direction of exit at an angle to said edges.

2. A device for catalytic treatment of gas as claimed in claim 1, c h a r a c t e r i s e d in that at least one of the gas reversal chambers (4, 5) houses devices controlling and affecting the temperature of the gas flowing past said chambers, said devices preferably being heating devices (7, 8).

3. A device for catalytic treatment of gas as claimed in claim 2, c h a r a c t e r i s e d in that at

least in one of the gas reversal chambers said heating device is an electric heater.

4. A device for catalytic treatment of gas as claimed in claim 2, c h a r a c t e r i s e d in that it comprises heating devices including burners using gas or liquid fuel.

5. A device for catalytic treatment of gas as claimed in claim 1, c h a r a c t e r i s e d in that it is adapted for heating at least one of the gas reversal chambers (4, 5) by means of supply of hot gas.

6. A device for catalytic treatment of gas as claimed in claim 1, c h a r a c t e r i s e d in that it is adapted for cooling at least one of the gas reversal chambers (4, 5) by means of supply of cool gas.

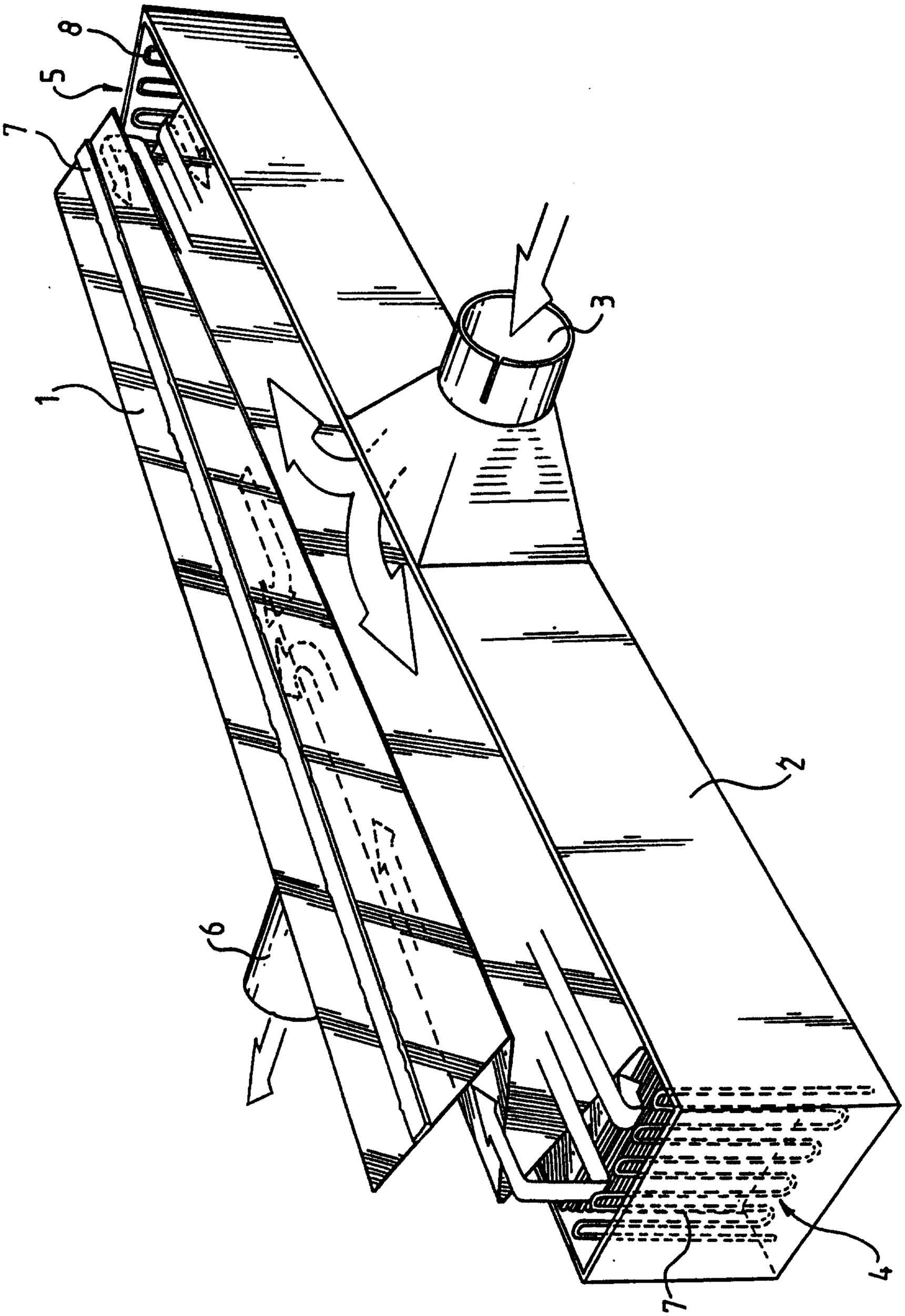
7. A device for catalytic treatment of gas as claimed in claim 1, c h a r a c t e r i s e d in that it comprises refrigerating elements disposed in the gas reversal chamber in question.

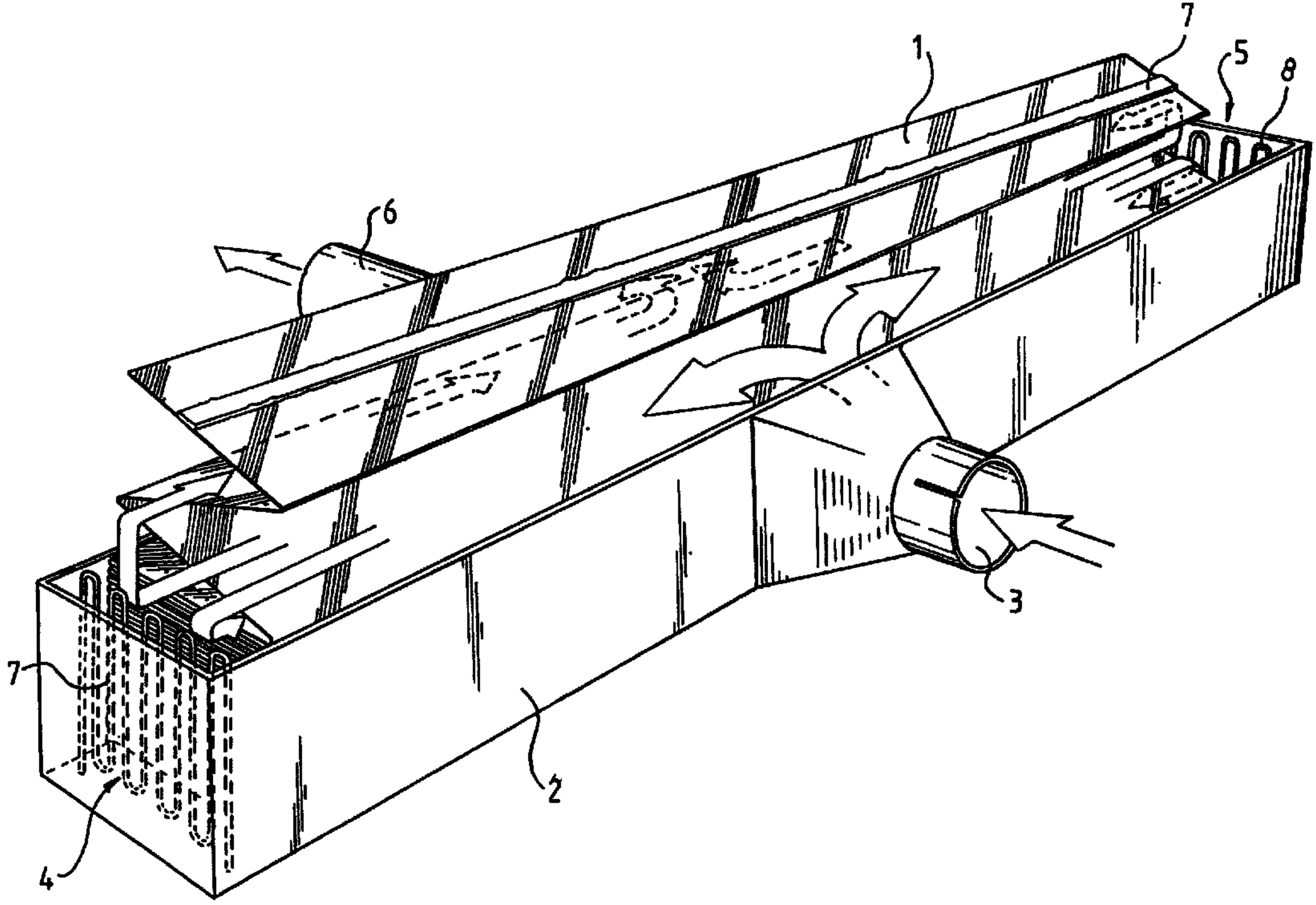
8. A device for catalytic treatment of gas as claimed in claims 1 - 6, c h a r a c t e r i s e d in that the band is coated with a catalyst on the inlet side of the band and possibly also on the outlet side of the band.

9. A device for catalytic treatment of gas as claimed in claim 1 - 6, c h a r a c t e r i s e d in that the band is coated with a catalyst only on the outlet side of the band.

10. A device for catalytic treatment of gas as claimed in claims 1 - 6, c h a r a c t e r i s e d in that the two sides of the band are coated with a different kind of catalyst.

11. A device for catalytic treatment of gas as claimed in claim 1 - 9, c h a r a c t e r i s e d in that the band is coated with a catalyst only on the band parts closest to the gas reversal chambers (4, 5).


8
5
7
1
3
2
6
4


1
2
3
4
5
6
7
8
7