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(54) EXHAUST AFTER TREATMENT ASSEMBLY

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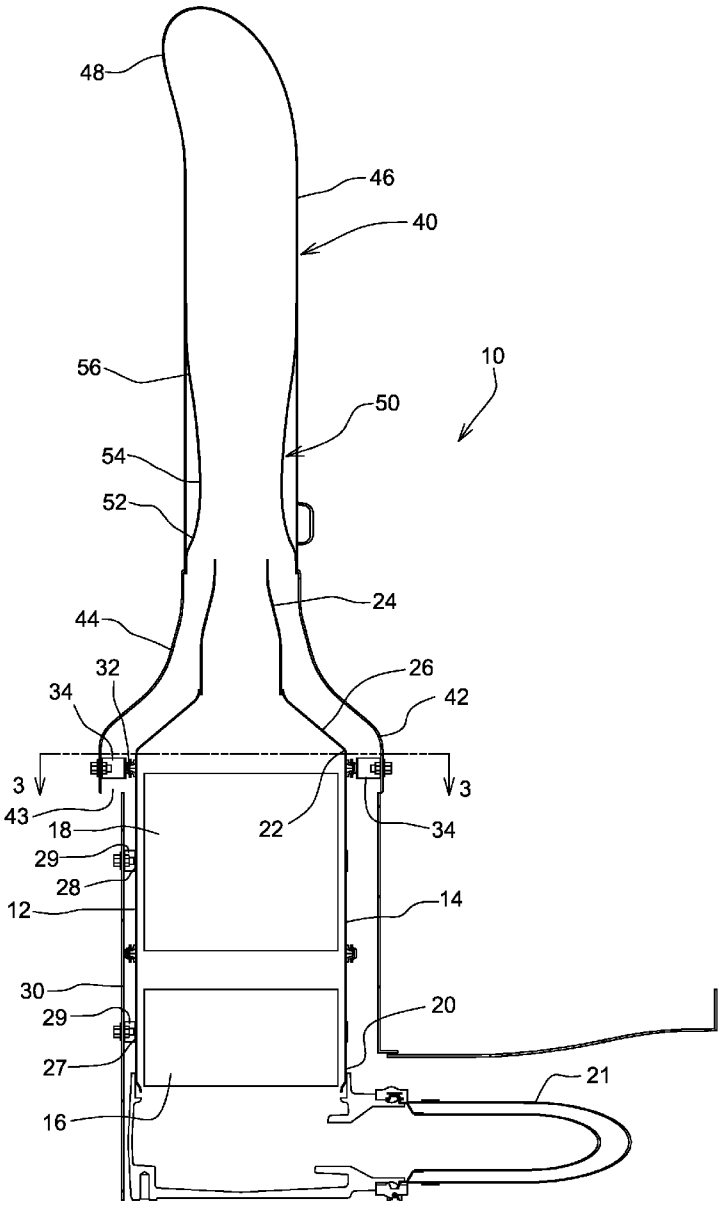
(57) **ABSTRACT**

The invention relates to an exhaust after treatment assembly. There is a need for such assembly which remains as cool as possible. An exhaust after treatment assembly includes a hollow housing containing an exhaust after treatment unit. The housing forms a nozzle which directs exhaust gases away from the after treatment unit. A shield surrounds and is spaced apart from the housing. A venturi unit receives exhaust gases from the nozzle and receives outside air. The venturi unit pulls outside air over an exterior of the shield and mixes the outside air with exhaust gases flowing though the after treatment unit. The venturi unit is mounted inside a hood which surrounds part of the housing. Outside air is drawn through an annular gap which is formed between an end of the hood and an end of the shield.



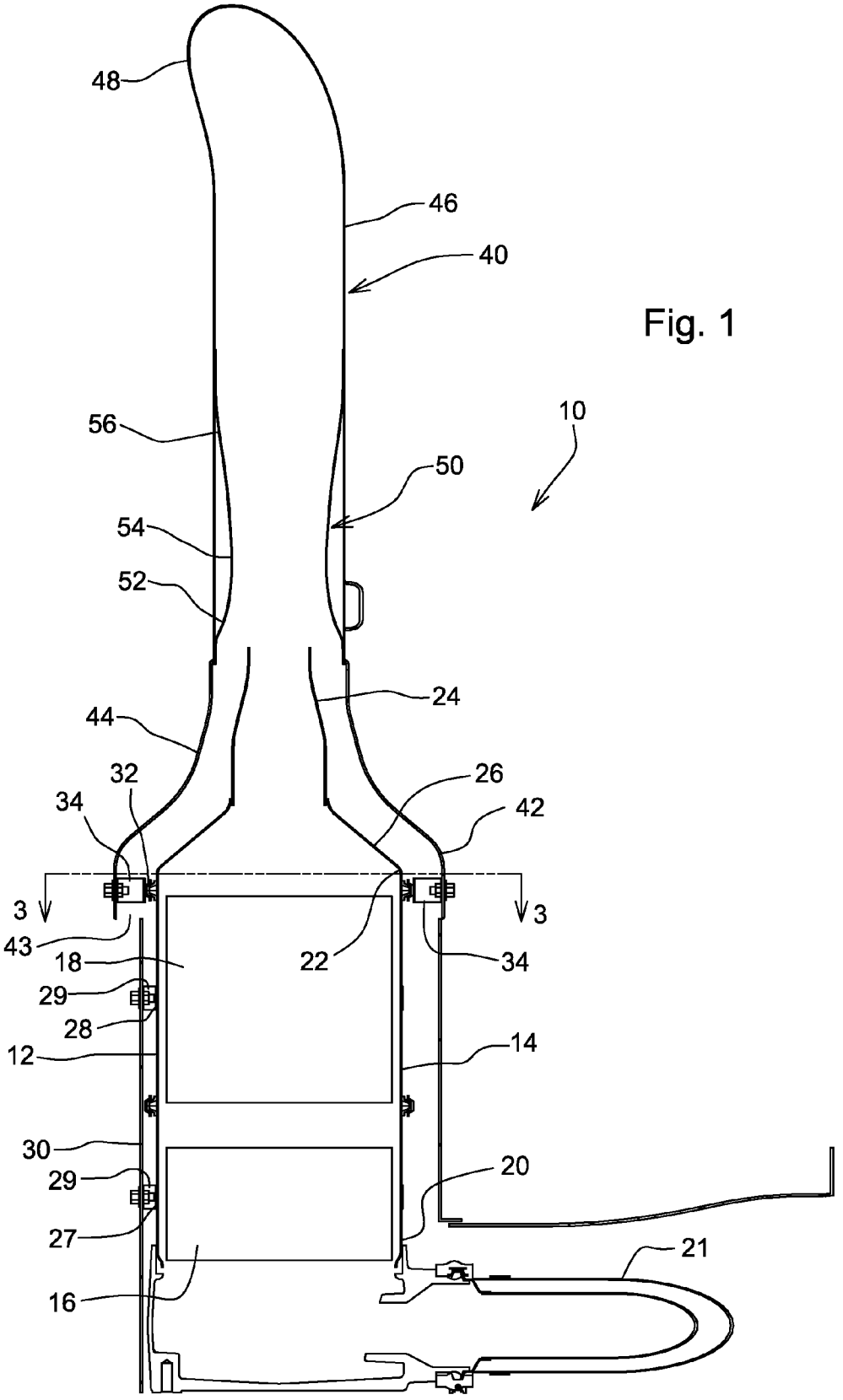

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Fig. 1

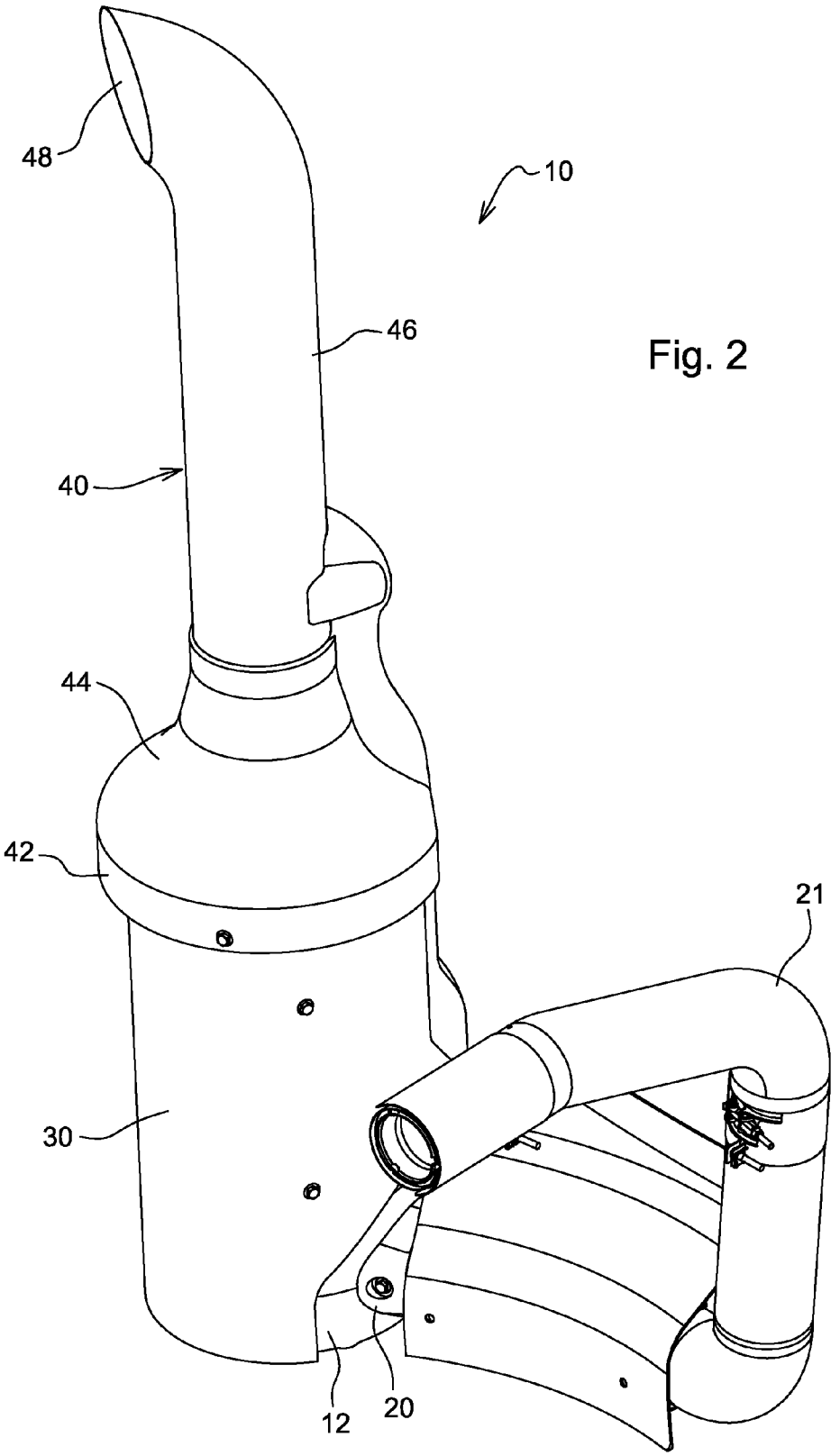

Fig. 2

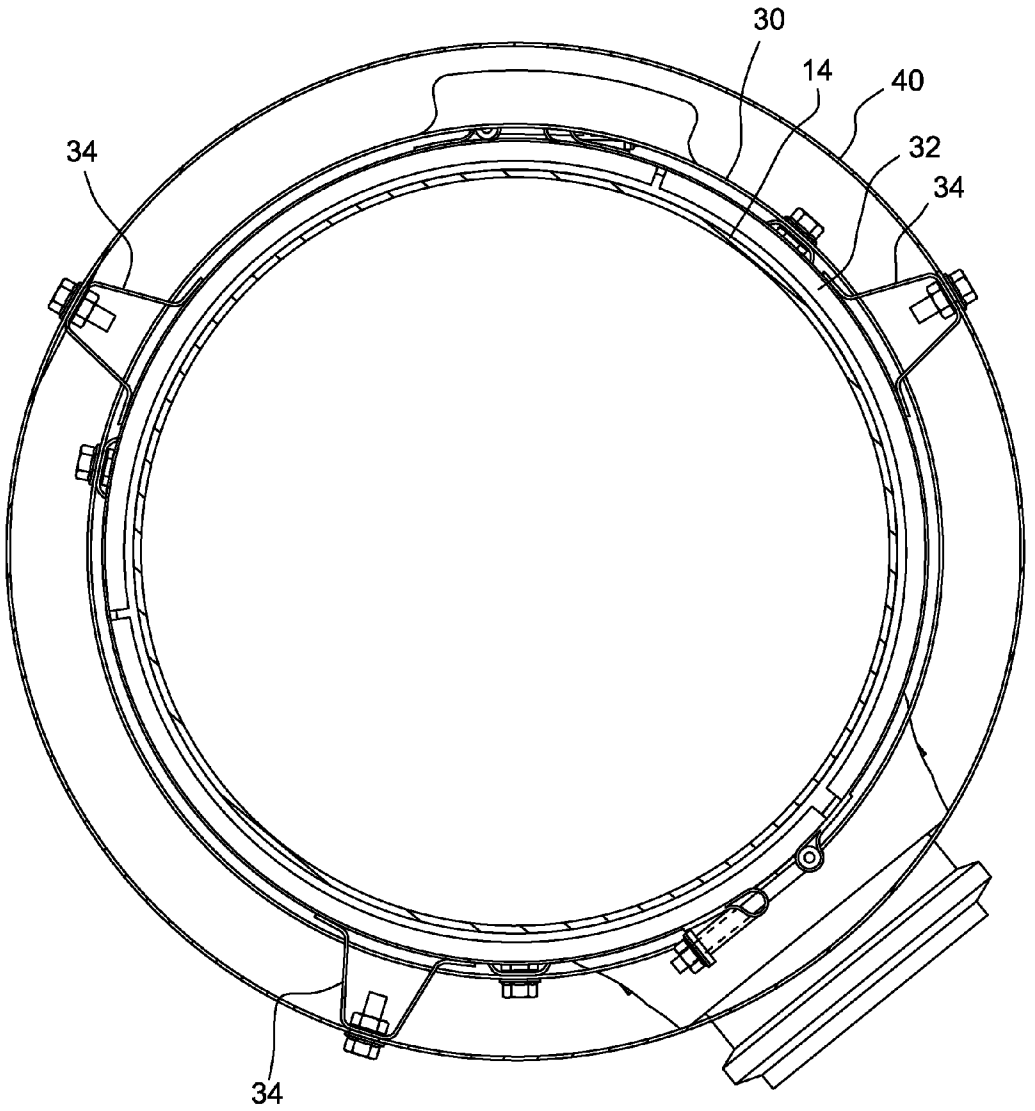

Fig. 3

EXHAUST AFTER TREATMENT ASSEMBLY

FIELD OF THE INVENTION

[0001] The present invention relates to an exhaust after treatment assembly for an internal combustion engine.

BACKGROUND OF THE INVENTION

[0002] An exhaust treatment component arrangement for an off-road vehicle such as an agricultural tractor is described in U.S. patent application Ser. No. 11/654,203 filed on 16 Jan. 2007 and assigned to the assignee of the present application. This exhaust treatment component arrangement is intended to meet Tier 4 interim emissions standards, which will require all off-highway vehicles to manage Particulate Matter (PM) and NOx levels. This exhaust treatment component arrangement includes exhaust after treatment devices, such as both a diesel particulate filter (PDF) and a Diesel Oxidation Catalyst (DOC).

[0003] A regeneration process is used with exhaust after treatment devices, wherein soot and particulate matter is burned off and temperatures inside the devices can reach 630 degrees C. Additionally, some of the after treatment device skin temperatures in certain areas can reach temperatures higher than desired. During vehicle operation, and especially during regeneration of such after treatment devices, it is desired to limit the heating of such an exhaust after treatment device.

SUMMARY

[0004] Accordingly, an object of this invention is to provide an exhaust after treatment assembly which cools exhaust air which flows therethrough.

[0005] A further object of the invention is to provide such an exhaust after treatment assembly which cools the exhaust after treatment components.

[0006] These and other objects are achieved by the present invention, wherein an exhaust after treatment assembly includes a hollow housing containing at least one exhaust after treatment unit. The housing forms a nozzle for directing exhaust gases away from the after treatment unit. A shield surrounds and is spaced apart from the housing. A venturi unit receives exhaust gases from the nozzle and receives outside air. A hood has an inlet end, an outlet end and a tubular portion connecting the inlet end to the outlet end. The venturi unit is mounted inside the tubular portion. The inlet end is spaced apart from and surrounds an end of the shield and forms an annular gap therebetween. The venturi unit draws outside air through the gap, pulls outside air over an exterior of the shield, and mixes the outside air with exhaust gases which have flowed though the after treatment units.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. **1** is a sectional side view of an exhaust after treatment assembly embodying the invention;

[0008] FIG. **2** is a perspective view of the exhaust after treatment assembly of FIG. **1**; and

[0009] FIG. **3** is a sectional view along lines **3-3** of FIG. **1**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0010] Referring to FIGS. **1** and **2**, an exhaust after treatment assembly **10** includes a hollow housing **12** which has a cylindrical main portion **14** which contains exhaust after treatment units, such as a diesel oxidation catalyst (DOC) **16** and diesel particulate filter (DPF) **18**. Housing **12** has an inlet end **20** which receives engine exhaust gases from an exhaust pipe **21** which is connected to a source of exhaust gases, such as a diesel engine (not shown). The inlet end **20** communicates exhaust gases to the after treatment units **16** and **18**. Housing **12** also includes an outlet **22** for directing exhaust gases away from the after treatment units **16** and **18**. The outlet **22** includes a nozzle **24** and a conical portion **26** which connects the nozzle **24** to an end of the main portion **14**.

[0011] As best seen in FIG. **1**, circular band clamps **27** and **28** are mounted around and on the housing **12**. A plurality of brackets **29** are attached to the clamps **27** and **28**. Brackets **29** support a hollow cylindrical shield **30** which surrounds and is spaced apart from the housing **12**. As best seen in FIGS. **1** and **3**, an additional circular band clamp **32** is mounted around the upper end of the housing **12**. A plurality of brackets **34** are attached to the clamp **32**. Brackets **34** support a hollow hood **40**.

[0012] The hood **40** has a larger diameter inlet end **42** which is adjacent to and spaced apart from a downstream end of the shield **30**, forming an annular gap **43** therebetween. The hood **40** also includes a tapered portion **44** which is connected to the inlet end **42** and which surrounds the conical portion **26** and the nozzle **24** of the housing **12**. The hood **40** also includes a tubular portion or exhaust pipe **46** which is connected to a downstream end of the tapered portion **44** and extends to an outlet **48** remote from the tapered portion **44**.

[0013] The tubular portion **44** has a venturi unit **50** therein. The venturi unit **50** has a larger diameter entry **52** which surrounds and is spaced apart from a downstream end of the nozzle **24**, a smaller diameter neck **54** downstream of the entry **52**, and a larger diameter exit **54** downstream of the neck **54**.

[0014] As hot exhaust gases flow through the units **16** and **18**, out of the nozzle **24** and through the venturi **50**, the increased velocity of the exhaust gases creates a pressure drop which pulls outside air into the gap **43** and through the space between the tapered portion **44** of the hood **40** and into the venturi **50**. In the venturi **50** this outside air mixes with and cools the exhaust gases. This outside air is also pulled over an exterior of the shield **30**, and over the exterior of the conical portion **26** and the nozzle **24**, and provides a cooling effect thereon.

[0015] As best seen in FIG. **3**, a circular clamp **52** is mounted on the upper end of the shield **30**, and a plurality of

[0016] The hood **40** is preferably made out of steel which is deep drawn or spun to achieve the desired shape. The hood **40** has a bell shape which closely matches the shape of the conical portion **26** and the nozzle **24** of the housing **14** in order to maximize airflow (minimum resistance) and to achieve the desired air volume, pressure, and velocities which optimize resulting exhaust gas temperature.

[0017] With this design hot exhaust gases exiting the after treatment units **16** and **18** are cooled down to desired temperatures as measured at varying distance from the exhaust pipe outlet. The hood **40** also acts as a shield to protect the top of the housing **14** and keeps debris off of the surfaces thereof. Thirdly, the cool air drawn in at the bottom of the hood **40** passes by the top surface of the conical portion **26** and the nozzle **24**, reducing their skin temperatures.

[0018] While the present invention has been described in conjunction with a specific embodiment, it is understood that many alternatives, modifications and variations will be apparent to those skilled in the art in light of the foregoing description.

[0019] Accordingly, this invention is intended to embrace all such alternatives, modifications and variations which fall within the spirit and scope of the appended claims.

We claim:

1. An exhaust after treatment assembly, comprising:

a hollow housing containing an exhaust after treatment unit;

a nozzle for directing exhaust gases away from the after treatment unit;

a shield surrounding and spaced apart from the housing; and

a venturi unit receiving exhaust gases from the nozzle and receiving outside air, the venturi unit operating to pull outside air over an exterior of the shield and to mix said outside air with exhaust gases flowing though the after treatment unit.

2. The exhaust after treatment assembly of claim **1**, further comprising:

a hood having an inlet end, an outlet end and a tubular portion connecting the inlet end to the outlet end, the venturi unit being mounted inside the tubular portion, the inlet end being spaced apart from and surrounding an end of the shield and forming an annular gap therebetween, the venturi unit drawing outside air through said gap.

3. The exhaust after treatment assembly of claim **2**, wherein:

the hood comprises a tapered portion connected between the inlet end and the tubular portion.

4. The exhaust after treatment assembly of claim **1**, wherein:

the housing includes a main portion surrounding the after treatment unit and a conical portion connecting the main portion to the nozzle.

5. The exhaust after treatment assembly of claim **1**, wherein:

the venturi unit comprises a larger diameter entry surrounding a downstream end of the nozzle, a smaller diameter neck downstream of the entry and a larger diameter exit downstream of the neck.

6. An exhaust after treatment assembly, comprising:

a hollow housing having a central portion containing an exhaust after treatment unit, an inlet end for communicating engine exhaust gases to the after treatment unit and having an outlet for directing exhaust gases away from the after treatment unit, the outlet having a nozzle and a conical portion connecting the nozzle to an end of the central portion;

a shield surrounding and spaced apart from the central portion of the housing; and

a hood having an inlet end surrounding a downstream end of the shield, a tapered portion connected to the inlet end and surrounding the conical portion and the nozzle, a tubular portion connected to a downstream end of the tapered portion and extending to an outlet remote from the tapered portion; and

the tubular portion having a venturi unit therein, the venturi unit having a larger diameter entry surrounding a downstream end of the nozzle, a smaller diameter neck downstream of the entry and a larger diameter exit downstream of the neck, the venturi operating to pull outside air over an exterior of the shield, over the an exterior of the conical portion and the nozzle and to mix said outside air with exhaust gases flowing though the after treatment unit.

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