

(19)



(11)

**EP 2 660 438 B1**

(12)

**EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention  
of the grant of the patent:  
**23.12.2015 Bulletin 2015/52**

(51) Int Cl.:  
**F01N 13/08** <sup>(2010.01)</sup> **F01N 3/021** <sup>(2006.01)</sup>  
**E02F 9/08** <sup>(2006.01)</sup>

(21) Application number: **10861253.2**

(86) International application number:  
**PCT/KR2010/009362**

(22) Date of filing: **27.12.2010**

(87) International publication number:  
**WO 2012/091188 (05.07.2012 Gazette 2012/27)**

**(54) EXHAUST GAS TREATMENT DEVICE FOR CONSTRUCTION MACHINE**

**ABGASBEHANDLUNGSVORRICHTUNG FÜR EINE BAUMASCHINE**

**DISPOSITIF DE TRAITEMENT DES GAZ D'ÉCHAPPEMENT POUR ENGIN DE CHANTIER**

(84) Designated Contracting States:  
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB  
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO  
PL PT RO RS SE SI SK SM TR**

(43) Date of publication of application:  
**06.11.2013 Bulletin 2013/45**

(73) Proprietor: **Volvo Construction Equipment AB  
631 85 Eskilstuna (SE)**

(72) Inventor: **JANG, Jin-Ho  
Busan 614-090 (KR)**

(74) Representative: **Zimmermann, Tankred Klaus et al  
Schoppe, Zimmermann, Stöckeler  
Zinkler, Schenk & Partner mbB  
Patentanwälte  
Radlkoferstrasse 2  
81373 München (DE)**

(56) References cited:  
**EP-A1- 2 211 038 EP-A2- 1 911 944  
JP-A- 10 121 945 JP-A- H11 257 045  
KR-A- 20100 086 525 US-A- 5 413 189**

**EP 2 660 438 B1**

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

## Description

### TECHNICAL FIELD

[0001] The present invention relates to an exhaust gas treatment apparatus for a construction machine. More particularly, the present invention relates to an exhaust gas treatment apparatus for a construction machine, which is connected to a diesel particulate filter trap (DPF) to discharge exhaust gas from an engine to outside through the DPF, and can lower the temperature of the exhaust gas that is discharged in the air using heat exchange effects between the high-temperature exhaust gas and tubes for guiding external air, that has exhaust holes in an exhaust direction so that the tubes communicate with ventilation holes formed on a tail pipe main body.

### BACKGROUND ART

[0002] A tail pipe is a pipe which is located in the rear of a heavy equipment muffler to guide exhaust gas, which has substantially stabilized pressure as passing through several partitions, to be discharged in the air, as described in document EP 2211038 A. Fig. 1 is a perspective view illustrating a tail pipe in the related art. As shown in Fig. 1, the shape of the tail pipe in the related art is limited in temperature reduction of hot air from a DPF. That is, due to the structural problem of the tail pipe, the exhaust gas is discharged in the air in a state where heat of the exhaust gas is not efficiently reduced. The DPF is a device which can reduce smoke levels by 80% or more by capturing particulate matters discharged from a diesel engine with a filter to burn the captured particulate matters and then capturing particulate matters again to continue using the captured particulate matters. Heat that is generated from the DPF is discharged to outside through the tail pipe. In the tail pipe structure in the related art, outer flow of the exhaust gas on the inner surface of the tail pipe can exchange heat with the outside air that is inhaled from a pipe inlet to achieve the effect of temperature reduction, but the center portion of the main flow of the exhaust gas is discharged in the air without exchanging heat with the outside air. In the case of a construction machine, e.g., an excavator, which frequently works in a forest area or in an airtight space, the high-temperature exhaust gas may cause fires or burns to occur. Accordingly, there is a need for temperature reduction of the exhaust gas for safety at work.

### DISCLOSURE

### TECHNICAL PROBLEM

[0003] Therefore, the present invention has been made to solve the above-mentioned problems occurring in the related art, and one subject to be achieved by the present invention is to prepare a tail pipe which can effi-

ciently lower the maximum temperature of an exhaust gas by making the exhaust gas discharged from the tail pipe exchange heat with outside air over the whole area in the tail pipe.

### TECHNICAL SOLUTION

[0004] In accordance with an aspect of the present invention, an exhaust gas treatment apparatus for a construction machine, which is connected to a diesel particulate filter trap (DPF) to discharge exhaust gas from an engine to outside through the DPF, includes a tail pipe main body provided with a plurality of ventilation holes penetratingly formed on the tail pipe main body to allow the outside air to pass through the ventilation holes, and installed on an outlet of the DPF; an exhaust heat dissipation unit provided with a plurality of tubes which respectively communicate with the ventilation holes, and are installed in a horizontal direction of the tail pipe main body; and a plurality of exhaust holes located in a longitudinal direction of the tubes and penetratingly formed in an exhaust gas discharge direction.

[0005] Vertical cross-sections of the tail pipe main body and the tube may be in a circular shape. It is preferable that three or five exhaust holes are provided in the longitudinal direction of the tubes and in the exhaust gas discharge direction. It is preferable that three tubes are provided in the horizontal direction on the same surface of the tail pipe main body.

### ADVANTAGEOUS EFFECT

[0006] According to the present invention, since the exhaust gas discharged from the tail pipe exchanges heat with the outside air over the whole area in the tail pipe, the maximum temperature of the exhaust gas can be efficiently lowered, and accidents, which may occur due to the high temperature of the exhaust gas during working, can be prevented from occurring.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The above objects, other features and advantages of the present invention will become more apparent by describing the preferred embodiments thereof with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view of a tail pipe in the related art;

Fig. 2 is a perspective view of a tail pipe according to an embodiment of the present invention;

Fig. 3 is a conceptual view explaining temperature reduction effects of exhaust gas according to the present invention; and

Figs. 4a and 4b are front and side views of a tail pipe according to an embodiment of the present invention.

## BEST MODE

**[0008]** Now, a preferred embodiment of the present invention will be described in detail with reference to the accompanying drawings.

**[0009]** Fig. 2 is a perspective view of a tail pipe according to an embodiment of the present invention.

**[0010]** Referring to Fig. 2, a tail pipe includes a tail pipe main body 100 provided with a plurality of ventilation holes 110 penetratingly formed on the tail pipe main body 100 to allow the outside air to pass through the ventilation holes 110, and installed on an outlet of a DPF; an exhaust heat dissipation unit 300 provided with a plurality of tubes 200 which respectively communicate with the ventilation holes 110, and are installed in a horizontal direction of the tail pipe main body 100; and a plurality of exhaust holes 210 located in a longitudinal direction of the tubes 200 and penetratingly formed in an exhaust gas discharge direction.

**[0011]** Since the tubes 200 are installed to communicate with the ventilation holes 110 of the tail pipe main body 100, outside air can easily enter into the tubes 200. The air that has entered into the tubes 200 is mixed with high-temperature exhaust gas through the plurality of exhaust holes which are penetratingly formed in an exhaust direction 400 to be discharged to the outside. The ventilation holes 110 are penetratingly formed on the tail pipe main body 100 to inhale the outside air therethrough.

**[0012]** Since the plurality of ventilation holes 110 are provided as shown in Fig. 2, the outside air can be smoothly inhaled into the tail pipe main body 100. Although the ventilation holes 110 are penetratingly formed in a line along the side surface of the tail pipe main body 100 as shown in Fig. 2, they may be formed in any form which can effectively inhale the outside air, e.g., in a zig-zag form.

**[0013]** The tubes 200 located inside the tail pipe main body 100 are designed so that the tubes 200 can be installed to communicate with the ventilation holes 110 of the tail pipe main body 100 and the outside air can pass through the tubes 200. Since the tubes 200 have the plurality of exhaust holes 210, the air inhaled from the outside can be discharged through the exhaust holes 210 penetratingly formed in the exhaust direction 400. In this case, the air inhaled from the outside is mixed with the high-temperature exhaust gas to reduce the temperature of the exhaust gas.

**[0014]** Fig. 3 is a conceptual view explaining the temperature reduction effects of the exhaust gas according to the present invention.

**[0015]** Long arrows in a direction that is vertical to the tube 200 indicate high-temperature exhaust gas that flows at high speed, and arrows that come into the tube 200 indicate low-temperature outside air that flows at low speed. Since the tubes 200 are installed to communicate with the tail pipe main body 100 that is provided with the plurality of ventilation holes 110, the high-temperature exhaust gas is not discharged to the outside as it is, but

is mixed with the outside air to lower the temperature of the exhaust gas. The outside air, which is inhaled into the tubes 200, is mixed with the exhaust gas through the exhaust holes 210 which are penetratingly formed in the exhaust gas discharge direction 400 that is the longitudinal direction of the tubes 200, and the mixed gas is discharged in the air. If the high-temperature exhaust gas, which is discharged from the DPF, passes through the tubes 200 at high speed, minimum pressure is formed in the exhaust holes 210 which are penetratingly formed on the tubes 200, and due to this, negative pressure is formed to inhale the outside air. The air that comes from the outside not only is mixed with the high-temperature exhaust gas that is discharged from the DPF but also transfers heat to the tubes 200, and thus the temperature of the exhaust gas is reduced.

**[0016]** Figs. 4a and 4b are front and side views of a tail pipe according to an embodiment of the present invention.

**[0017]** Vertical cross-sections of the tail pipe main body 100 and the tube 200 may be in various shapes and may not be specially limited. However, they are normally in a circular shape. It is preferable that three or five exhaust holes 210 are provided in the longitudinal direction of the tubes 200 that is the exhaust gas discharge direction. If the number of exhaust holes is too small or too large, it may be inappropriate to inhale the outside air and to mix the inhaled air with the exhaust gas. It is preferable that three tubes 200 are provided in the horizontal direction on the same surface of the tail pipe main body 100. If the number of the tubes 200 is smaller than or larger than three, it may be inappropriate to inhale the outside air and to mix the inhaled air with the exhaust gas.

**[0018]** Although preferred embodiments of the present invention have been described for illustrative purposes, the present invention is not limited to the above-described embodiments, and those skilled in the art will appreciate that various modifications, additions and substitutions are possible, as disclosed in the accompanying claims. Accordingly, the scope of the present invention is defined by the appended claims, and it will be understood that all technical features in the equivalent range fall within the scope of the present invention.

## INDUSTRIAL APPLICABILITY

**[0019]** As apparent from the above description, the present invention can be used in the exhaust gas treatment apparatus for a construction machine that is installed in the DPF to discharge the exhaust gas, which flows from the engine to the DPF, to the outside.

## Claims

1. An exhaust gas treatment apparatus for a construction machine, which is connected to a diesel particulate filter trap (DPF) to discharge exhaust gas from

an engine to outside through the DPF, comprising:

a tail pipe main body (100) provided with a plurality of ventilation holes (110) penetratingly formed on the tail pipe main body (100) to allow the outside air to pass through the ventilation holes (110), and installed on an outlet of the DPF; **characterised in that**

an exhaust heat dissipation unit provided with a plurality of tubes (200) which respectively communicate with the ventilation holes (110), and are installed inside the tail pipe main body (100) arranged in a direction perpendicular to the exhaust gas discharge direction; and a plurality of exhaust holes (210) located in a longitudinal direction of the tubes (200) and penetratingly formed in an exhaust gas discharge direction.

2. The exhaust gas treatment apparatus for a construction machine according to claim 1, wherein the vertical cross-sections of the tail pipe main body (100) and the tubes (200) are in a circular shape.
3. The exhaust gas treatment apparatus for a construction machine according to claim 1, wherein three or five exhaust holes (210) are provided in the longitudinal direction of the tubes (200) and in the exhaust gas discharge direction.
4. The exhaust gas treatment apparatus for a construction machine according to claim 2, wherein three tubes (200) are provided in the horizontal direction on the same surface of the tail pipe main body (100).

#### Patentansprüche

1. Eine Abgasbehandlungsvorrichtung für eine Baumaschine, die mit einer Dieselpartikelfilterfalle (DPF) verbunden ist, um Abgas von einem Motor durch die DPF nach außen abzulassen, die folgende Merkmale aufweist:

einen Endrohrhauptkörper (100), der mit einer Mehrzahl von Lüftungslöchern (110) versehen ist, die auf durchdringende Weise an dem Endrohrhauptkörper (100) gebildet sind, um es der Außenluft zu ermöglichen, durch die Lüftungslöcher (110) zu verlaufen, und der an einem Auslass der DPF eingebaut ist; **gekennzeichnet durch**

eine Abwärmedissipationseinheit, die mit einer Mehrzahl von Röhren (200) versehen ist, die jeweils mit den Lüftungslöchern (110) kommunizieren und in dem Endrohrhauptkörper (100) eingebaut sind, angeordnet in einer Richtung senkrecht zu der Abgasablassrichtung; und

eine Mehrzahl von Auslasslöchern (210), die in einer Längsrichtung der Röhren (200) angeordnet sind und auf durchdringende Weise in einer Abgasablassrichtung gebildet sind.

2. Die Abgasbehandlungsvorrichtung für eine Baumaschine gemäß Anspruch 1, bei der die vertikalen Querschnitte des Endrohrhauptkörpers (100) und der Röhren (200) kreisförmig sind.
3. Die Abgasbehandlungsvorrichtung für eine Baumaschine gemäß Anspruch 1, bei der drei oder fünf Auslasslöcher (210) in der Längsrichtung der Röhren (200) und in der Abgasablassrichtung vorgesehen sind.
4. Die Abgasbehandlungsvorrichtung für eine Baumaschine gemäß Anspruch 2, bei der drei Röhren (200) in der horizontalen Richtung auf der gleichen Oberfläche des Endrohrhauptkörpers (100) vorgesehen sind.

#### Revendications

1. Dispositif de traitement des gaz d'échappement pour un engin de chantier qui est connecté à un filtre à particules de diesel (DPF) pour évacuer les gaz d'échappement d'un engin vers l'extérieur à travers le DPF, comprenant:

un corps principal de tuyau d'échappement (100) pourvu d'une pluralité de trous de ventilation (110) formés de manière pénétrante dans le corps principal de tuyau d'échappement (100) pour permettre que l'air extérieur passe à travers les trous de ventilation (110), et installé sur une sortie du DPF;

#### **caractérisé par le fait que**

une unité de dissipation de chaleur d'échappement pourvue d'une pluralité de tubes (200) qui communiquent respectivement avec les trous de ventilation (110) et sont installés à l'intérieur du corps principal de tuyau d'échappement (100) disposé dans une direction perpendiculaire à la direction d'évacuation des gaz d'échappement; et une pluralité de trous d'échappement (210) situés dans une direction longitudinale des tubes (200) et formés de manière pénétrante dans une direction d'évacuation des gaz d'échappement.

2. Dispositif de traitement des gaz d'échappement pour un engin de chantier selon la revendication 1, dans lequel les sections verticales du corps principal de tuyau d'échappement (100) et les tubes (200) sont de forme circulaire.

3. Dispositif de traitement des gaz d'échappement pour un engin de chantier selon la revendication 1, dans lequel trois ou cinq trous d'échappement (210) sont prévus dans la direction longitudinale des tubes (200) et dans la direction d'évacuation des gaz d'échappement. 5
4. Dispositif de traitement des gaz d'échappement pour un engin de chantier selon la revendication 2, dans lequel trois tubes (200) sont prévus dans la direction horizontale sur la même surface du corps principal de tuyau d'échappement (100). 10

15

20

25

30

35

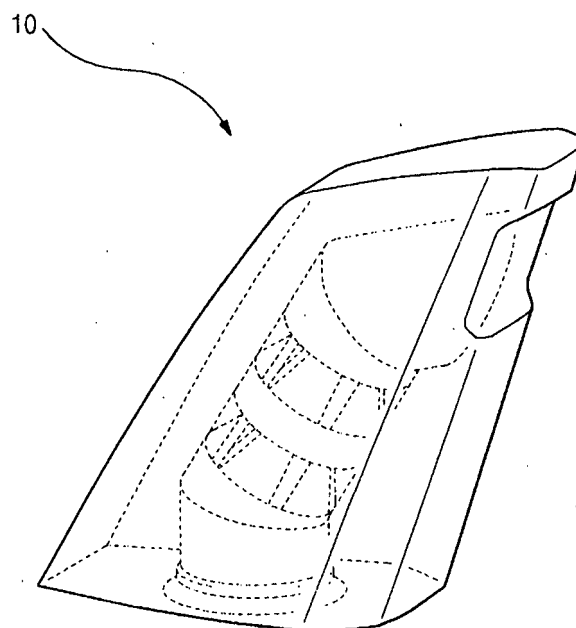
40

45

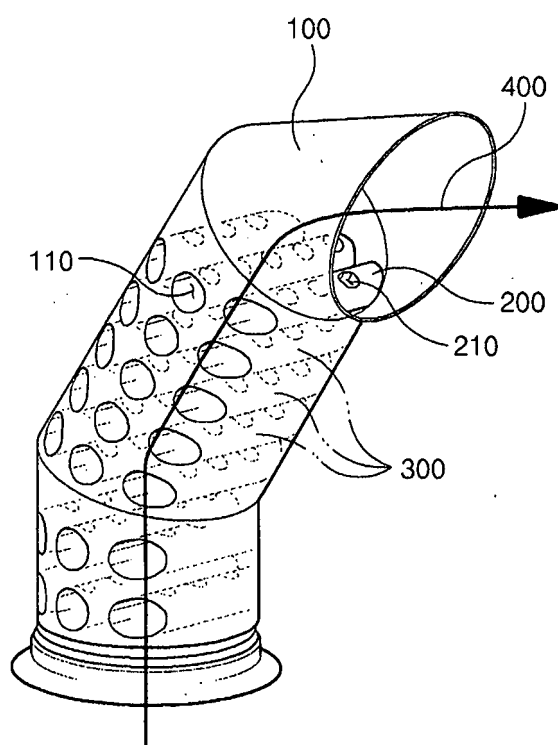
50

55

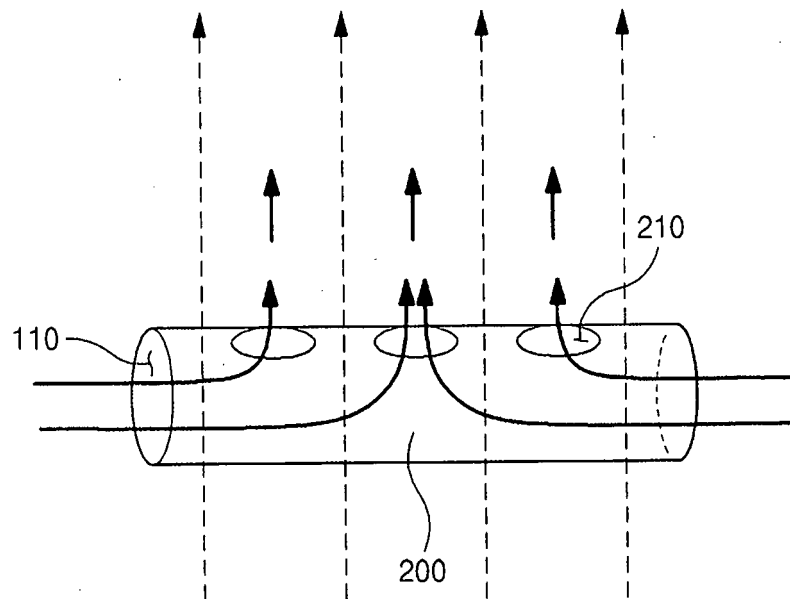
[Fig. 1]



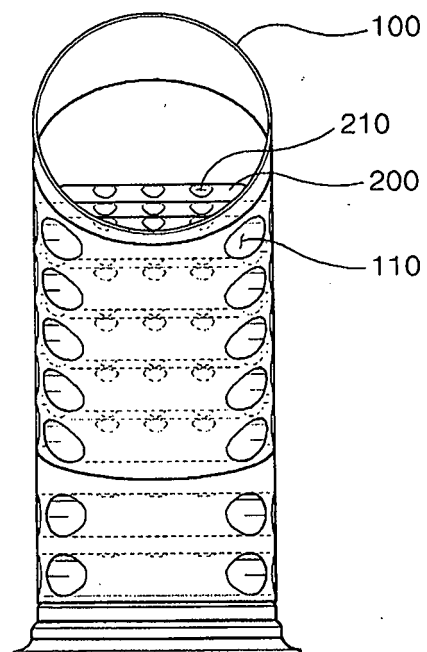
[Fig. 2]



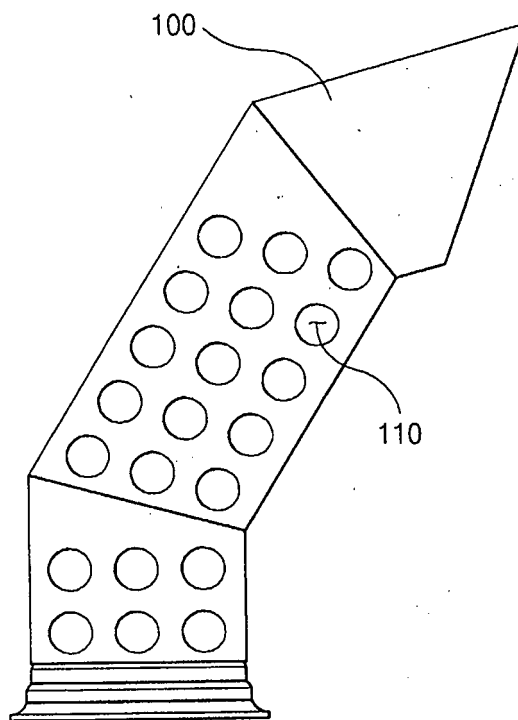
[Fig. 3]



[Fig. 4a]



[Fig. 4b]



**REFERENCES CITED IN THE DESCRIPTION**

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

**Patent documents cited in the description**

- EP 2211038 A [0002]