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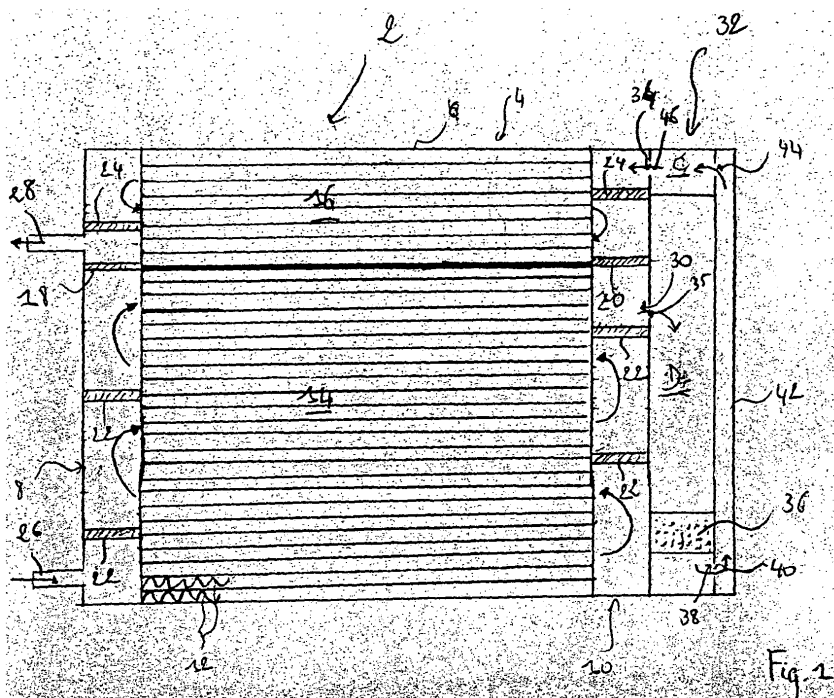
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(54) **Improved tank for a condenser, and corresponding condenser**

(57) The invention proposes a tank for a condenser, comprising a wall member (50) defining an interior space (52) having a drying zone (D) and a connection zone (C). The wall member (50) receives a drying element (38) and has an inlet opening (35) in an upper portion of the drying zone (D) and an outlet opening (40) in the lower portion

of the drying zone (D). The tank (32) further comprises a riser pipe (42) connected at one end to the outlet opening (40) of the drying zone (D) and at another end to an inlet (44) opening of the wall member (50) in the connection zone (C). The riser pipe (42) is located exterior to the interior space (52), for driving a fluid dried in the drying zone (D) to the connection zone (C).



## Description

**[0001]** The invention relates to a tank for a condenser of a cooling circuit of an automotive vehicle.

**[0002]** More specifically, the invention is concerned with a tank comprising a wall member defining an interior space having a drying zone and a connection zone, the wall member receiving a drying element and having an inlet opening in an upper portion of the drying zone and an outlet opening in the lower portion of the drying zone.

**[0003]** Condensers having a core portion and a sub cooling portion are known in the art. Conventionally, the core portion condenses a refrigerant fluid flowing through the condenser, which is then dehydrated or dried in a tank, and further cooled in the sub cooling portion.

**[0004]** This type of condenser is conventionally placed vertically in the vehicle, the refrigerant fluid flowing from top to bottom and the sub cooling portion being thus placed below the core portion.

**[0005]** However, when the vehicle is at a stop, or more generally when the engine idles, the cooling air that has passed through the condenser and the radiator of the vehicle tends to be driven through the sub cooling portion, which results in a lower efficiency of the sub cooling portion.

**[0006]** In order to resolve this problem, condensers having a sub cooling portion on top of the core portion have been proposed. In those condensers, the fluid circulation is from bottom to top, and the fluid dried in the tank has to be driven up to the sub cooling portion.

**[0007]** Several solutions have been adopted, ranging from including an inner duct in the tank for elevating the dehydrated refrigerant, to using an outer duct.

**[0008]** However, these solutions lack industrial manufacturability, demand specific designs, and are not entirely compatible with former condensers.

**[0009]** The invention aims at improving the situation.

**[0010]** To this end, a tank for a condenser is proposed, comprising a wall member defining an interior space having a drying zone and a connection zone, said wall member receiving a drying element and having an inlet opening in an upper portion of the drying zone and an outlet opening in the lower portion of the drying zone. According to this invention, the tank further comprises a riser pipe connected at one end to the outlet opening of the drying zone and at another end to an inlet opening of the wall member in the connection zone, and the pipe is located exterior to the interior space, for driving a fluid dried in the drying zone to the connection zone.

**[0011]** The riser pipe may be integral with the wall member, and it may also be alongside to the wall member. More particularly, the wall member and the riser pipe may be generally cylindrical.

**[0012]** This design is advantageous because it allows manufacturing a tank which contains all the elements for driving the dried fluid to the sub cooling portion of the condenser via the connection zone.

**[0013]** The condenser to be equipped with this tank

may thus be designed almost independently of the tank, except for the connection. This allows for great design flexibility. Furthermore, this type of tank may be produced automatically and in an industrial manner, as opposed to the custom tanks of the prior art.

**[0014]** In one embodiment, the tank may comprise a baffle disposed transversely in the wall member for separating the drying zone and the connection zone in a sealed manner. The baffle may be brazed or soldered to the wall member and the riser pipe.

**[0015]** In another embodiment, the tank may comprise a thru pipe disposed transversely through the wall member, the thru pipe being connected to the riser pipe at one end, and protruding transversely from the wall member at the other end. The thru pipe may be brazed or soldered to the wall member and the riser pipe.

**[0016]** The wall member may have an outlet opening in the connection zone, for connection to a header of a heat exchanger, and the wall member and the riser pipe may be extruded, while the wall member may be closed by a cap in the connection zone.

**[0017]** The invention further concerns a condenser comprising a core portion and a sub-cooling portion disposed on top of said core portion, as well as a tank described above. In this condenser, an outlet opening of the core portion is connected to the inlet opening of the drying zone, and an inlet opening of the sub-cooling portion is connected to an outlet of the connection zone of the tank.

**[0018]** This condenser may comprise a beam of condensing tubes received at both ends in respective headers of the condenser. Each header may comprise respective flanges for defining the core portion and the sub-cooling portion, one of the headers further comprising connection means for inlet and outlet of fluid in the condenser, and the other header further comprising the outlet opening of the core portion, and the inlet opening of the sub-cooling portion.

**[0019]** The tank may be disposed parallel to the other header, and attached to the condenser by means of hooks gripping the other header, or by brazing.

**[0020]** Other characteristics and advantages of the invention will appear from the following description of drawings, given by way of example and in a non limitative way.

**[0021]** On the drawings :

- figure 1 shows a schematic cross sectional view of a first embodiment of a condenser according to the invention ;
- figure 2 shows a detailed view of part of figure 1 ; and
- figure 3 shows a general cross-sectional view of an alternative of the condenser of figure 1.

**[0022]** The drawings and the following description essentially comprise elements having a defining character. Thus, they may serve to enhance the comprehension of

the invention, but also to help defining it, in some cases.

**[0023]** Figure 1 shows a general schematic view of a condenser 2 according to the invention.

**[0024]** Condenser 2 comprises a beam 4 of condensing tubes 6 disposed parallel to each other and received at each of their ends in two headers 8 and 10. Between tubes 6, fins 12 are arranged, which enhance the heat exchange surface.

**[0025]** Condenser 2 comprises two portions for the refrigerant fluid flowing through it. A first portion, hereinafter named core portion 14, is arranged in the lower part of condenser 2. The core portion 14 is used to condense the refrigerant fluid after its expansion in the cooling cycle of the vehicle.

**[0026]** A second portion, hereinafter named sub cooling portion 16, is arranged on top of the core portion 14. The sub cooling portion 16 is used to cool down the condensed fluid output from the core portion 14.

**[0027]** Core portion 14 and sub cooling portion 16 are defined by means of flanges 18 and 20 arranged at the same level in headers 8 and 10.

**[0028]** Core portion 14 is defined by the tubes 6 and the part of headers 8 and 10 which are below flanges 18 and 20. Sub cooling portion 16 is defined by the tubes 6 and the part of headers 8 and 10 which are above flanges 18 and 20.

**[0029]** Headers 8 and 10 further comprise flanges 22 in the core portion 14 and 24 in the sub cooling portion 16, which help defining a fluid path in condenser 2.

**[0030]** Other means than flanges may be used to define the core portion 14 and the sub cooling portion 16, and to define a refrigerant fluid path in condenser 2.

**[0031]** When received in a vehicle, condenser 2 is disposed substantially vertically, thus headers 8 and 10 are also disposed vertically in the vehicle.

**[0032]** Header 8 comprises a refrigerant fluid inlet 26 in the core portion 14, and a refrigerant fluid outlet 28 in the sub cooling portion 16 for receiving and outputting the refrigerant fluid.

**[0033]** Header 10 comprises a condensed fluid outlet 30 for outputting the refrigerant fluid condensed in core portion 14 in a drying tank 32, and a dried fluid inlet 34 for inputting the dried refrigerant fluid in the sub cooling portion 16.

**[0034]** Tank 32 comprises a drying zone D and a connection zone C. Drying zone D comprises a refrigerant fluid inlet 35 for receiving the refrigerant fluid output from condensed fluid outlet 30. In a lower part of drying zone D, tank 32 contains a drying element 36 for drying the condensed refrigerant fluid output from the core portion 14.

**[0035]** Drying zone D further comprises a dried fluid outlet 38 connected to an end 40 of a riser pipe 42 for driving the dried fluid to a dried fluid inlet 44 of the connection zone C. Connection zone C further comprises a fluid outlet 46 connected to the dried fluid inlet 34 of header 10.

**[0036]** The movement of the refrigerant fluid in con-

denser 2 is outlined by the arrows of figure 1 :

- refrigerant fluid enters inlet 26 of header 8, flows from bottom to top in core portion 14 and is condensed along the path defined by flanges 22 ;
- condensed refrigerant fluid is output from header 10 by outlet 30 via inlet 35 into tank 32, where it is dried by drying element 36 in the drying zone D ;
- dried refrigerant fluid is driven through outlet 38 of the drying zone D into riser pipe 42, up to the connection zone C via inlet 44 ;
- dried refrigerant fluid is output from tank 32 into the sub cooling portion 16 by outlet 46, via inlet 34 of header 10 ;
- dried refrigerant fluid is cooled along the path defined by flanges 24, and output of the condenser by outlet 28.

**[0037]** The structure of tank 32 appears more clearly on figure 2. Tank 32 comprises a wall member 50, which is essentially cylindrical. Wall member 50 defines an interior space 52 containing the drying zone D and the connection zone C. Interior space 52 is closed in the connection zone C by a cap 54. Riser pipe 42 has the same cylindrical shape as wall member 50, and is also closed in the region of the connection zone C by a cap 58.

**[0038]** Riser pipe 42 and wall member 50 are integral and are made by means of extrusion. Riser pipe 42 and wall member 50 are made of aluminium, and could be made of steel or any aluminium or steel alloy. Riser pipe 42 and wall member 50 could also be two different parts machined in a different manner.

**[0039]** Drying zone D and connection zone C are separated by a baffle 56. Baffle 56 is generally made of aluminium, and is brazed to the wall member 50 during the brazing of condenser 2, in order to realize a sealed separation of drying zone D and connection zone C. Baffle 56 may also be soldered to wall member 50.

**[0040]** Tank 32 is disposed parallel to header 10, such that inlet 34 (respectively outlet 30) of header 10 and outlet 46 (respectively inlet 35) of tank 32 face each other and are adjacent to each other. A duct portion 60 penetrates these openings for sealing the connection between tank 32 and header 10. Duct portion 60 is brazed to both tank 32 and header 10 during the brazing of condenser 2. Tank 32 is further attached to header 10 by means of hooks 62, which grip the outer surface of header 10.

**[0041]** Figure 3 shows another embodiment of the condenser, in a view similar to that of figure 2.

**[0042]** In this embodiment, the connection zone C is realized by means of a thru pipe 64 which is disposed transversely to the wall member 50, and penetrates header 10 through inlet 34 and outlet 46 at one end, and inlet 44 at the other end. Thru pipe 64 is thus connected

to riser pipe 42 at one end, and protrudes transversely from wall member 50 at the other end.

[0043] Thru pipe 64 is brazed in place during the brazing of condenser 2, which insures the sealed separation between connection zone C and drying zone D. The drying zone D corresponds to the entire interior space 52 that is not occupied by thru pipe 64.

[0044] Moreover, wall member 50 comprises an unused opening 66 in the lower part of drying zone D. Opening 66 has the same diameter as openings 35 and 46. The distance between openings 35 and 46 is the same as that between openings 35 and 66.

[0045] No refrigerant fluid leak may happen, because the outer surface of wall member 50 is covered with brazing paste, for brazing to header 10 during the brazing of condenser 2. This brazing further insures attachment of tank 32 to header 10.

[0046] This way, it is possible to industrially manufacture tank 32 with periodical openings of the type of openings 35, 46 and 66. Only those which are placed in front of a homologous opening in header 10 will actually be functional. The same design may be used with riser pipe 42.

[0047] The description of the above embodiments is meant to enhance the comprehension of the invention. However, the scope of the invention should not be limited by this description, and the man skilled in the art will be aware of all the alternatives within the invention.

## Claims

1. A tank for a condenser, comprising a wall member (50) defining an interior space (52) having a drying zone (D) and a connection zone (C), said wall member (50) receiving a drying element (38) and having an inlet opening (35) in an upper portion of the drying zone (D) and an outlet opening (40) in the lower portion of the drying zone (D), **characterized in that** the tank (32) further comprises a riser pipe (42) connected at one end to the outlet opening (40) of the drying zone (D) and at another end to an inlet (44) opening of the wall member (50) in the connection zone (C), and that said riser pipe (42) is located exterior to the interior space (52), for driving a fluid dried in the drying zone (D) to the connection zone (C).
2. A tank according to claim 1, **characterized in that** the riser pipe (42) is integral with the wall member (50).
3. A tank according to claim 1 or 2, **characterized in that** said riser pipe (42) is alongside to said wall member (50).
4. A tank according to any of claims 1 to 3, **characterized in that** said wall member (50) and said riser pipe (42) are generally cylindrical.

5. A tank according to any of claim 1 to 4, **characterized in that** it comprises a baffle (56) disposed transversely in the wall member (50) for separating said drying zone (D) and said connection zone © in a sealed manner.
6. A tank according to claim 5, **characterized in that** said baffle (56) is brazed or soldered to said wall member (50) and said riser pipe (42).
7. A tank according to any of claims 1 to 4, **characterized in that** it comprises a thru pipe (64) disposed transversely through the wall member (50), said thru pipe (64) being connected to said riser pipe (42) at one end, and protruding transversely from said wall member (50) at the other end.
8. A tank according to claim 7, **characterized in that** said thru pipe (64) is brazed or soldered to said wall member (50) and said riser pipe (42).
9. A tank according to any of the preceding claims, **characterized in that** said wall member (50) has an outlet opening (46) in the connection zone, for connection to a header (10) of a condenser (2).
10. A tank according to any of the preceding claims, **characterized in that** said wall member (50) and said riser pipe (42) are extruded.
11. A tank according to any of the preceding claims, **characterized in that** said wall member (50) is closed by a cap (54) in the connection zone (C).
12. A condenser comprising a core portion (14) and a sub-cooling portion (16) disposed on top of said core portion (14), **characterized in that** it further comprises a tank (32) according to any of the preceding claims, and that an outlet opening (30) of the core portion (14) is connected to the inlet opening (35) of the drying zone (D) of the tank (32), and that an inlet opening (34) of the sub-cooling portion (16) is connected to an outlet (46) of the connection zone (C) of the tank (32).
13. A condenser according to claim 12, **characterized in that** it comprises a beam (4) of condensing tubes (6) received at both ends in respective headers (8, 10), each header (8, 10) comprising respective flanges (18, 20) for defining said core portion (14) and said sub-cooling portion (16), one of said header (8) further comprising connection openings (26, 28) for inlet and outlet of fluid in the condenser (2), and the other header (10) further comprising the outlet opening (30) of the core portion (14), and the inlet opening (34) of the sub-cooling portion (16).
14. A condenser according to any of the preceding

claims, **characterized in that** said tank (32) is disposed parallel to said other header (10).

15. A condenser according to any of the preceding claims, **characterized in that** the tank (32) is attached to the condenser (2) by means of hooks (62) gripping said other header (10). 5
16. A condenser according to any of the preceding claims, **characterized in that** the tank (32) is brazed to said other header (10). 10

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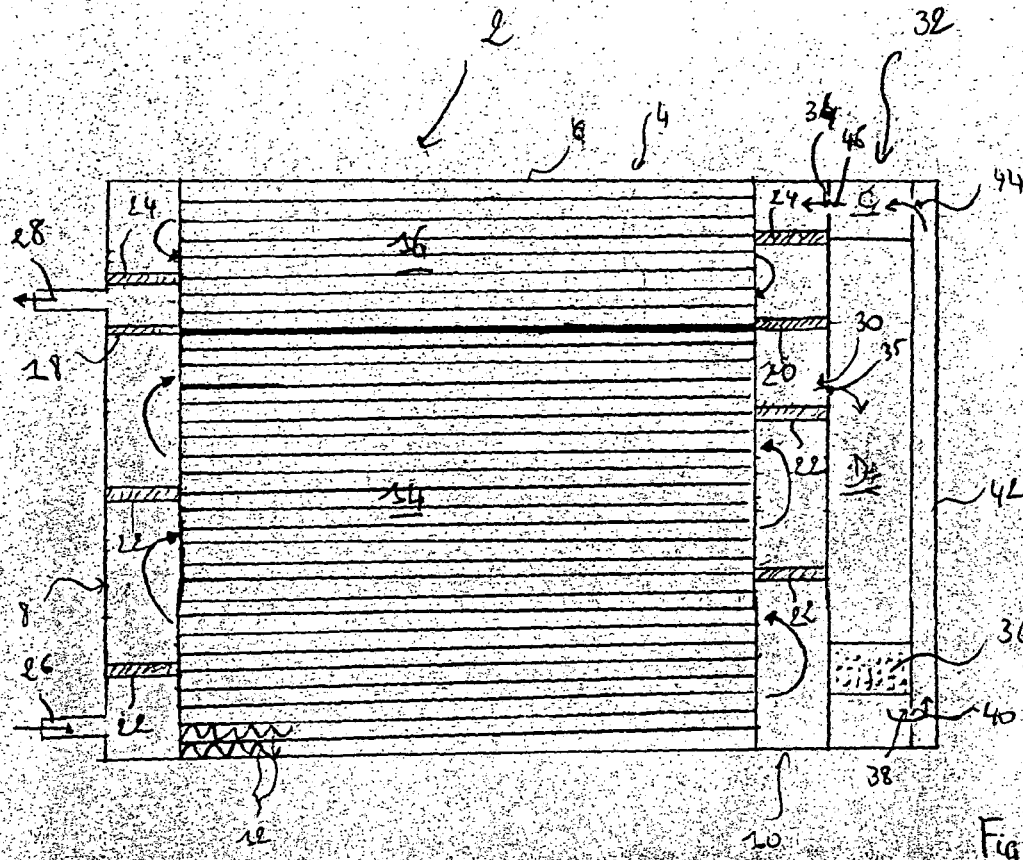


Fig. 1

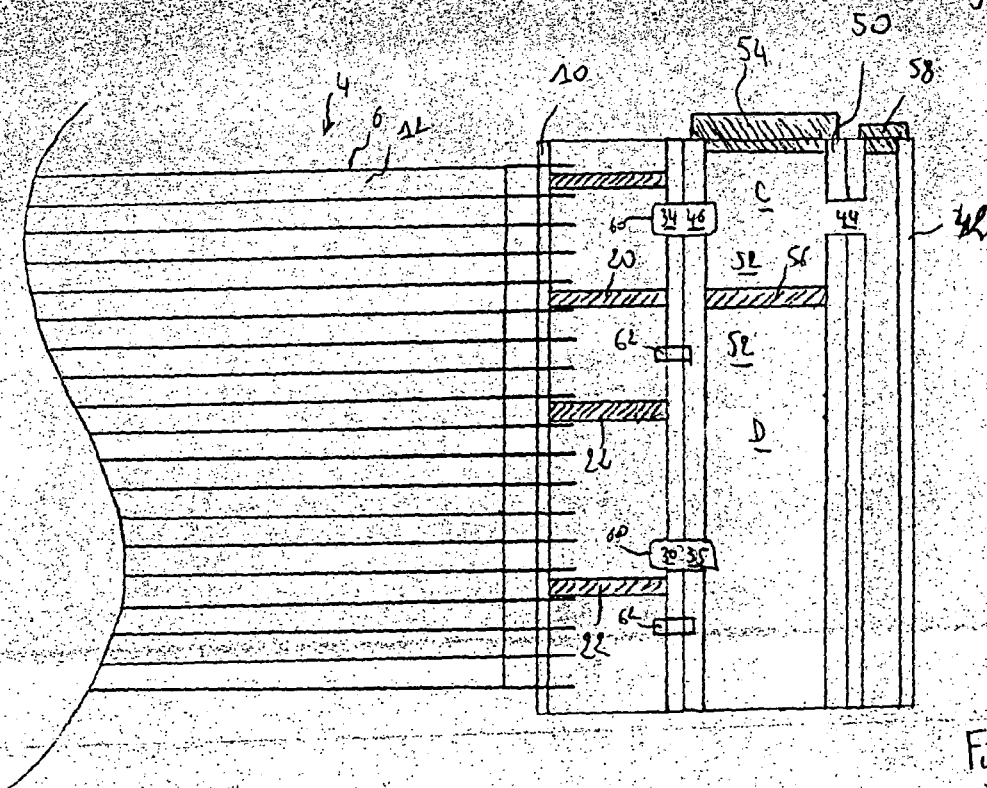
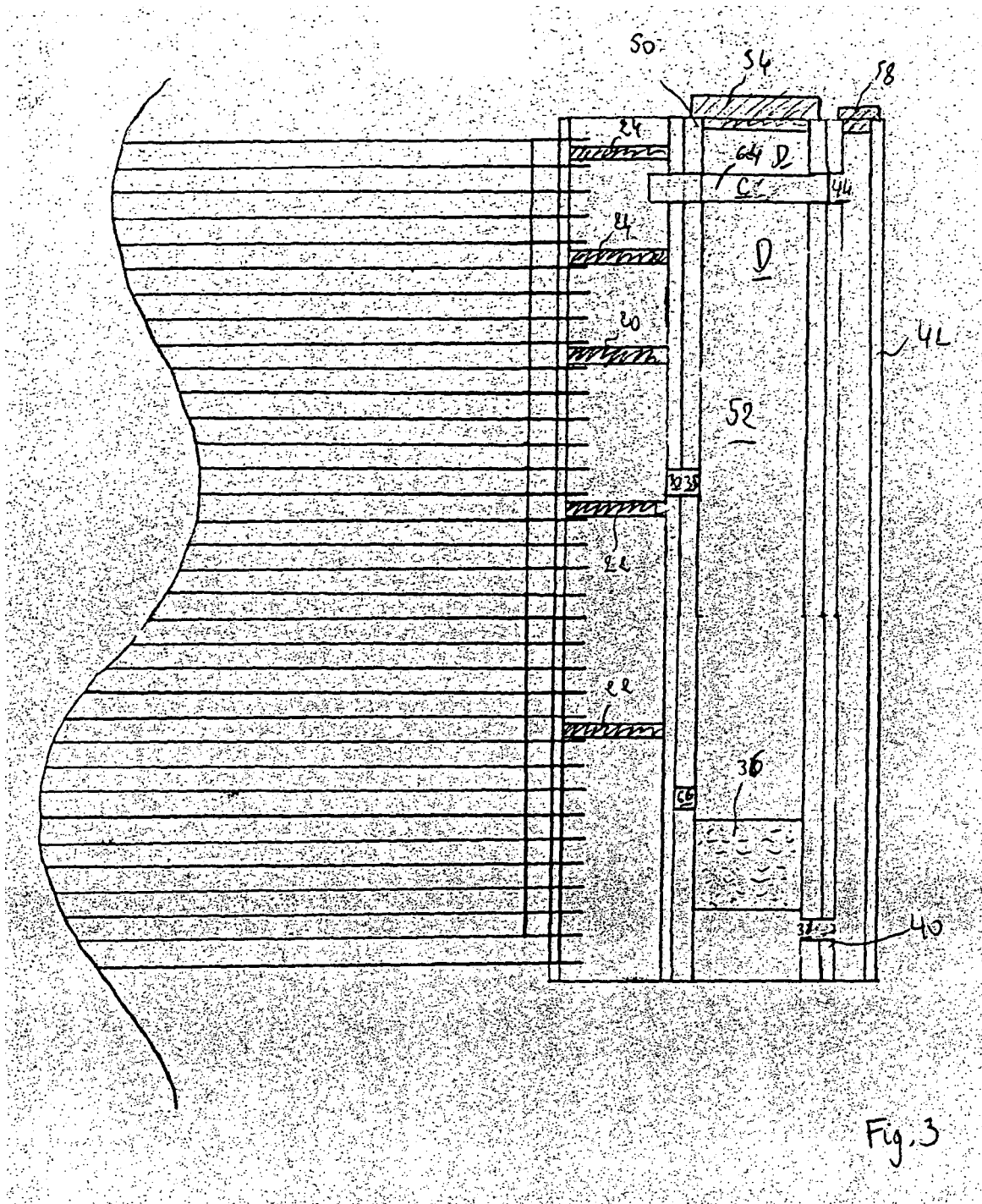


Fig. 2





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Application Number  
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| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                    |                                                                                                                                                        |                                                                                                                                                                                                                                                                                       |                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| Category                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                                                                          | Relevant to claim                                                                                                                                                                                                                                                                     | CLASSIFICATION OF THE APPLICATION (IPC)     |
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| Y                                                                                                                                                                                                                                                      | * paragraphs [0147] - [0167], [0186];<br>figures 27,29,39,41 *                                                                                         | 15                                                                                                                                                                                                                                                                                    |                                             |
| Y                                                                                                                                                                                                                                                      | -----<br>WO 2004/065881 A (VALEO THERMIQUE MOTEUR<br>[FR]; HUBERT SYLVAIN [FR]; CORMET NICOLAS<br>[FR];) 5 August 2004 (2004-08-05)<br>* figures 1-3 * | 15                                                                                                                                                                                                                                                                                    |                                             |
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| A                                                                                                                                                                                                                                                      | -----<br>US 5 228 315 A (NAGASAKA YOSHIKIYO [JP] ET<br>AL) 20 July 1993 (1993-07-20)<br>* the whole document *                                         | 10                                                                                                                                                                                                                                                                                    | TECHNICAL FIELDS<br>SEARCHED (IPC)<br>F25B  |
| A                                                                                                                                                                                                                                                      | -----<br>DE 199 12 381 A1 (BEHR GMBH & CO [DE])<br>21 September 2000 (2000-09-21)<br>* column 2, line 56 - column 3, line 37;<br>figure 1 *            | 1,4,5,9,<br>12-14                                                                                                                                                                                                                                                                     |                                             |
| A                                                                                                                                                                                                                                                      | -----<br>JP 2004 077053 A (DENSO CORP)<br>11 March 2004 (2004-03-11)<br>* figures 1,2 *                                                                | 1,4,5,9,<br>12-14                                                                                                                                                                                                                                                                     |                                             |
| The present search report has been drawn up for all claims                                                                                                                                                                                             |                                                                                                                                                        |                                                                                                                                                                                                                                                                                       |                                             |
| Place of search<br>The Hague                                                                                                                                                                                                                           |                                                                                                                                                        | Date of completion of the search<br>14 February 2007                                                                                                                                                                                                                                  | Examiner<br>Léandre, Arnaud                 |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document |                                                                                                                                                        | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>.....<br>& : member of the same patent family, corresponding document |                                             |

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