(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 997 632 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
03.05.2000 Bulletin 2000/18

(51) Int Cl.[7]: **F02M 35/04**, B60R 16/02

(21) Application number: **99308508.3**

(22) Date of filing: **27.10.1999**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **28.10.1998 GB 9823556**

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(54) An air cleaner assembly

(57) An air cleaner assembly 10 suitable for a vehicle is disclosed, the air cleaner assembly 10 comprising an air filter box 12 through which in use intake air is supplied to a prime mover (not shown). The assembly further comprises an ECU box 20, arranged in use to accommodate an electronic control unit (ECU) 18. The air filter box 12 and the ECU box 20, are interlinked by an inlet passage 22 and an outlet passage 24, which are arranged to allow a flow of unfiltered air through the ECU box 20 from the air filter box 12. The ECU box 20 is defined in such a manner that the ECU 18 is a substantially sliding fit in the ECU box 20, with a clearance C being provided between at least a portion of the ECU 18 and at least one wall which defines the ECU box 20, such that the flow of air can pass substantially freely over at least one surface 18b of the ECU 18 to provide a cooling effect therefor.

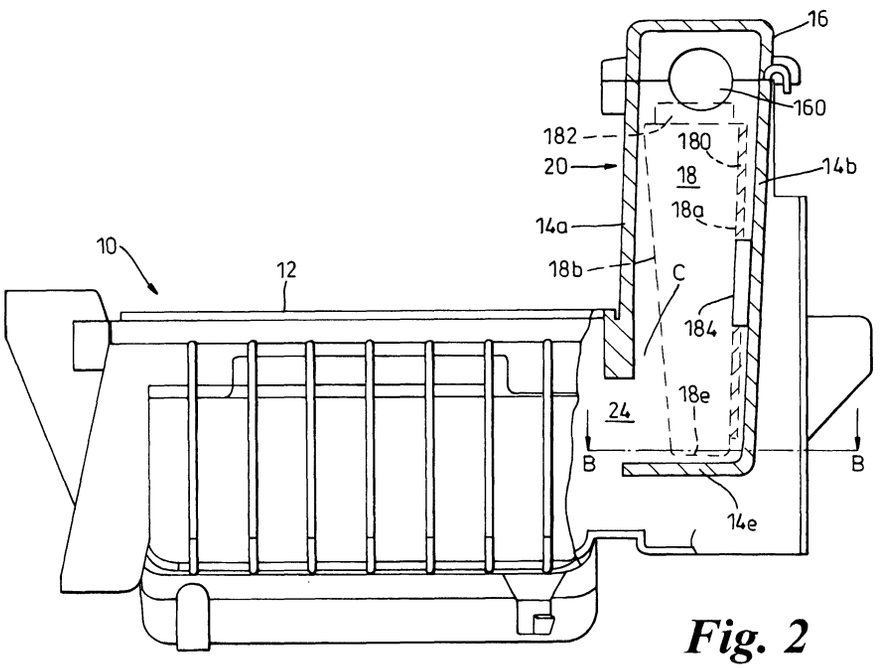

Fig. 2

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Description

[0001] This invention relates to air cleaner assemblies and in particular, but not exclusively, to an air cleaner assembly which is suitable for a vehicle.

[0002] Electronic control units (ECUs) used in vehicles have become increasingly more complicated over the years and the size of some of these units has increased accordingly. This has, in some cases, made it difficult to find sufficient space to mount the electronic control unit (ECU) within the vehicle. Although increasing integration and advances is technology have helped to keep the size of some ECUs down, the need to provide drive for devices such as stepper motors, solenoids, ignition coils and fuel injectors has resulted in many such ECUs generating a significant amount of internal heat, which needs to be dissipated.

[0003] One early attempt to provide cooling for vehicle electrical components is disclosed in GB 1510436. In this case, the circuits are mechanically fixed to the walls of a cooling chamber in an air cleaner. It is a problem with such an arrangement that production time is lost while installing the circuits, whether done on the vehicle production line or off-line as a sub-assembly. While the individual circuits could be tested during their own manufacture, i.e. as stand-alone items, in this case it may also prove desirable to introduce an additional testing procedure to check they all still work properly after sub-assembly into the air cleaner.

[0004] In DE 3338653, a more recent arrangement for cooling a control unit is disclosed. In common with the arrangement in GB 1510436, however, this arrangement also requires mechanical fixing of the electronic control unit to the air cleaner assembly.

[0005] It is an object of this invention to provide an improved air cleaner assembly.

[0006] Accordingly, the invention provides an air cleaner assembly suitable for a vehicle, the air cleaner assembly comprising a first chamber through which in use intake air is supplied to a prime mover, a second chamber arranged in use to accommodate an electronic control unit, the chambers being interlinked by at least one inlet means which is arranged to allow a flow of air into the second chamber from the first chamber and the second chamber being provided with at least one outlet means to allow the flow to exit the second chamber, characterised in that the second chamber is defined in such a manner that the electronic control unit is a substantially sliding fit in the second chamber with a clearance being provided between at least a portion of the electronic control unit and at least one wall which defines the second chamber, such that the flow of air can pass substantially freely over at least one surface of the electronic control unit to provide a cooling effect therefor.

[0007] The electronic control unit may be spaced apart from at least a said wall by one or more rib or lug members, so as to provide at least part of the clearance. A said rib or lug member may be included as part of the electronic control unit and may comprise a heat sink member. In another version of the invention, a said rib or lug member may in the alternative or in addition be included as part of a said wall.

[0008] At least one wall of the second chamber and at least one face of the electronic control unit, which face lies in use substantially facing that said wall, may be disposed in non-parallel planes along at least a portion of their facing regions, so as to provide at least part of the clearance.

[0009] The second chamber may further comprise its own lid means, arranged to allow one or more of insertion of, access to, removal of or enclosure of the electronic control unit.

[0010] The second chamber may be substantially sealed in use from the external environment, so as to provide an anti-tamper means and/or weather protection for the electronic control unit. In the alternative, the second chamber may be at least partially unsealed, such that air can be drawn into the second chamber from the external environment.

[0011] The first chamber may be arranged in use to accommodate an air filter for filtering the intake air.

[0012] The flow of air into the second chamber from the first chamber may be substantially unfiltered.

[0013] The outlet means may be in communication with the first chamber and the inlet and outlet means may be arranged such that the air pressure in the first chamber in the region of the inlet means is higher than the air pressure in the region of the outlet means.

[0014] The air cleaner assembly may further comprise a directing means arranged in use to direct a portion of intake air towards the inlet means.

[0015] The invention will now be described by way of example only and with reference to the accompanying drawings, in which:

Figure 1 is an isometric view of part of an air cleaner assembly according to the invention;

Figure 2 is a front view of the air cleaner assembly of Figure 1, showing a partial section along the line A-A;

Figure 3 is a plan view of the air cleaner assembly of Figure 1, showing a partial section along the break-line B-B; and

Figure 4 is an isometric view of an electronic control unit which is, in use, accommodated in the air cleaner assembly of Figures 1 to 3 and is, furthermore, represented in section along the line C-C in an accommodated condition in Figure 3.

[0016] With reference to the figures, an air cleaner assembly 10 includes a first chamber in the form of an air filter box 12, arranged in use to accommodate an air fil-

ter element. The air filter box 12 is shown without a lid and without an air filter element. Intake air is supplied through the filter box 12 to a prime mover (not shown, but could for example comprise an engine).

[0017] The air filter box 12 is moulded from a plastics material in unit construction with a second chamber. The second chamber comprises a box type structure defined by a set of side walls 14a, 14b, 14c, 14d, a bottom wall 14e and its own openable and separable lid 16. Pairs of the side walls 14a, 14b; 14c, 14d are opposed and lie in substantially parallel planes. The second chamber is arranged in use to accommodate an electronic control unit (ECU) 18 and is referred to for convenience as an ECU box 20.

[0018] The air filter box 12 and the ECU box 20 are interlinked by a cooling air inlet passage 22 and a cooling air outlet passage 24. The inlet passage 22 is formed in a region of the air filter box 12 in which in use the intake air is at a higher pressure than it is in the region of the air filter box 12 in which is formed the outlet passage 24. In this manner, a flow of air tends to be drawn through the ECU box 20, at least while the prime mover is operating.

[0019] As can be seen with particular reference to Figures 2 and 4, the ECU 18 is of a substantially wedged shape in cross-section. A rear face 18a includes a series of rib members in the form of heat sinks 180. A front face 18b of the ECU 18 slopes downwardly away from an upper face 18c, which is of a similar width to the gap between side walls 14a, 14b and on which are mounted the ECU connectors 182.

[0020] At its end sides 18d, the ECU 18 is provided with lug members 184, which act as heat sinks whilst also spacing the end sides 18d of the ECU 18 away from the end walls 14c, 14d and the rear wall 14b of the ECU box 20, so as to provide a clearance around the ECU 18 to allow air to flow substantially freely around the end sides 18d and rear face 18a.

[0021] The width of the upper face 18c and a rearward projection of the lugs 184 ensures that the ECU 18 is a substantially sliding fit in the ECU box 20, whilst the sloping nature of the front face 18b ensures that a clearance C is produced between the ECU 18 and the face 14a through which the inlet/outlet passages 22, 24 are defined. The clearance C provides a passage for the air flow between the inlet/outlet passages 22, 24 and this air flow passes across a portion of the front face 18b and provides a cooling effect for it.

[0022] When the ECU 18 is accommodated in the main body of the ECU box 20, the lid 16 is fitted and substantially secured in place, e.g. by snap-fitting, and no mechanical fixing such as a screw or bolt is required between the ECU 18 and the ECU box. Cut-outs 160 are provided on the joint face between the ECU box 20 and the lid 16, to allow cabling (none shown) to enter and leave the ECU box 20 through grommets (none shown) so as to connect the ECU 18 to vehicle wiring (none shown).

[0023] The air flow through the inlet/outlet passages 22, 24 is unfiltered air. This can be tolerated by the ECU 18, because it is a substantially sealed unit. In the embodiment shown, the lid 16 is not environmentally sealed and this allows air to be drawn in from the external environment and this inwardly drawn air supplements the air flow through the inlet/outlet passages 22, 24 such that it adds to the cooling air flow around the ECU 18.

[0024] The invention allows a simplified ECU fitting process to be employed on the vehicle production line. Fitting the ECU 18 is now a case of connecting it to its harness, sliding it into the ECU box 20 and snapping on the lid 16. No sub-assembly operation or mechanical fixing of the ECU 18 to the ECU box 20 are necessary. Access for servicing and/or replacement is also simplified.

[0025] A directing means, e.g. in the form of a vane member (not shown), could be used to create a region of high pressure in the region of the inlet passage 22. The shape of such a vane could also be arranged such that, not only does it create a region of high pressure, but it also tends to guide towards the inlet passage 22 at least a portion of the air entering the air filter box 12.

[0026] Although not shown in the embodiment described above, it would be possible to provide means (e.g. ribs or lugs) on the bottom face 14e of the ECU box 20 or the bottom wall 14e of the ECU 18 itself, which would space the bottom face 18e of the ECU 18 away from the bottom wall 14e of the ECU box 20, thereby allowing air to flow under this face 18e as well as around the others 18a, 18b, 18c, 18d.

[0027] It might also, in a variation to the embodiments described above, prove preferable to orientate the ECU 18 the other way around, such that the face 18a which supports the heat sinks 180 faces the wall 14a which defines the inlet/outlet passages 22, 24, so that the heat sinks 180 are exposed to the greatest air flow.

[0028] In another variation to the invention, if an ECU 18 were to be used which has substantially parallel front and rear faces 18a, 18b, it may prove desirable to form the ECU box 20 with non-parallel faces 14a, 14b, so as to achieve a similar effect to the wedge shaped ECU installation of the embodiment in the specific description above.

[0029] In another variation to the invention, it may prove desirable to environmentally seal the ECU box 20, e.g. by providing a resilient and/or adhesive seal along the joint face between the lid 16 and the rest of the ECU box 20. This might be done if an unsealed ECU 18 were to be used or, perhaps, as a way of providing tamper proofing and/or security for the ECU 18.

Claims

1. An air cleaner assembly (10) suitable for a vehicle, the air cleaner assembly (10) comprising a first

chamber (12) through which in use intake air is supplied to a prime mover, a second chamber (20) arranged in use to accommodate an electronic control unit (18), the chambers (12, 20) being interlinked by at least one inlet means (22) which is arranged to allow a flow of air into the second chamber (20) from the first chamber (12) and the second chamber (20) being provided with at least one outlet means (24) to allow the flow to exit the second chamber (20), characterised in that the second chamber (20) is defined in such a manner that the electronic control unit (18) is a substantially sliding fit in the second chamber (20) with a clearance being provided between at least a portion (18b) of the electronic control unit (18) and at least one wall (14a) which defines the second chamber (20), such that the flow of air can pass substantially freely over at least one surface (18b) of the electronic control unit (18) to provide a cooling effect therefor.

2. An assembly according to Claim 1, wherein the electronic control unit (18) is spaced apart from at least a said wall (14a) by one or more rib or lug members (182, 184), so as to provide at least part of the clearance.

3. An assembly according to Claim 2, wherein a said rib or lug member (180, 184) is included as part of the electronic control unit (18).

4. An assembly according to Claim 3, wherein the said rib or lug member (180, 184) comprises a heat sink member.

5. An assembly according to any one of Claims 2 to 4, wherein a said rib or lug member is included as part of a said wall.

6. An assembly according to any preceding claim, wherein at least one wall (14a) of the second chamber (20) and at least one face (18b) of the electronic control unit (18), which face (18b) lies in use substantially facing that said wall (14a), are disposed in non-parallel planes along at least a portion of their facing regions, so as to provide at least part of the clearance (C).

7. An assembly according to any preceding claim, the second chamber (20) further comprising its own lid means (16), arranged to allow one or more of insertion of, access to, removal of or enclosure of the electronic control unit (18).

8. An assembly according to Claim 7, wherein the second chamber (20) is substantially sealed in use from the external environment, so as to provide an anti-tamper means and/or weather protection for the electronic control unit (18).

9. An assembly according to any one of Claims 1 to 7, wherein the second chamber (20) is at least partially unsealed, such that air can be drawn into the second chamber (20) from the external environment.

10. An assembly according to any preceding claim, wherein the first chamber (12) is arranged in use to accommodate an air filter for filtering the intake air.

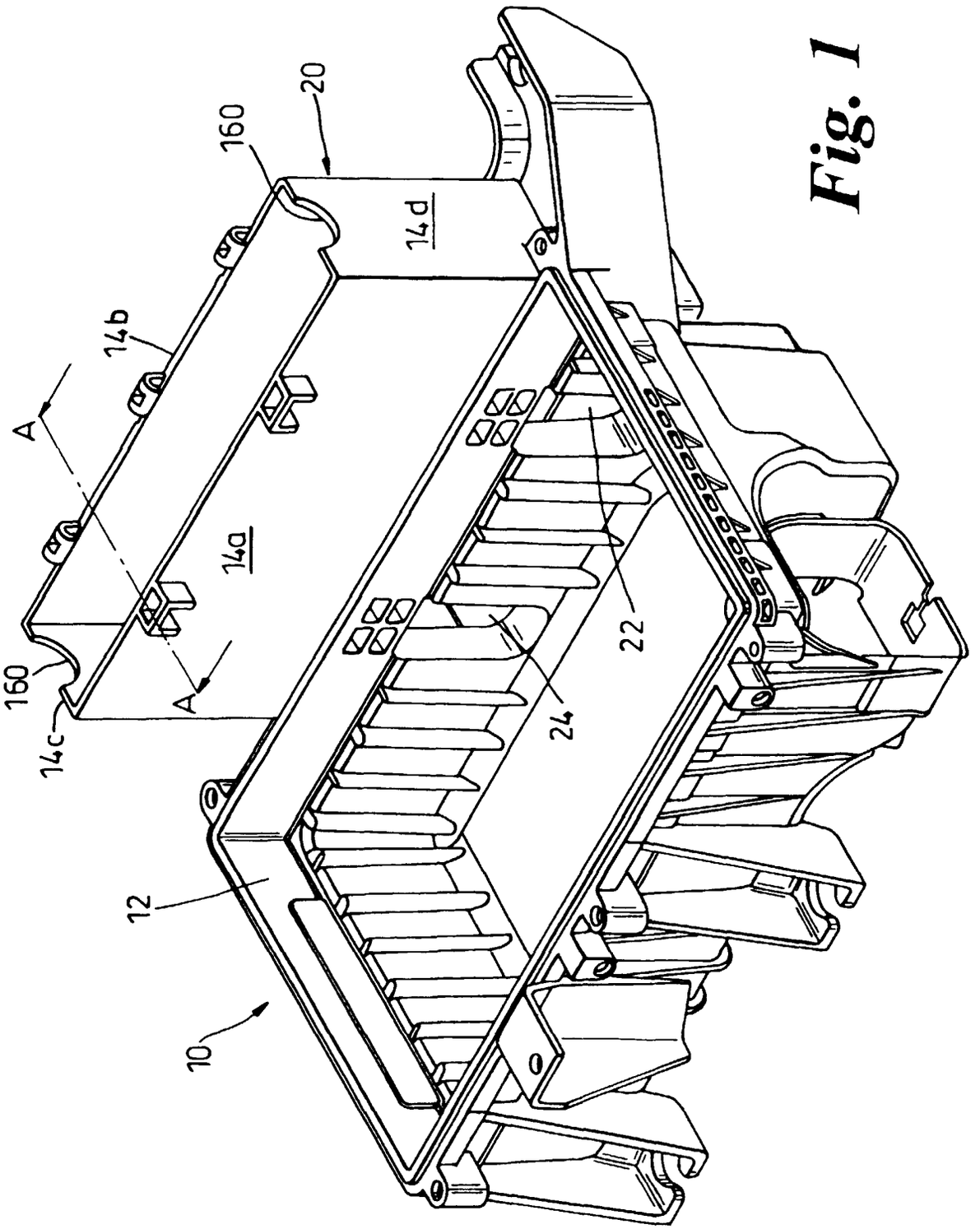

Fig. 1

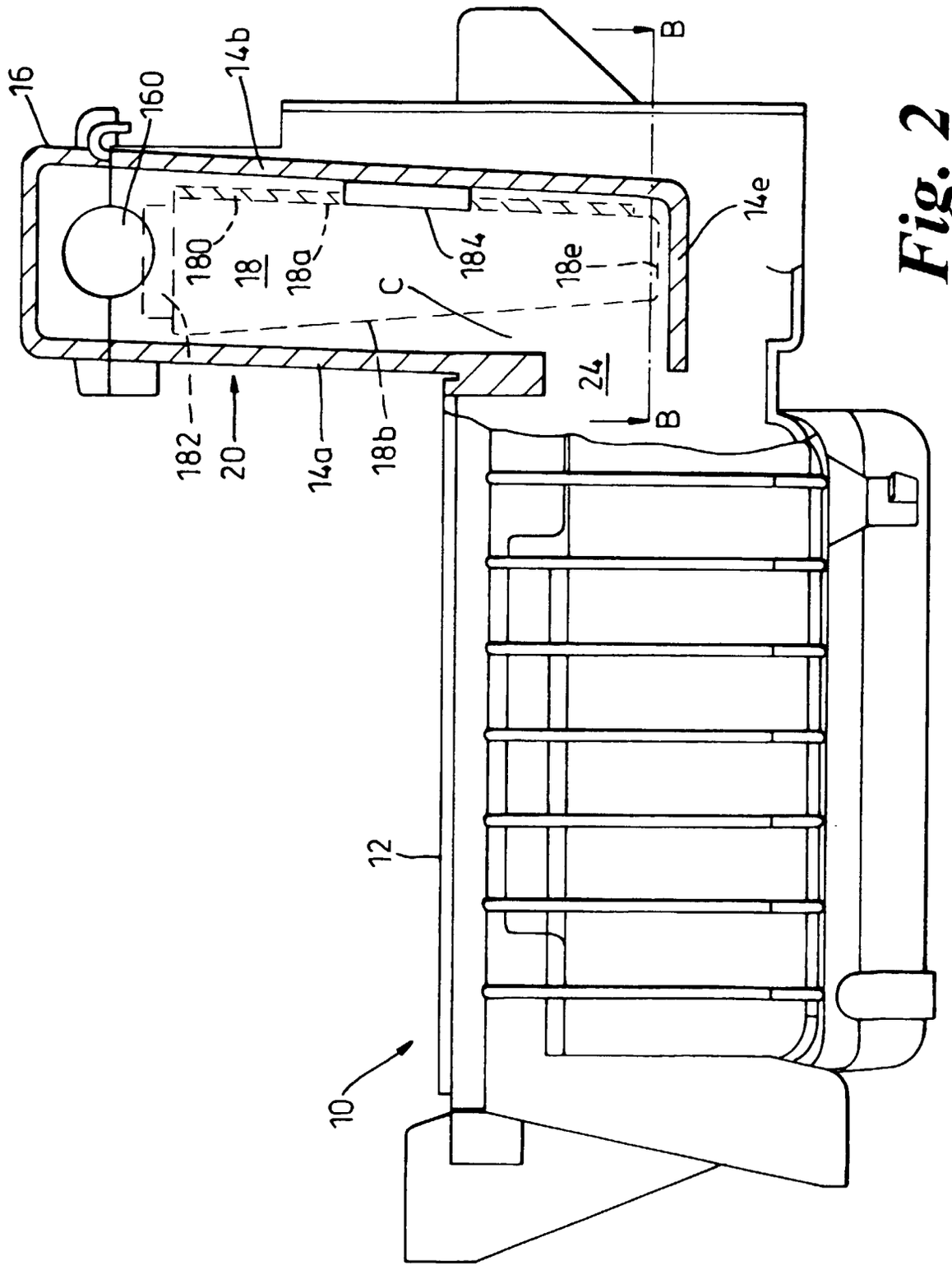

Fig. 2

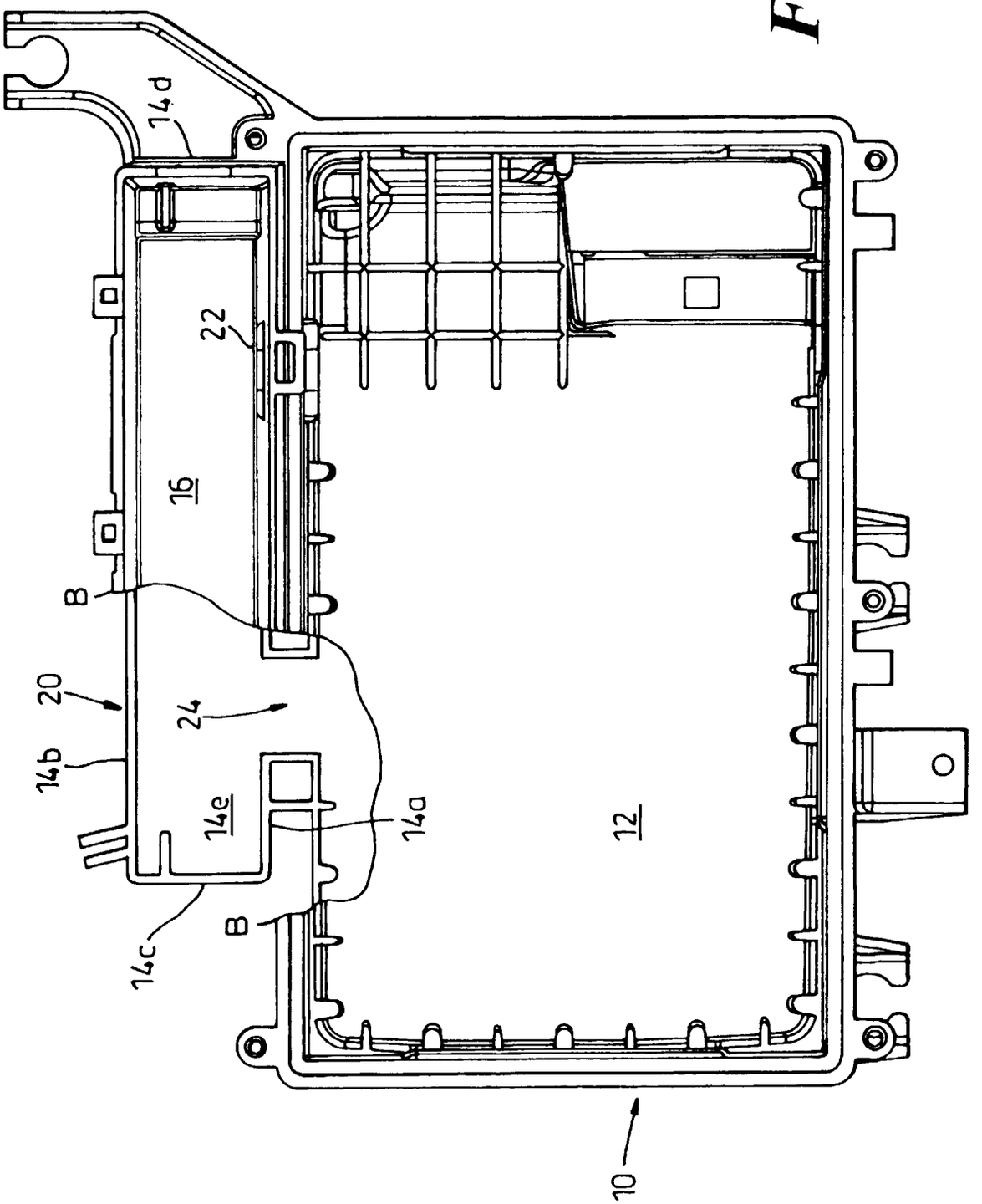

Fig. 3

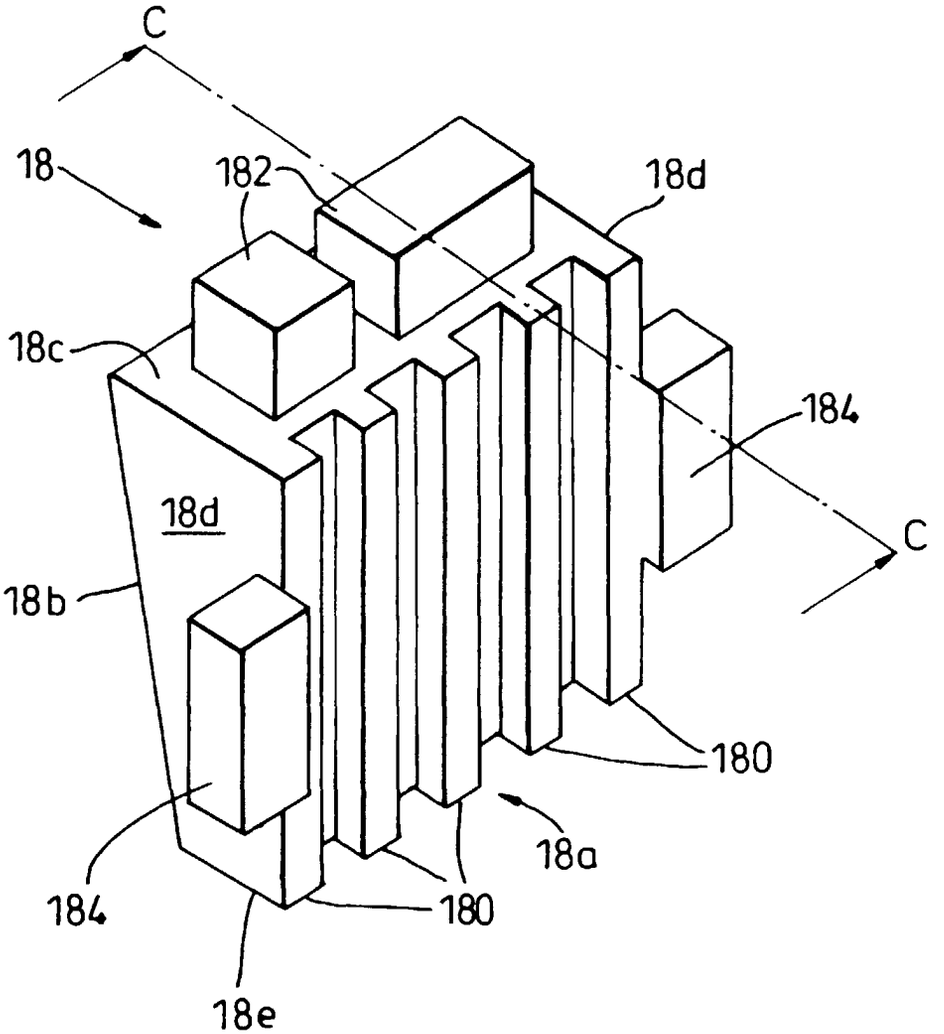

Fig. 4

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Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	2 February 2000	Alconchel y Ungria,J

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