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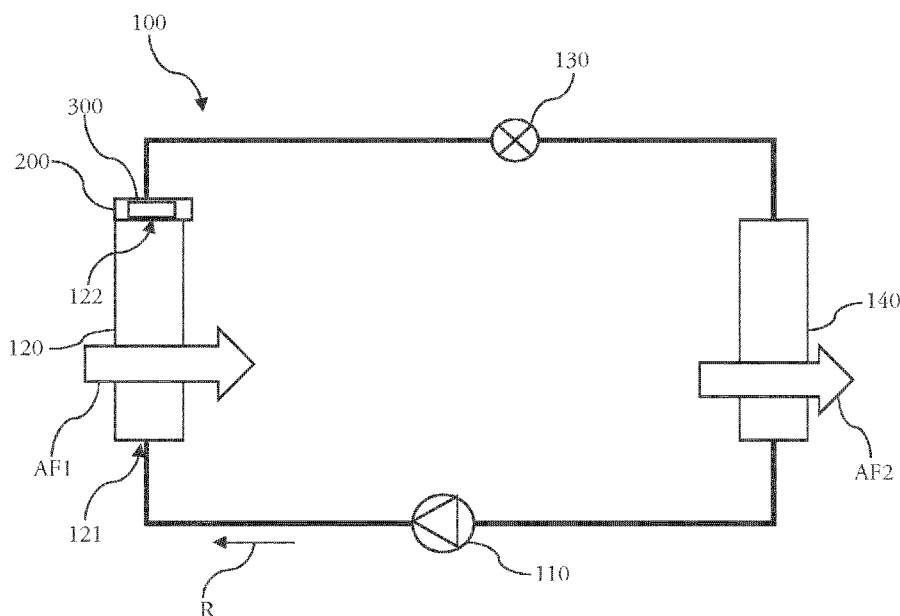


Fig. 1

(57) Abstract: The invention relates to a heat exchanger (120) for a refrigerant fluid loop (too), the heat exchanger (120) comprising at least one inlet (121) configured to allow a refrigerant fluid (R) to enter in the heat exchanger (120), and at least one outlet (122) configured to allow the refrigerant fluid (R) to exit the heat exchanger (120), the heat exchanger (120) comprising a filter (300) configured to filter the refrigerant fluid (R), characterized in that the filter (300) is arranged at the outlet (122) of the heat exchanger (120).



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## HEAT EXCHANGER WITH FILTER, FOR REFRIGERANT FLUID LOOP

The present invention concerns the domain of heat exchangers designed for refrigerant fluid loops. More specifically, the present invention relates to devices for filtering the refrigerant fluid that flows through such heat exchangers.

5 A refrigerant fluid loop generally comprises at least two heat exchangers, at least one compressor and at least one expansion device. The compressor and the expansion device are both fragile and comprise movable elements that can easily break. It is therefore important that only the refrigerant fluid enters this compressor or the expansion device. In order to achieve that goal, it is already  
10 known to filter the refrigerant fluid before it reaches one of these components.

However, some particles may be inside heat exchangers, for instance due to manufacturing processes or default in the cleaning system of such heat exchanger. The cleaning of such particles appears to be really expensive and complex. And even with all the care that can be given to this cleaning, some of those particles,  
15 especially particles that have a diameter smaller than  $60\mu\text{m}$  can remain in those heat exchangers and can then be dragged by the refrigerant fluid to finally damage the compressor, the expansion device or any other element in which this refrigerant fluid could flow.

As a result, automotive suppliers are more and more concerned with this  
20 filtration, and they aim to filter even smaller particles than what is already filtered.

The present invention solves at least this issue, by providing a heat exchanger for a refrigerant fluid loop, the heat exchanger comprising at least one inlet configured to allow a refrigerant fluid to enter in the heat exchanger, and at least one outlet configured to allow the refrigerant fluid to exit the heat exchanger, the  
25 heat exchanger comprising a filter configured to filter the refrigerant fluid. According to the invention, the filter is arranged at the outlet of the heat exchanger.

Such filter is located at the outlet where a pipe of the refrigerant fluid loop is attached to heat exchanger. When the heat exchanger comprises an integrated

receiver dryer, the filter is separated from any filtering means that could be located in the integrated receiver dryer, and is located downstream this integrated receiver dryer.

According to the invention, the filter is configured to filter particles  
5 presenting a certain diameter, for example above 30 $\mu$ m, preferably above 50 $\mu$ m, that can be dragged by the refrigerant fluid along its flow through the heat exchanger. As a result, those particles are prevented to reach any other element of the refrigerant fluid loop.

According to a feature of the invention, the heat exchanger comprises a block  
10 arranged at the outlet of the heat exchanger, the block comprising a path configured to allow a circulation of the refrigerant fluid inside the block, such path extending between the outlet of the heat exchanger and an orifice of the block, such orifice being configured to allow the refrigerant fluid to exit the block, wherein the block is provided with at least one opening configured to allow the  
15 insertion of the filter inside the block. For example, the block can be welded or brazed to the heat exchanger, especially to the header tank. As a result, the path arranged inside the block directly extends the outlet of the heat exchanger in order to make sure that all the refrigerant fluid that exits the heat exchanger reaches the path of the block. Arranging the filter at the outlet of the heat exchanger allows a  
20 filtration of the particles that can remain in it, for instance due to manufacturing process, that are otherwise complex to clean. As the filter is pushed into the block through the opening, it can easily be removed and changed or cleaned, when needed.

According to the invention, the block comprises a cap configured to close the  
25 opening. According to a feature of the invention, the cap comprises a first portion configured to secure the cap to the block and a second portion configured to close the opening through which the filter is inserted in the block. In other words, the shape and the dimensions of the second part are similar, or substantially similar, to the shape and the dimensions of the opening. For example, the first portion of  
30 the cap can be screwed to the block.

According to the invention, the filter extends, at least partially, in the path

arranged in the block. This filter is arranged in such a way that the refrigerant fluid enters the filter flowing along a first direction and exits the filter along a second direction, the first direction intersecting the second direction. Optionally, the first direction and the second direction are perpendicular.

5           The path comprises at least a first part, a second part substantially parallel to the first part, and a third part connecting the first part with the second part, the third part intersecting the first part and the second part. According to a specific embodiment of the present invention, the third part extends perpendicularly to the first part and the second part. Additionally, the path can comprise a fourth part  
10 connected to the second part, this fourth part intersecting the second part. Alternatively, the fourth part can extend perpendicularly to the second part. In other words, the second part, the third part and the fourth part form a U-shape wherein the base is formed by the third part and wherein the branches are respectively formed by the second and the fourth parts.

15           According to a first embodiment of the present invention, the filter is arranged at a junction between the second part and the third part. According to this first embodiment, the filter can extend mainly parallel to the second part. Alternatively, the filter can, according to this first embodiment, extend mainly parallel to the third part.

20           According to a second embodiment, the filter is arranged at a junction between the second part and the fourth part, and the filter extends mainly parallel to the fourth part.

          Depending on the embodiment according to which the invention is realised, it is understood that the opening through which the filter is inserted in the block is  
25 arranged on different part of this block. In any case, this opening is arranged on order for the filter to be pushed into the path arranged in the block.

          The filter comprises a frame in which at least one aperture is realized, the aperture being closed by a meshed element. For example, this meshed element can be made of synthetic material. Alternatively, the meshed element can be made of  
30 metal. Obviously, the size of this meshed element determines the size of the

particles that are retained by the filter and according to the invention, this meshed element is configured to retain particles presenting a certain diameter, for example larger than 50µm. For example, the filter can have a cylindrical shape with a circular cross section.

5           According to the invention, the filter extends mainly along a longitudinal axis, the filter comprising a first end and a second end along this longitudinal axis, and the filter comprises a collar arranged at its first end, this collar being configured to seal the opening through which the filter can be inserted in the block. More precisely, this collar is arranged between the block and the cap, and  
10 especially between the block and the second portion of the cap. For example, the collar can be overmolded on the first end of the filter. As a result, it is to be understood that the filter is inserted in the path arranged in the block by its second end.

          According to another feature of the present invention, a sealing device is  
15 arranged between the second end of the filter and a wall defining the path. More precisely, the sealing device is arranged between an outer periphery of the filter and the wall defining the path arranged in the block. In other words, this sealing device is designed to be in contact both with the wall defining the path and with the outer periphery of the filter. Advantageously, when the filter comprises both  
20 the collar and the sealing device, it is understood that all the refrigerant fluid that flows through the path of the block also flows through the filter. Consequently, thanks to the invention, all the refrigerant fluid that exit the heat exchanger is filtered by this filter and none of the small particles it could have dragged will reach the rest of the refrigerant fluid loop the heat exchanger is designed for,  
25 protecting the other elements of such refrigerant fluid loop.

          For example, the sealing device can be an O-ring. Alternatively, the sealing device can comprise at least one tooth realized on an outer periphery of the frame of the filter. For instance, the at least one tooth and the outer periphery of this frame form a single piece, that is to say that the outer periphery of the frame and  
30 the at least one tooth cannot be separated without damaging one of them. According to a specific embodiment of the present invention, the sealing device comprises three teeth, all of those teeth extending all around the outer periphery of

the frame of the filter and the wall defining the path.

According to an aspect of the invention, the block is made of a single piece. In other words, according to this aspect of the invention, the block forms a monobloc piece and the elements that are part of it cannot be separated without damaging at least one of them. Such a monobloc piece may be attached to the header tank of the heat exchanger, for example by welding or brazing.

According to another aspect of the invention, a duct can be layered between the outlet and the block. To put it in another way, the connection between the block and the outlet of the heat exchanger can be indirect, allowing the block to be placed away from the heat exchanger, without reducing the efficiency of the filtration.

The present invention also concerns a refrigerant fluid loop comprising at least one compressor, a first heat exchanger, one expansion device, and a second heat exchanger, wherein at least the first heat exchanger is realized according to the present invention.

The present invention also relates to a motor vehicle comprising at least one refrigerant fluid loop comprising at least one heat exchanger according to the present invention. According to a specific application of the invention, the heat exchanger can be used as a condenser, that is to say that this heat exchanger is configured to allow the refrigerant fluid that flows through it to cool and, as a result, to liquefy.

Other features, details and advantages of the invention can be inferred from the specification of the invention given hereunder. Various embodiments are represented in the figures wherein:

-figure 1 is a schematic representation of a refrigerant fluid loop comprising at least one heat exchanger according to the invention ;

- figure 2 is a perspective view of a block comprising a filter, the block being designed to be connected to the heat exchanger according to the invention ;

- figure 3 is a perspective view of the filter comprised in the block illustrated

on figure 2 ;

- figure 4 is a cross-section view of the block illustrated on figure 2, the figure making visible the filter arranged into said block according to a first embodiment of the invention ;

5       - figure 5 is a cross-section view of the block which comprises the filter, according to a variant of the first embodiment of the invention illustrated on figure 4 and wherein the filter is represented in a schematic manner ;

10       - figure 6 is a cross-section view of the block illustrated on figure 2, the figure making visible the filter arranged into said block according to a second embodiment of the invention, this filter being illustrated in a schematic manner.

Figure 1 is a schematic view of a refrigerant fluid loop 100 intended to be accommodated in a motor vehicle. This refrigerant fluid loop 100 comprises at least a compressor 110 configured to increase the pressure of a refrigerant fluid R circulating through the loop 100, a first heat exchanger 120 configured to  
15 undertake a heat exchange between the refrigerant fluid R and a first airflow AF1, an expansion device 130 configured to decrease the pressure of the refrigerant fluid R and a second heat exchanger 140 configured to undertake a heat exchange between the refrigerant fluid R and a second airflow AF2. For instance, the first  
20 airflow AF1 is taken outside the motor vehicle in which the refrigerant fluid loop 100 is accommodated, and the second airflow AF2 is reserved to be sent in a passenger compartment of said motor vehicle.

According to the illustrated embodiment, the first heat exchanger 120 is realized according to the invention and comprises a block 200 in which, as explain  
25 in more details below, a filter 300 is arranged. According to the invention, this filter is located at an outlet 122 of the heat exchanger. As illustrated, the block 200 is arranged after the first heat exchanger 120 along a flowing direction of the refrigerant fluid R, this flowing direction being illustrated by the arrow R.

First, the refrigerant fluid R exits the compressor 110 in a gaseous state and reaches the first heat exchanger 120, and more precisely it reaches an inlet 121 of  
30 the first heat exchanger 120. Once the refrigerant fluid R has entered the first heat

exchanger 120, a transfer of calories is undertaken between said refrigerant fluid R circulating in this first heat exchanger 120 and the first airflow AF1 that flows through it. More precisely, the refrigerant fluid R gives calories to the first airflow AF1 and liquefies. In other words, the first heat exchanger 120 acts, in this particular example, as a condenser. As a result, the refrigerant fluid R exits the first heat exchanger 120 in a liquefied state and reaches the block 200 wherein it is filtered by the filter 300. In other words, it is to be understood that the block 200 is connected on one hand to an outlet 122 of the first heat exchanger 120 configured to allow the refrigerant fluid R to exit said first heat exchanger 120 and on the other hand to a pipe 101 of the refrigerant fluid loop 100. Then the refrigerant fluid R goes through the expansion device 130 in which its pressure is reduced before it reaches the second heat exchanger 140. In this second heat exchanger 140, the refrigerant fluid R takes calories from the second airflow AF2 and evaporates. The second airflow AF2 can then be sent to the passenger compartment to drop the temperature of this compartment and the refrigerant fluid R, which is again in a gaseous state, can again reach the compressor 110 to start a new cycle.

Generally speaking, the first heat exchanger 120 and the second heat exchanger 140 are similar and both comprise at least two manifolds or header tanks arranged at an extremity of a heat exchange area wherein the heat exchange between the refrigerant fluid and the first or the second airflow AF1, AF2 takes place.

We are now going to describe with more details the block 200 connected to the first heat exchanger 120. For the rest of the specification, the words “first heat exchanger” and “heat exchanger” will be used with no distinction.

Figure 2 is a perspective view of the block 200 which houses the filter 300. As illustrated, this block 200 is made of a single piece, that is to say that the pieces that constitute it cannot be separated without damaging at least one of them. As mentioned earlier, this block 200 is connected to the first heat exchanger and this block 200 may be considered as the outlet of the heat exchanger. In order to achieve this connection, the block 200 presents a hollowness 210 configured to receive a projection of the first heat exchanger. At a centre of this hollowness 210

extends a conduit 211 that forms an inlet of the block 200, that is to say an orifice through which the refrigerant fluid can enter the block. As shown on figure 2, this conduit 211 presents a size that allows a physical contact between the block and the heat exchanger. As a result, this block 200 can for instance be welded or brazed to the heat exchanger. Advantageously, this connection prevents any refrigerant fluid leakage between the heat exchanger and the block 200. According to an embodiment which is not illustrated here, a duct can be layered between the block and the heat exchanger, this duct being at least long enough to avoid any physical contact between the heat exchanger and the block. In other word, according to this embodiment, the block is arranged away from the heat exchanger, but is in anyway considered as the outlet of the heat exchanger, because this block is a one-component with the rest of the heat exchanger, and is the part that received the pipe connecting the heat exchanger to the refrigerant fluid loop.

As detailed hereafter, the block 200 also comprises a path that extends between the inlet of the block 200 and an orifice 221 of the block 200 – that can be seen on figures 4 to 6 – which allows the refrigerant fluid to exit the block 200.

As mentioned above, a filter is arranged in the block 200. As it will be detailed later, the filter extends, at least partially, in the path arranged in the block 200. According to the invention, the block 200 comprises at least one opening 220 – for instance illustrated on figures 4 to 6 - configured to allow the insertion of such a filter. In order to close this opening 220a cap 230 is provided, this cap 230 being configured to protect the filter and to avoid any unsolicited material to enter the block 200. As illustrated, this cap 230 comprises a first portion 231 secured to the block 200 and a second portion 232 configured to close the opening 220, by entering this opening 220. According to the embodiment described here, the first portion 231 is secured to the block 200 thanks to a screw 233. The second portion 232 is more particularly provided with a recess 234 that fits the opening 220, that is to say that said recess 234 has a similar shape and similar dimensions with the opening, in order to help preventing refrigerant fluid leakages. In other word, it is understood that a bottom 235 that defines said recess 234 at least partially extends in the path 240 of the block 200.

Figure 3 is a perspective view of the filter 300 that is inserted through the at

least one opening arranged in the block. As illustrated, this filter 300 extends mainly along a longitudinal axis X and comprises a first end 301 and a second end 302 along this longitudinal axis X.

This filter 300 comprises a frame 303 in which at least one aperture 304 is made, advantageously several apertures 304, those apertures 304 being closed with a meshed element 305. The size of this meshed element 305 determines the size of the particles that are filtered by this filter 300. According to the invention, this meshed element 305 is chosen for its ability to filter particles presenting a certain diameter, for example larger than  $50\mu\text{m}$ . This meshed element 305 can comprise a synthetic material or metal material. As illustrated, the filter 300 has a cylindrical shape and a circular cross section. More precisely, the frame 303 of this filter 300 has a cylindrical shape in which apertures 304 are created, each aperture 304 extending mainly parallel to the longitudinal axis X. Consequently, it is understood that the refrigerant fluid that reaches such filter 300 enters this filter 300 along a first direction  $d_1$  and exits this filter 300 along a second direction  $d_2$ , the first direction  $d_1$  intersecting the second direction  $d_2$ . According to the embodiment illustrated here, the first direction  $d_1$  is parallel to the longitudinal axis X and the second direction  $d_2$  is perpendicular to this longitudinal axis X. As detailed below, especially with reference to figures 5 and 6, according to a different embodiment of the invention, the first direction  $d_1$  can extend perpendicularly to the longitudinal axis X while the second direction  $d_2$  extends parallel to said longitudinal axis X. To put it another way, depending on the embodiment chosen, the refrigerant fluid can be filtered when it enters the filter 300 or when it exits it.

As illustrated, the filter 300 can also comprise a collar 310 which, as explained below, is configured to seal the opening through which the filter 300 is inserted in the block. According to the illustrated embodiment, this collar 310 is arranged at the first end 301 of the filter 300, and more particularly, this collar 310 can be overmolded with this first end 301. Therefore, this filter 300 is inserted in the block by its second end 302. As explained above, the invention aims to filter all the refrigerant fluid that exits the heat exchanger. Additionally, a sealing device 320 can therefore be arranged at the second end 302 of the filter 300. As shown on figures 3 to 6, this sealing device 320 is layered between the filter 300 and a wall

defining the path in which the filter 300 is intended to be inserted. This sealing device 320 can be part of the filter 300, by being moulded out of the frame 303, as shown on figure 3 or 4. The sealing device 320 can also be a separated seal located between the frame 303 and the block 200, as illustrated by figures 5 or 6.

5           According to the embodiment illustrated on figure 3, the sealing device 320 comprises teeth 321, for example three teeth 321. Those teeth 321 emerge from an outer periphery of the frame 303 of the filter 300, said teeth 321 and said outer periphery forming a single piece, that is to say that the teeth 321 and the outer periphery of the frame 303 cannot be separated without damaging at least one of  
10           them. As explained below, those teeth 321 are designed to prevent the refrigerant fluid to by-pass the filter 300, that is to say to make sure that all the refrigerant fluid that enters the block goes through the filter 300. Obviously, this embodiment is only an example of what can be the sealing device 320, and does not restrict the present invention. For instance, said sealing device 320 could comprise only one  
15           tooth or more than three teeth without getting out of the invention context. Alternatively, as shown on figures 5 and 6, this sealing device can be an O-ring arranged all around the second end 302 of the filter 300.

Referring now to figures 4 to 6, we're going to describe in more details the interior of the block 200, including the path 240 in which the filter 300 is intended  
20           to be inserted. Figures 4 and 5 both illustrate a first embodiment of the present invention according to two different variants and figure 6 illustrates a second embodiment of the present invention. Those embodiments differ essentially from one another in the position of the filter 300 within the path 240.

As mentioned above, the block 200 comprises the path 240 that is reached by  
25           the refrigerant fluid that exit the heat exchanger tank and in which the filter 300 is arranged. According to any of said embodiments, the path 240 is defined by a continuous wall of the block 200 and comprises at least a first part 241 parallel to a second part 242, this first part 241 and this second part 242 being connected to each other by a third part 243 that intersects both the first and the second parts  
30           241, 242. As illustrated, the third part 243 more precisely extends perpendicularly to the first part 241 and the second part 242. According to the embodiments illustrated here, the path 240 also comprises a fourth part 244 that extends the

second part 242 and that intersects said second part 242. According to the embodiments illustrated here, this fourth part 244 more precisely extends perpendicularly to the second part 242, that is to say that this fourth part 244 extends parallel to the third part 243. To faster understanding of the present invention, the continuous wall which defines the path 240 is arbitrarily divided  
5 into four segments, a first segment 341 that defines the first part 241 of the path 240, a second segment 342 that defines the second part 242 of the path 240, a third segment 343 that defines the third part 243 of the path 240 and a fourth segment 344 that defines the fourth part 244 of the path 240. The cross section of  
10 the path 240 as described above is circular.

As explained above, the path 240 extends between an exit of the header tank of the heat exchanger, which also forms the inlet of the block 200, and the orifice 221 of the block 200 which is configured to allow the refrigerant fluid to exit the block 200. More particularly, the first part 241 of the path 240 is arranged in the  
15 conduit 211 designed to be connected to the exit of the header tank of the heat exchanger. In other words, the first segment 341 of the wall defining the path 240 also defines the conduit 211 thanks to which the block 200 is connected to the heat exchanger.

According to the first embodiment illustrated on figure 4, the opening 220 is  
20 drilled in the second segment 342 of the wall defining the path 240, and more specifically in a portion of said second segment 342 that faces the third part 243 of the path 240. As a result, the filter 300, which is inserted through this opening 220, extends at a junction between the second part 242 and the third part 243 of the path 240 and extends mainly parallel to said third part 243. In other words, the  
25 longitudinal axis X is parallel, according to this first embodiment, to the third part 243 of the path 240.

As illustrated, a groove 222 is realized all around the opening 220 through which the filter 300 is inserted, this groove 222 being configured to receive the collar 310 overmolded on the first end 301 of the filter 300. After the insertion of  
30 the filter 300, the cap is positioned and the bottom defining the recess realized in the first portion of said cap extends in the filter 300, while the rest of the first portion covers the collar 310 in order to avoid refrigerant fluid leakage.

At the second end 302 of the filter 300, the sealing device 320 which, according to this first embodiment, comprises three teeth 321, is in contact with the wall defining the path 240, and specifically with the third segment 343 of this wall, in order to make sure that all the refrigerant fluid that enters said path 240 goes through said filter 300. According to the illustrated embodiment, the first direction d1 along which the refrigerant fluid enters the filter 300 is parallel to the longitudinal axis X and the second direction d2 along which the refrigerant fluid exits the filter 300 is perpendicular to this longitudinal axis X. In other words, according to this first embodiment, the refrigerant fluid exits the filter 300 through the meshed element that closes the apertures 304 of it, that is to say that this refrigerant fluid is filtered when it exits said filter 300. Once in the second part 242 of the path 240, the refrigerant fluid reaches the fourth part 244 and then exits the block 200 thanks to the orifice 221 and then continues the refrigerant fluid loop on which the block 200 is positioned.

According to the variant of the first embodiment illustrated on figure 5, the block 200 differs from first embodiment illustrated on figure 4 essentially on the position of the opening 220. As illustrated, according to this variant, this opening 220 is realized in the third segment 343 of the wall that defines the third part 243 of the path 240 and specifically in a portion of this third segment 343 that faces the second part 242 of the path 240. As a result, the filter 300 inserted through said opening 220 still extends at the junction between the second and the third part 242, 243 but it extends mainly parallel to the second part 242. According to this variant, the refrigerant fluid enters by the apertures 304 closed by the meshed element 305. In other words, the first direction d1 is perpendicular to the longitudinal axis X and the second direction d2 is parallel to this longitudinal axis X and the refrigerant fluid is filtered when it enters the filter 300.

The sealing device 320 also differs from the first embodiment illustrated on figure 4 and comprises an O-ring 322 arranged between the frame 303 of the filter 300 and the second segment 342 of the wall defining the path 240 and more particularly, this O-ring 322 is compressed between this second segment 342 of the wall and the frame 303 of the filter 300, in order to make sure that all the refrigerant fluid that enters the block 200 also goes through the filter 300 and that

all the particles presenting a certain diameter, for example above 30µm, preferably above 50µm, are eliminated from this refrigerant fluid.

Figure 6 finally illustrates a second embodiment of the present invention that differs from the first embodiment in the fact that the filter 300 is arranged at a junction between the second part 242 and the fourth part 244 and that it extends  
5 mainly parallel to said fourth part 244. To achieve this second embodiment, the opening 220, through which the filter 300 is inserted, is realized in a portion of the second segment 342 of the wall defining the path 240 that faces the fourth part 244 of the path 240. In a similar way to what has been described related to figure  
10 5, the refrigerant fluid, according to this second embodiment, is filtered when it enters the filter 300. In other words, the refrigerant fluid enters said filter 300 through the apertures 304 when crossing the meshed element 305, that is to say that the first direction d1 extends perpendicularly to the longitudinal axis X and exits the filter 300 through its second end 302, that is to say that the second  
15 direction d2 extends parallel to the longitudinal axis X.

According to this second embodiment, the sealing device 320 is an O-ring as detailed above with reference to figure 5. Alternatively, it is understood that this sealing device 320 could be different, for instance, it could comprise teeth realised on the outer periphery of the frame 303 of the filter 300, as explained with  
20 reference to figure 4.

It will be understood from the foregoing that the present invention provides a simple, easily adaptable and easily replaceable means to filter the refrigerant fluid that exit a heat exchanger accommodated on a refrigerant fluid loop so as to prevent any damage on other components of such a refrigerant fluid loop.

25 However, the invention cannot be limited to the means and configurations described and illustrated herein, and it also extends to any equivalent means or configurations and to any technically operative combination of such means. In particular, the shape and arrangement of the block and/or the filter can be modified insofar as they fulfil the functionalities described in the present  
30 document.

## CLAIMS

1. Heat exchanger (120) for a refrigerant fluid loop (100), the heat exchanger (120) comprising at least one inlet (121) configured to allow a refrigerant fluid (R) to enter in the heat exchanger (120), and at least one outlet (122) configured to allow the refrigerant fluid (R) to exit the heat exchanger (120), the heat exchanger (120) comprising a filter (300) configured to filter the refrigerant fluid (R), characterized in that the filter (300) is arranged at the outlet (122) of the heat exchanger (120).  
5
2. Heat exchanger (120) according to the preceding claim, comprising a block (200) arranged at the outlet (122) of the heat exchanger (120), the block (200) comprising a path (240) configured to allow a circulation of the refrigerant fluid (R) inside the block (200), such path (240) extending between the outlet (122) of the heat exchanger (120) and an orifice (221) of the block (200), such orifice (221) being configured to allow the refrigerant fluid (R) to exit the block (200), wherein the block (200) is provided with at least one opening (220) configured to allow the insertion of the filter (300) inside the block (200).  
10  
15
3. Heat exchanger (120) according to the preceding claim, wherein the block (200) comprises a cap (230) configured to close the opening (220).
4. Heat exchanger (120) according to the preceding claim, wherein the cap (230) comprises a first portion (231) configured to secure the cap (230) to the block (200) and a second portion (232) configured to close the opening (220) through which the filter (300) is inserted in the block (200).  
20
5. Heat exchanger (120) according to any of claims 2 to 4, wherein the filter (300) extends, at least partially, in the path (240) arranged in the block (200).
6. Heat exchanger (120) according to any of claims 2 to 5, wherein the filter (300) is arranged in such a way that the refrigerant fluid (R) enters the filter (300) flowing along a first direction (d1) and exits the filter (300) along a second direction (d2), the first direction (d1) intersecting the second direction (d2).  
25
7. Heat exchanger (120) according to any of claims 2 to 6, wherein the path

(240) comprises at least a first part (241), a second part (242) substantially parallel to the first part (241), and a third part (243) connecting the first part (241) to the second part (242), the third part (243) intersecting the first part (241) and the second part (242).

5           **8.** Heat exchanger (120) according to the preceding claim, wherein the path (240) comprises a fourth part (244) connecting the second part (242), this fourth part (244) intersecting the second part (242).

**9.** Heat exchanger (120) according to any of claims 2 to 8, wherein the filter (300) comprises a frame (303) in which at least one aperture (304) is realized, the  
10 aperture (304) being closed by a meshed element.

**10.** Heat exchanger (120) according to any of claims 2 to 9, wherein the filter (300) extends mainly along a longitudinal axis (X), the filter (300) comprising a first end (301) and a second end (302) along this longitudinal axis (X), and wherein the filter (300) comprises a collar (310) arranged at its first end  
15 (301), this collar (310) being configured to seal the opening (220) through which the filter (300) can be inserted in the block (200).

**11.** Heat exchanger (120) according to the preceding claim, wherein the collar (310) is arranged between the block (200) and the cap (230).

**12.** Heat exchanger (120) according to any of claims 10 to 11, comprising  
20 a sealing device (320) arranged between the second end (302) of the filter (300) and a wall (341, 342, 343, 344) defining the path (240).

**13.** Heat exchanger (120) according to any of claims 2 to 12, wherein the block (200) is made of a single piece.

**14.** Heat exchanger (120) according to any of the claims 2 to 13, wherein  
25 a duct is layered between the outlet (122) and the block (200).

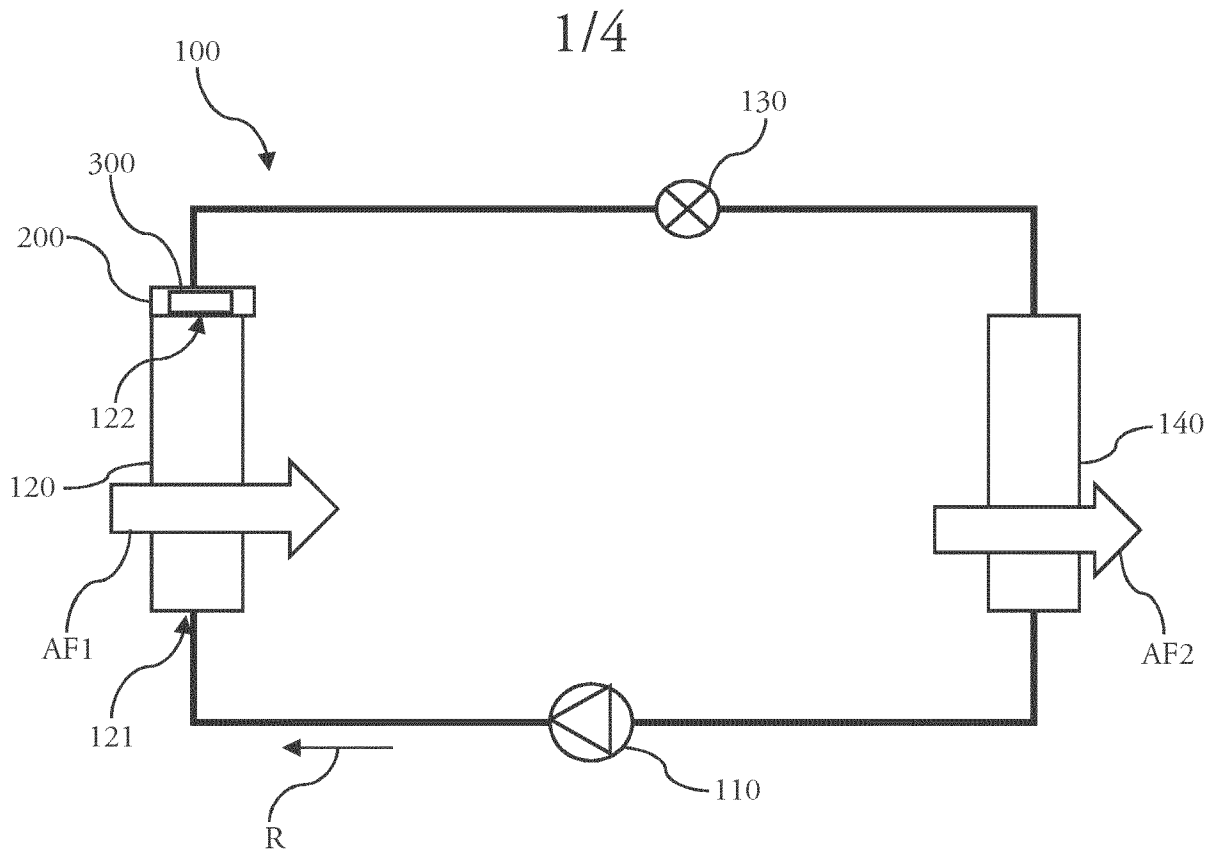


Fig. 1

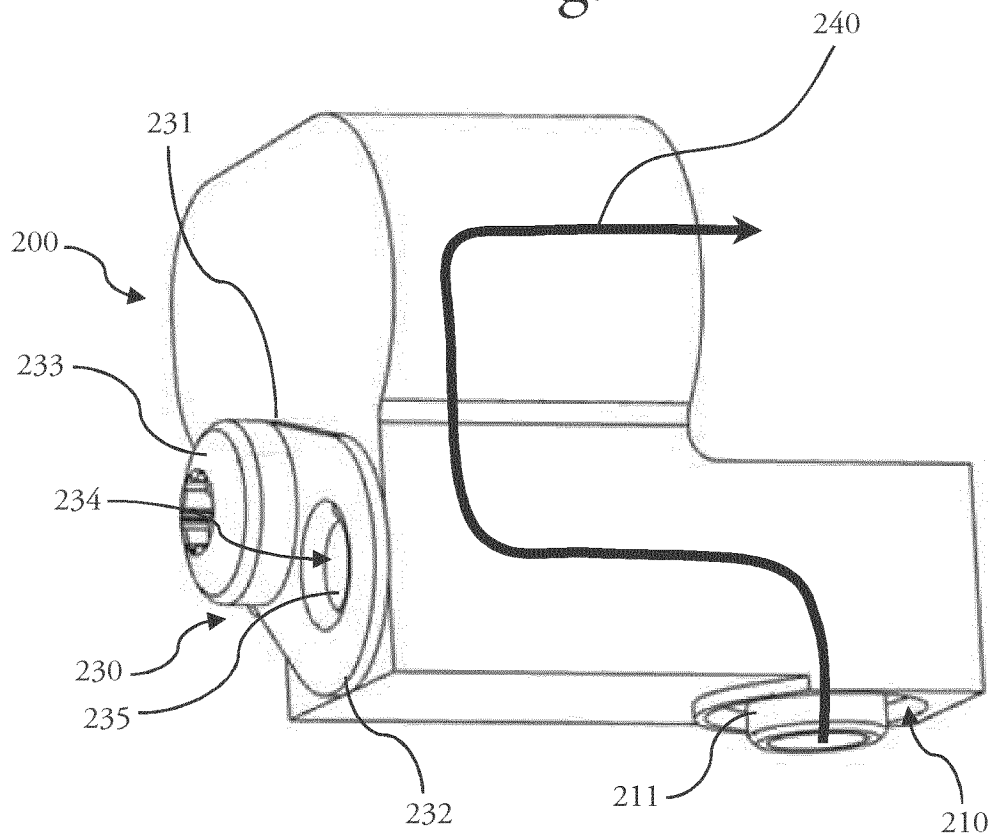
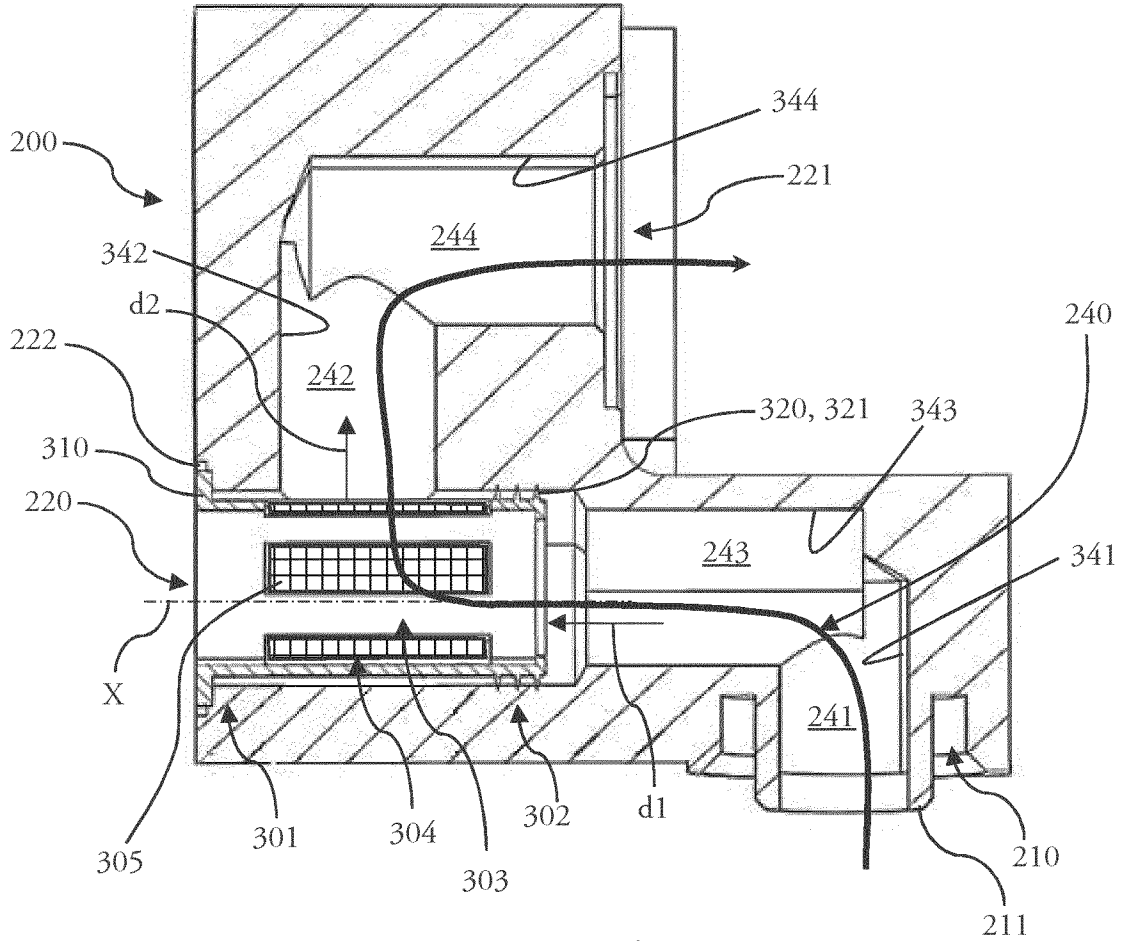
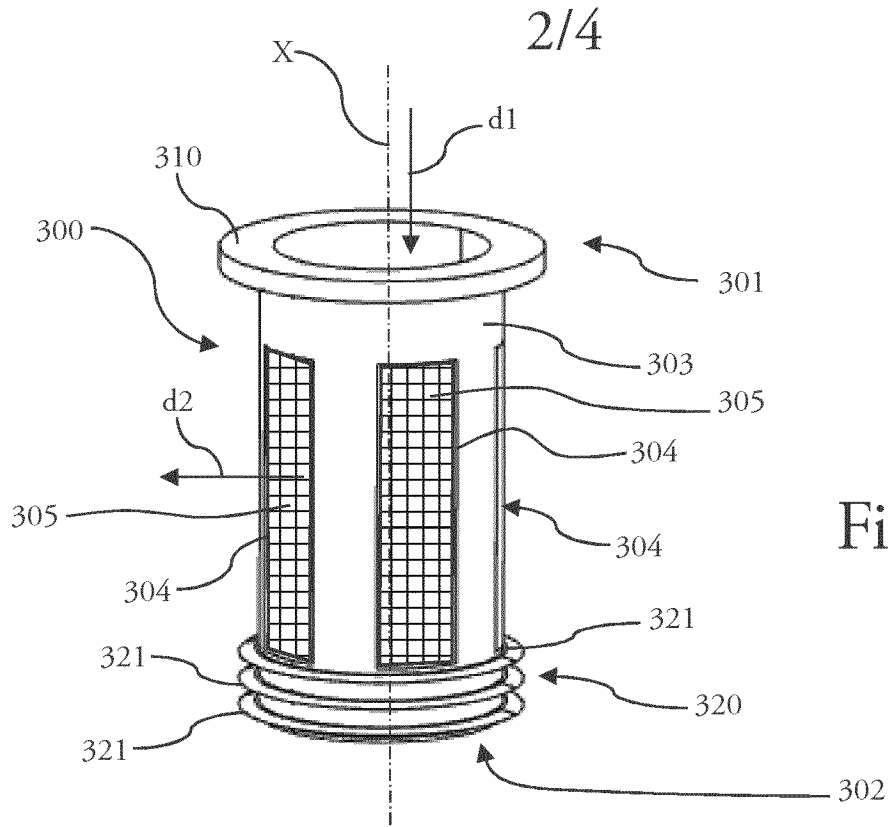
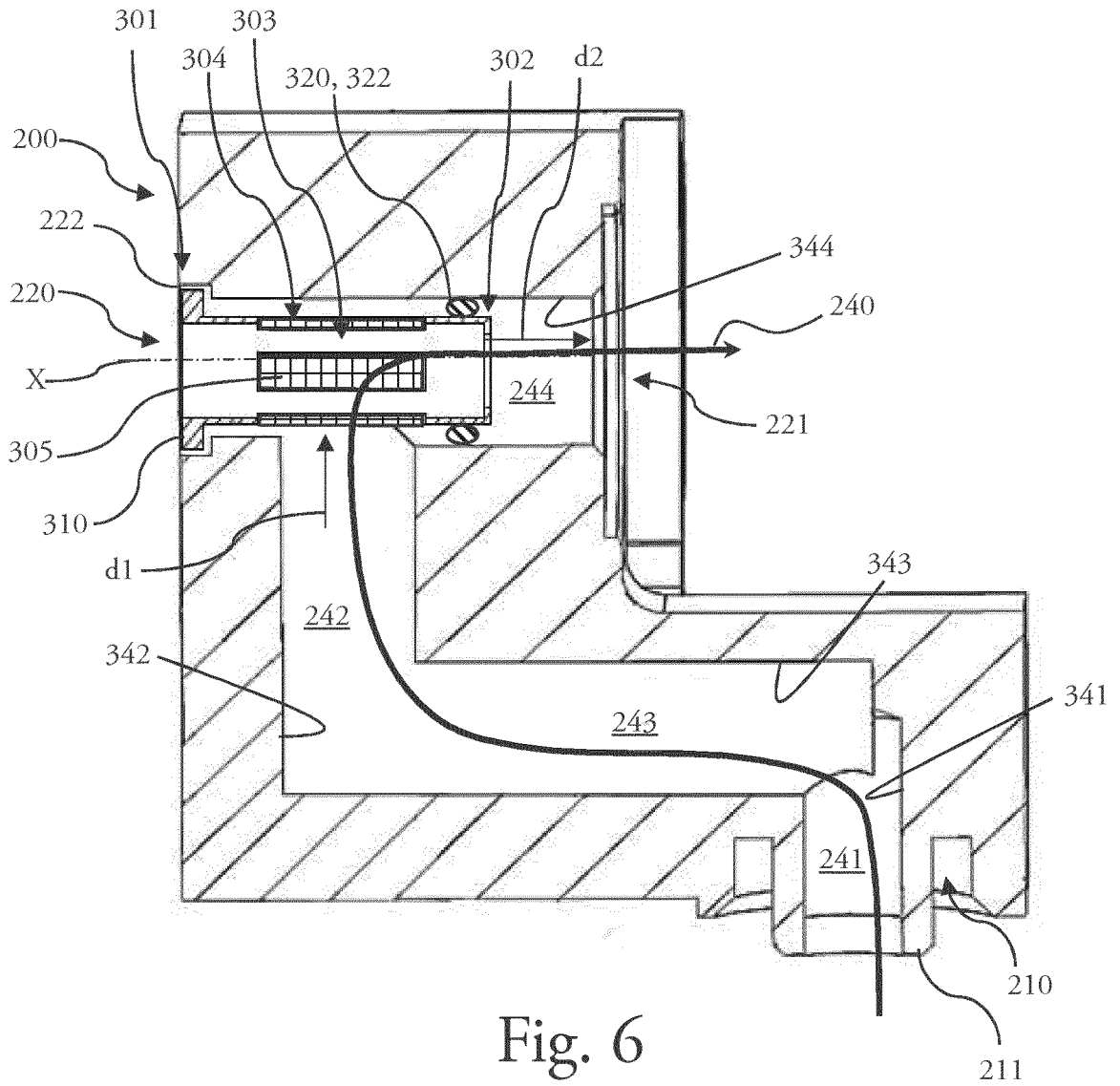


Fig. 2







**INTERNATIONAL SEARCH REPORT**

International application No  
PCT/EP2019/077144

A. CLASSIFICATION OF SUBJECT MATTER  
INV. F25B39/04 F28D1/00 F25B43/00  
ADD.  
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED  
Minimum documentation searched (classification system followed by classification symbols)  
F25B F28D F28F  
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 3 881 546 A (OTSUKA YOSHINORI ET AL) 6 May 1975 (1975-05-06) column 2, line 60 - column 3, line 20; figure 8	1-6,9, 10,12,14 7,8,11, 13
X A	CA 2 013 377 A1 (HITACHI LTD [JP]) 5 October 1990 (1990-10-05) page 6, line 5 - page 16, line 1; figures 1-13	1-9 10-14
X A	JP H06 129733 A (ZEXEL CORP) 13 May 1994 (1994-05-13) paragraph [0010] - paragraph [0026]; figures 1-6	1-6,9 7,8, 10-14

Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search <b>20 November 2019</b>	Date of mailing of the international search report <b>03/12/2019</b>
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Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer <b>Szilagyi, Barnabas</b>
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Information on patent family members

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