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- **Bicrel, Christophe**
Peoria, IL 61629-6490 (US)
- **Teppoz, Pascal**
Peoria, IL 61629-6490 (US)
- **Turrillot, Come**
Peoria, IL 61629-6490 (US)

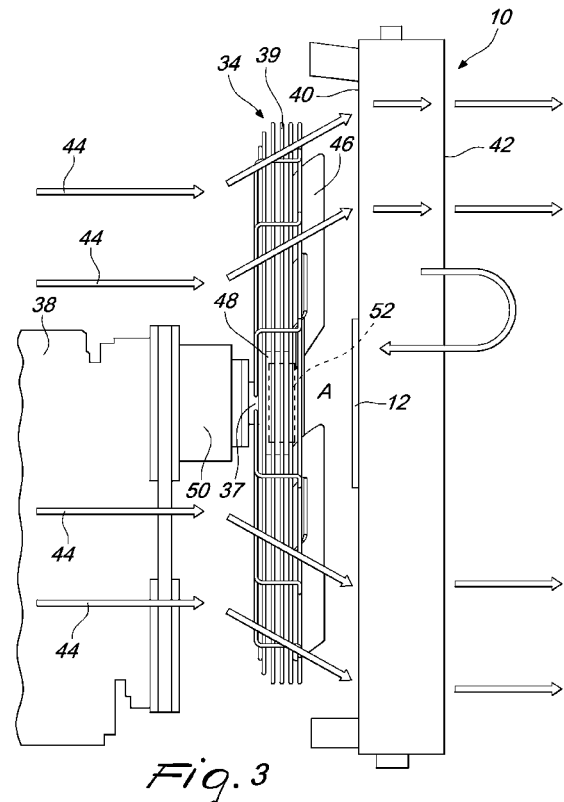
(71) Applicant: **Caterpillar, Inc.**
Peoria, IL 61629-6490 (US)

(74) Representative: **Modiano, Micaela Nadia**
Modiano & Partners (IT)
Via Meravigli, 16
20123 Milano (IT)

(72) Inventors:
• **Fezzi, Marie-Linh**
Peoria, IL 61629-6490 (US)

(54) **Cooler device**

(57) A cooler device for use with a fan associated with a vehicle engine, the cooler device comprising at least one heat exchanger configured for receiving, in use, an airflow generated by the fan; and a flow control member coupled to the at least one heat exchanger wherein the flow control member is positioned upstream to an air pressure depression with respect to the direction of airflow to restrict re-circulation of heated air through the at least one heat exchanger.



Description

Technical Field

[0001] This disclosure relates to the field of cooler devices for internal combustion engines used in trucks and other motor vehicles, and in particular to the circulation of air through the cooler devices.

Background

[0002] Generally, engine compartments of vehicles or machines may generate large amounts of heat during the course of operation of the vehicles or machines. Heat may be dissipated from the engine by an engine cooling system. The engine cooling system may comprise an internal combustion engine through which a liquid engine coolant may flow for cooling purposes. The liquid coolant may flow through a cooler device for the dissipation of heat from the liquid coolant.

[0003] To increase efficiency of the engine, other devices, for instance a turbo compressor, may be added to the engine. Hence, the engine may further include powertrain components such as torque converters, hydraulic pumps, and so on. The cooler device may provide for the dissipation of heat produced by the powertrain components.

[0004] Heat from the apparatus may be dissipated by natural convection. Heat in the cooler device may be dissipated by air flowing through the engine compartment. The air flow may be produced by motion of the vehicle or by a fan.

[0005] The efficiency of heat dissipation from the cooler device may be improved according to the present disclosure.

Brief Summary of the Invention

[0006] In a first aspect, the present disclosure describes a cooler device for use with a fan associated with a vehicle engine, the cooler device comprising at least one heat exchanger configured for receiving, in use, an airflow generated by the fan; and a flow control member coupled to the at least one heat exchanger wherein the flow control member is positioned upstream to an air pressure depression with respect to the direction of airflow to restrict re-circulation of heated air through the at least one heat exchanger.

[0007] In a second aspect, the present disclosure describes a method of restricting re-circulation of heated air through a cooler device in a vehicle engine comprising the steps of positioning at least one heat exchanger adjacent to a fan for receiving an airflow generated by the fan; and coupling a flow control member to the at least one heat exchanger upstream to an air pressure depression with respect to the direction of airflow to restrict re-circulation of heated air through the at least one heat exchanger.

Brief Description of the Drawings

[0008] The foregoing and other features and advantages of the present disclosure will be more fully understood from the following description of various embodiments, when read together with the accompanying drawings, in which:

Fig. 1 is an isometric view of a cooler device according to the present disclosure;

Fig. 2 is an isometric view of a cooler device positioned between an axial fan and a hood of a vehicle according to the present disclosure; and

Fig. 3 is a schematic representation of a cooler device positioned adjacent an axial fan with arrows indicating path of air flow .

Detailed Description

[0009] This disclosure generally relates to a cooler device **10** having restricted re-circulation of heated air there-through.

[0010] With reference to Fig. 1, the cooler device **10** may generally be a heat core for a vehicle engine and may comprise cooling mechanisms, for instance a heat exchanger. The heat exchanger may comprise a fluid that circulates through the engine or other components to absorb heat from the various components. The heat exchanger may enable transfer of heat from the heated fluid to the surrounding air. The cooler device **10** may be located in an engine compartment of a vehicle.

[0011] The cooler device **10** may comprise a plurality of heat exchangers which are formed as sub-cores for heat dissipation. In one embodiment, the sub-cores may include a coolant tank **14** for the liquid coolant, a charge air cooler **22** for a turbo compressor and a powertrain oil cooler **28**.

[0012] The coolant tank **14** may have an inlet port **16** and an outlet port **18**. The coolant tank may be provided with a drain port **20**. The drain port **20** may have a smaller diameter than the inlet port **16** and the outlet port **18**.

[0013] The charge air cooler **22** may have a compressed air inlet **24** leading from the turbo compressor and a compressed air outlet **26**.

[0014] The powertrain oil cooler **28** may have an oil inlet **30** and an oil outlet **32**.

[0015] The cooler device **10** may comprise a flow control member **12**. The flow control member **12** may be mounted to the heat exchanger or to the sub-core positioned in the centre. The flow control member **12** may be mounted by any suitable means. The flow control member **12** may be bolted, riveted or welded to the cooler device **10**. The engine compartment may contain a fluid circulator. Ambient air may be directed into the engine compartment through an inlet by the fluid circulator. The fluid circulator may also effect the circulation of air within the engine compartment before the circulated air exits through an outlet. The fluid circulator may be suitably

provided as required. For instance, the fluid circulator may be an air intake formed over the inlet whereby the movement of the machine, such as a vehicle, forces air through the inlet to drive the circulation of air within the engine compartment. In an embodiment, the flow control member 12 may be a plate.

[0016] With reference to Fig. 2, in an embodiment, the fluid circulator may be a fan 34. Rotation of the fan 34 may draw air into the engine compartment through an inlet and may force air out through an outlet to drive circulation of air within the engine compartment.

[0017] The fan 34 may be an axial fan which forces air to move substantially parallel to the fan shaft 37 about which the fan blades 46 rotate. The fan blades 46 may be mounted to a fan hub 48.

[0018] The fan 34 may be directly connected to the engine 38. This directly connected fan 34 may be driven at the engine speed. In an embodiment, a mechanical fan clutch 52 may be provided between the fan 34 and the engine 38 so that the speed of the fan may be variable. The mechanical fan clutch 52 may be provided adjacent the fan hub 48. The fan shaft 37 and the fan hub 48 may form the fan drive.

[0019] In an embodiment, the fan 34 may be a hydraulic demand fan wherein the fan is connected to a hydraulic motor.

[0020] The fan 34 may be provided with protective cage 39 to shield the fan blades 46 from debris. The fan may be driven via a fan pulley 50.

[0021] The fan 34 may be provided with shrouds 35 to direct the flow of air towards the cooler device 10. The shrouds 35 may be L-shaped with an end being mounted to the cage 39 substantially perpendicular to the fan shaft 37. A portion of the shrouds 35 may extend parallel to the fan shaft 37 which serves as a guide for the airflow produced by the fan blades 46 towards the cooler device 10.

[0022] The fan 34 may be positioned adjacent to the cooler device 10. In an embodiment, fan 34 may be positioned so that the plane of rotation of the fan blades 46 may be parallel to the vertical axis of the cooler device 10 and the axis of the fan shaft 37 may be transverse to the vertical axis of the cooler device 10.

[0023] The fan 34 may be located between the engine 38 and the cooler device 10. The cooler device 10 may be located between the fan 34 and an engine hood 36. The cooler device 10 may be located between the fan 34 and the grill of the engine hood 36.

[0024] The airflow circulated through the engine compartment may be directed at the cooler device 10 such that heat may be transferred from the heat exchangers 14, 22, 28 to the flowing air. The airflow may be directed to flow through the heat exchangers 14, 22, 28.

[0025] Unobstructed circulated air may flow uniformly through the cooler device 10 from the first side 40 to the second side 42. The air pressure along the first side 40 is substantially uniform. The air pressure at first side 40 may be marginally higher than the air pressure at second

side 42.

[0026] In the presence of an obstruction, for example an engine component or a fan component, the circulated air may not flow uniformly through the cooler device 10 at the first side 40. The air pressure along the first side 40 may not be substantially uniform. The air pressure at the obstruction zone between the obstructing component and the first side 40 may be lower than the air pressure at other points along the first side 40 thereby forming an air pressure depression. As a result of the air pressure depression, the pressure at second side 42 may be substantially greater than the first side 40 at the obstruction zone.

[0027] With reference to Fig. 3, the fan 34 may be positioned adjacent the cooler device 10. The arrows 44 may indicate the path of airflow generated by the fan 34 through the cooler device 10. The airflow may flow at the region of the fan blades 46 with a uniform air pressure. Air flow at the region of the fan hub 48 may be reduced or absent.

[0028] The cooler device 10 may comprise the heat exchanger 14, 22, 28 which is positioned adjacent to the fan 34 for directing an airflow toward the heat exchanger 14, 22, 28. The flow control member 12 may be positioned on the heat exchanger 14, 22, 28 upstream to the air pressure depression A with respect to the airflow. As shown in Fig 3, the air pressure depression A may be formed by the fan hub 48, another component of the fan 34 or an engine component. In particular, by the movement of air over the fan hub 48, another component of the fan 34, such as the fan clutch 52 or an engine component. In an embodiment, air fins on the fan clutch 52 may create the air pressure depression A.

[0029] The flow control member 12 may restrict re-circulation of heated air through the heat exchanger 14, 22, 28. The flow control member 12 may obstruct the flow of downstream heated air from returning upstream through the zone of the air pressure depression A.

[0030] In an embodiment, the position of the flow control member 12 on the cooler device 10 may correspond to the fan hub 48. The flow control member 12 may be axially aligned to the fan hub 48. The flow control member 12 may have a length that is equivalent to the diameter of the fan hub 48. The flow control member 12 may have a length greater than the diameter of the fan hub 48.

[0031] In an embodiment, the shape of the flow control member 12 may substantially correspond to the shape of the fan hub 48.

[0032] In an embodiment, the position of the flow control member 12 on the cooler device 10 may correspond to the fan clutch 52. The flow control member 12 may be axially aligned to the fan clutch 52. The flow control member 12 may have a diameter that is equivalent to the diameter of the fan clutch. The flow control member 12 may have a diameter greater than the diameter of the fan clutch 52.

[0033] In an embodiment, the shape of the flow control member 12 may substantially correspond to the shape

of the fan clutch **52**.

[0034] In an embodiment, the length of the flow control member **12** may be the diameter thereof.

[0035] In an embodiment, when the fan **34** is at a distance of 80 - 100 mm from the cooler device **10** the diameter of the flow control member **12** may be substantially equal to the diameter of the fan clutch **52**. In an embodiment, when the fan **34** is at a distance of 90 mm from the cooler device **10** the diameter of the flow control member **12** may be substantially equal to the diameter of the fan clutch **52**.

[0036] In an embodiment, the centre of the flow control member **12** may be axially aligned with the central axis of the fan hub **48**. The centre of the flow control member **12** may be collinear with the central axis of the fan hub **48**.

[0037] In an embodiment, the centre of the flow control member **12** may be axially aligned with the central axis of the fan clutch **52**. The centre of the flow control member **12** may be collinear with the central axis of the fan clutch **52**.

[0038] The flow control member **12** may have a suitable shape to obstruct the flow of downstream heated air from returning upstream through the zone of air pressure depression **A**. The flow control member **12** may have a circular shape.

[0039] The flow control member **12** may be suitably disposed to obstruct the flow of downstream heated air from returning upstream through the zone of air pressure depression **A**. The flow control member **12** may be coupled to the heat exchanger **14, 22, 28** at first side **40**.

[0040] In an embodiment, the flow control member **12** may be positioned between the heat exchanger **14, 22, 28** and the fan **34**.

[0041] In an embodiment, the flow control member may be positioned between the heat exchanger **14, 22, 28** and the engine hood **36**. In an embodiment, the flow control member may be positioned between the heat exchanger **14, 22, 28** and the grill of the engine hood **36**. The flow control member **12** may be coupled to the heat exchanger **14, 22, 28** at second side **42**.

[0042] In an embodiment, a first flow control member **12** may be coupled to the heat exchanger **14, 22, 28** at the first side **40** and a second flow control member **12** may be coupled to the heat exchanger **14, 22, 28** at the second side **42**. The first and second flow control members **12** may be axially aligned.

[0043] A cooler assembly may comprise the fan **34** and the cooler device **10** as herein described. The cooler device **10** may be arranged adjacent to the fan **34**.

[0044] A method of restricting re-circulation of heated air through the cooler device **10** may comprise the steps of providing the heat exchanger **14, 22, 28** in a vehicle engine and positioning the heat exchanger **14, 22, 28** adjacent to an fan **34** for directing an airflow toward the at least one heat exchanger **14, 22, 28** and coupling a flow control member **12** to the at least one heat exchanger **14, 22, 28** upstream to an air pressure depression **A** with respect to the direction of airflow to restrict re-circulation

of heated air through the at least one heat exchanger **14, 22, 28**.

[0045] The skilled person would appreciate that foregoing embodiments may be modified or combined to obtain the cooler device **10** of the present disclosure.

Industrial Applicability

[0046] This disclosure describes a cooler device **10** for restricting re-circulation of heated air therethrough.

[0047] The presence of an air depression upstream of an airflow moving through the cooler device **10** may result in air that is heated by the cooler device **10** to re-circulate through the heat exchangers **14, 22, 28**. This re-circulation of heated air may result in heating of the upstream air going through the heat exchangers **14, 22, 28** thereby causing a reduction in heat dissipation performance.

[0048] The flow control member **12** may be positioned so as to block the return path of the heated air in order to reduce or prevent the heated air from re-circulating. By blocking the re-circulation of heated air the mixing of this heated air with the cooler upstream air may be reduced or prevented so that the airflow going through the heat exchangers **14, 22, 28** may be cooler. The flow of cooler air through the cooler device **10** may result in more heat being transferred from the heat exchangers **14, 22, 28**.

[0049] Accordingly, this disclosure includes all modifications and equivalents of the subject matter recited in the claims appended hereto as permitted by applicable law. Moreover, any combination of the above-described elements in all possible variations thereof is encompassed by the disclosure unless otherwise indicated herein.

[0050] Where technical features mentioned in any claim are followed by reference signs, the reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, neither the reference signs nor their absence have any limiting effect on the technical features as described above or on the scope of any claim elements.

[0051] One skilled in the art will realise the disclosure may be embodied in other specific forms without departing from the disclosure or essential characteristics thereof. The foregoing embodiments are therefore to be considered in all respects illustrative rather than limiting of the disclosure described herein. Scope of the invention is thus indicated by the appended claims, rather than the foregoing description, and all changes that come within the meaning and range of equivalence of the claims are therefore intended to be embraced therein.

Claims

1. A cooler device (10) for use with a fan (34) associated with a vehicle engine, the cooler device comprising:

- at least one heat exchanger (14, 22, 28) configured for receiving, in use, an airflow generated by the fan (34); and
 a flow control member (12) coupled to the at least one heat exchanger (14, 22, 28) wherein the flow control member (12) is positioned upstream to an air pressure depression (A) with respect to the direction of airflow to restrict re-circulation of heated air through the at least one heat exchanger (14, 22, 28).
2. The cooler device (10) of claim 1 wherein the flow control member (12) is arranged so as to be, in use, axially aligned with a fan hub (48) of the fan (34).
 3. The cooler device (10) of claim 2 wherein the shape of the flow control member (12) substantially corresponds to the shape of the fan hub (48).
 4. The cooler device (10) of claim 2 wherein the flow control member (12) has a length greater or equivalent to the diameter of the fan hub (48).
 5. The cooler device (10) of claim 1 wherein the flow control member (12) is arranged so as to be, in use, axially aligned with a fan clutch (52) of the fan (34).
 6. The cooler device (10) of claim 5 wherein the shape of the flow control member (12) substantially corresponds to the shape of the fan clutch (52).
 7. The cooler device (10) of claim 5 wherein the flow control member (12) has a length greater or equivalent to the diameter of the fan clutch (52).
 8. The cooler device (10) of any of the preceding claims wherein the flow control member (12) is a plate.
 9. A cooler assembly comprising:
 - a fan (34); and
 - a cooler device (10) arranged adjacent to the fan (34), the cooler device (10) comprising:
 - at least one heat exchanger (14, 22, 28) configured for receiving an airflow generated by the fan (34); and
 - a flow control member (12) coupled to the at least one heat exchanger (14, 22, 28) wherein the flow control member (12) is positioned upstream to an air pressure depression (A) with respect to the direction of airflow to restrict re-circulation of heated air through the at least one heat exchanger (14, 22, 28).
 10. The cooler assembly of claim 9 wherein the diameter of the flow control member (12) is equal to the diameter of a fan clutch (52) when the fan (34) is at a distance of 80 - 100 mm from the cooler device (10).
 11. The cooler assembly of claim 9 wherein the diameter of the flow control member (12) is equal to the diameter of a fan clutch (52) when the fan (34) is at a distance of 90 mm from the cooler device (10).
 12. The cooler assembly of claim 9, 10 or 11 wherein the flow control member (12) is positioned between the at least one heat exchanger (14, 22, 28). and the fan (34).
 13. The cooler assembly of claim 9, 10 or 11 wherein the flow control member (12) is positioned between the at least one heat exchanger (14, 22, 28). and an engine hood (36).
 14. A vehicle comprising the cooler device (10) of any one of claims 1 to 8 or the cooler assembly of any one of claims 9 to 11.
 15. A method of restricting re-circulation of heated air through a cooler device (10) of a vehicle engine comprising the steps of:
 - positioning at least one heat exchanger (14, 22, 28) adjacent to a fan (34) for receiving an airflow generated by the fan (34); and
 - coupling a flow control member (12) to the at least one heat exchanger (14, 22, 28) upstream to an air pressure depression (A) with respect to the direction of airflow to restrict re-circulation of heated air through the at least one heat exchanger (14, 22, 28).

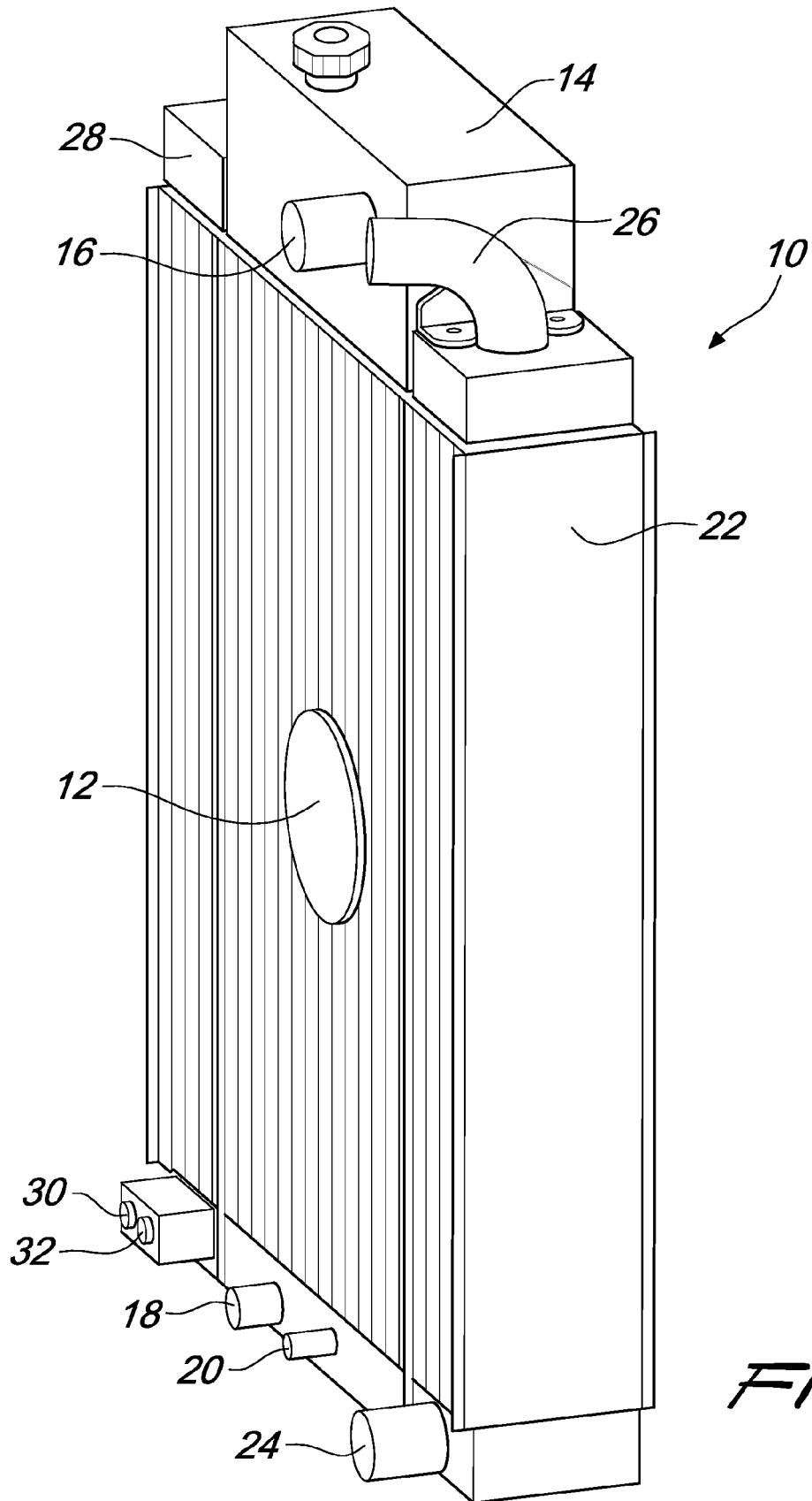
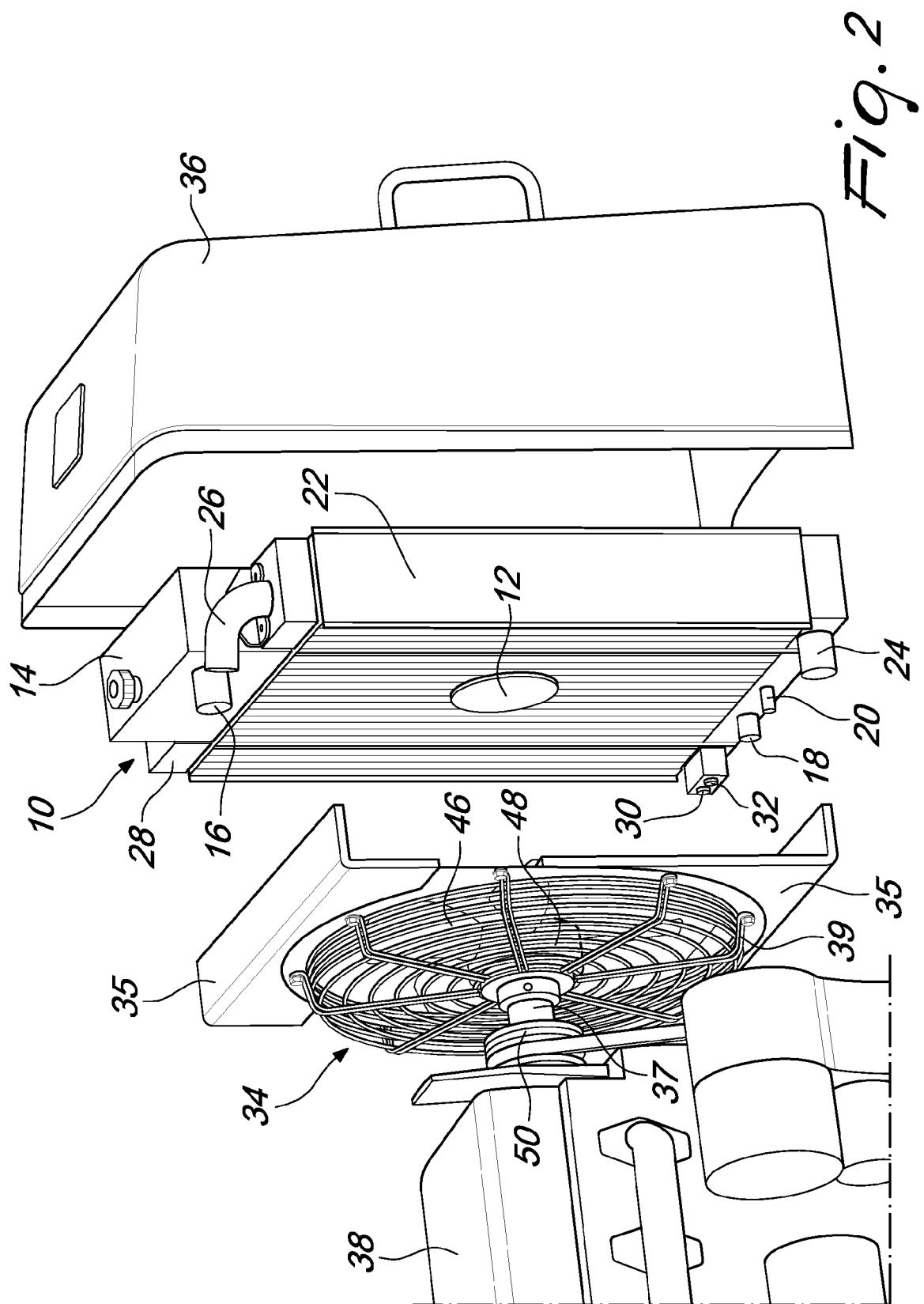


Fig. 1



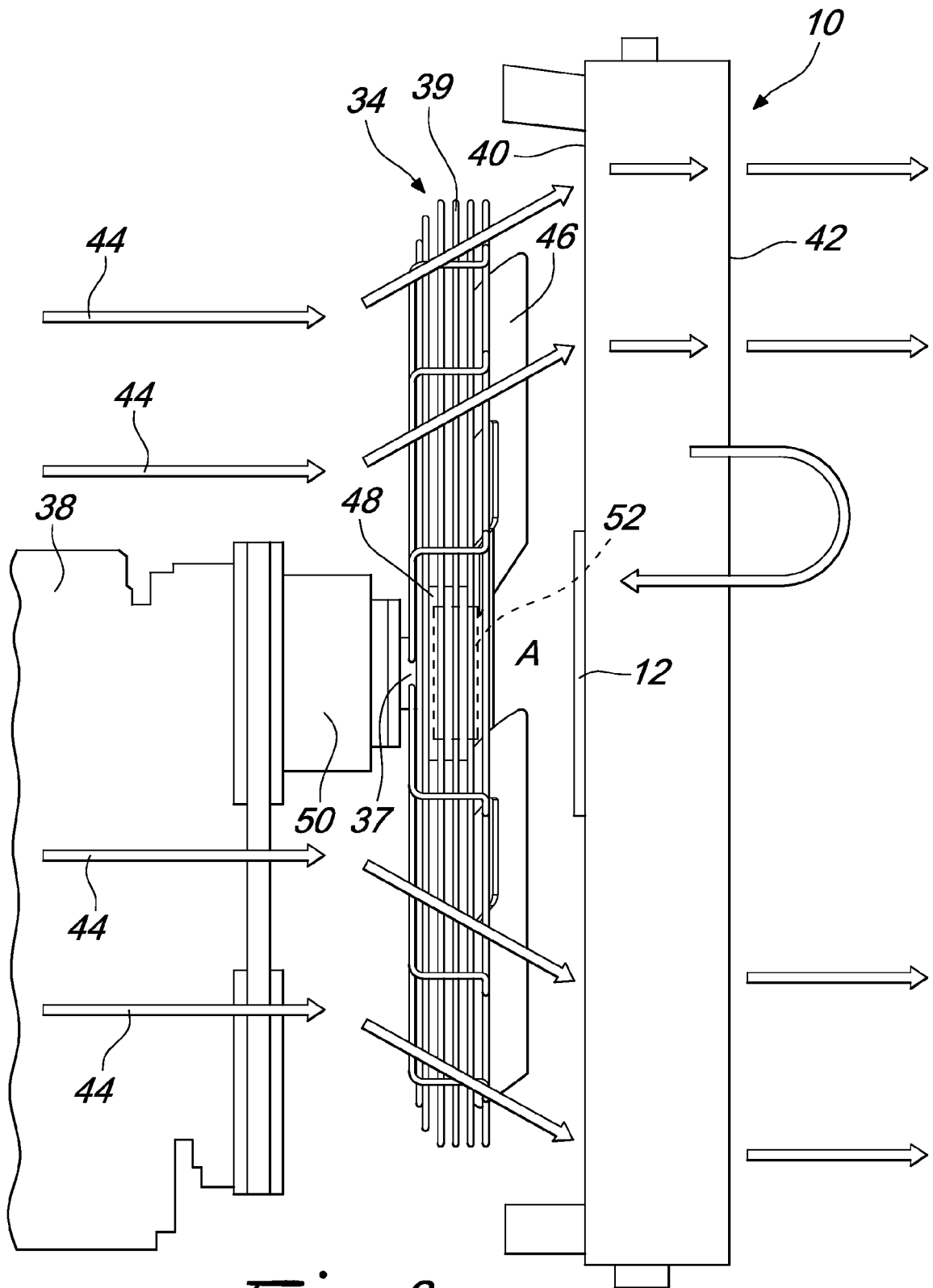


Fig. 3



EUROPEAN SEARCH REPORT

Application Number
EP 11 16 8695

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP 2004 183500 A (KOMATSU MFG CO LTD) 2 July 2004 (2004-07-02) * abstract * * figures * -----	1-15	INV. F01P5/06 F01P11/10 F28D1/04 F28F13/06
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			TECHNICAL FIELDS SEARCHED (IPC)
			F01P F28D F28F
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 24 November 2011	Examiner Matray, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 16 8695

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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24-11-2011

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