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(54) **LINEAR TRAP**

(57) The invention relates to a linear trap, preferably intended for the industrial cooling sector, which prevents oil backflow and facilitates oil return in the lines of cooling circuits. The invention allows oil particles in the lubricant to be separated and captured without the ducts or pipes having to adopt any shape, owing to its in-line mounting, and its operation allows it to be used both vertically and horizontally. Circuit layout is facilitated and installation labour reduced.

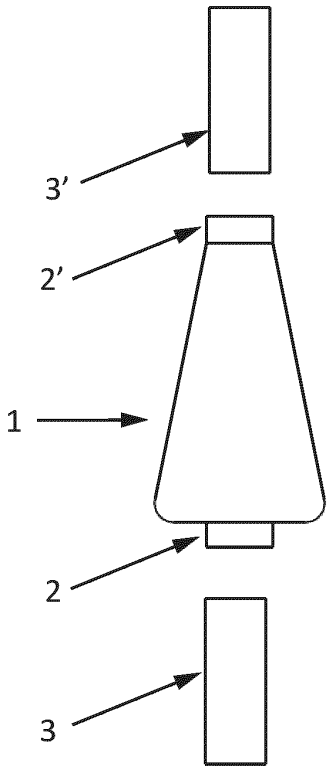



FIG.1

EP 4 431 845 A1

## Description

### Technical sector

**[0001]** Intended for the industrial sector dedicated to industrial refrigeration.

### Background

**[0002]** Oil separators and accumulators are well known in refrigeration installations. They are also known in the sector the oil traps or siphons, these siphons are usually configured forcing the lines of the installation (pipes or ducts) to adopt different curves, or combination of curves and counter-curves, which complicates and spoils the installation.

**[0003]** The first, separators and accumulators, both vertical and horizontal, are arranged in the compression stations (and in the compressors themselves) for an initial coarse separation of the oil fluid.

**[0004]** The second, the siphons, are arranged in the refrigeration lines to facilitate the conduction of the oil through the lines, and to enable as much as possible the return to the compression system. These siphons also prevent backflow, especially during shutdowns.

**[0005]** Other separators use centrifugal force on the refrigerant/oil mixture by means of an angled injection pipe that pours against a cylindrical wall, can be seen in the patent document with publication number WO15174022 of the applicant Daikin Industries, LTD.

### Object

**[0006]** To provide means to avoid the return of oil against flow and to facilitate the return of oil in the refrigeration circuit lines, to avoid the change of layout currently used in the oil traps with the use of bends and elbows, to provide an aesthetic improvement in the installations due to its assembly in line. Reduce installation labor.

### Detailed description of the invention

**[0007]** The linear trap object of this invention presents means to capture and retain the oil that flows together with the refrigerant in a refrigeration installation, it comprises a main body with two concentric openings that present an inlet to receive the ducts or pipes of a refrigeration installation which are joined to it by conventional means such as welding or threaded joint used in the sector, It has the particularity that the installation of the trap keeps the inlet and outlet of this and both ducts aligned, being its preferential vertical assembly, also working horizontally, thanks to the static and dynamic pressure of the flow.It comprises after the inlet opening of the coolant/oil, a conical shaped element that we will call funnel, whose base has the diameter of the inlet duct and whose end is open, the progressive reduction of the funnel modifies the dynamics of the fluids that pass through it causing this narrowing a change of speed in them, behind this funnel and concentrically has an element as an inverted vessel whose walls are essentially parallel to the funnel and whose open edge maintains a free space with the body of the siphon, this inverted vessel is fixed either to the body of the trap or to the outside of the funnel by a support that has allowed the passage of fluids, by conventional means such as the use of spokes or a grid.

**[0008]** The arrangement of the elements described above, i.e. inlet opening, funnel and inverted vessel, generates a path through which the coolant and oil flow in such a way that the coolant/oil mixture first enters the funnel and gains speed to reach the base of the inverted vessel, the oil, having a higher density, will flow along the inner walls of the vessel and the outer face of the funnel, precipitating at the bottom of the siphon, and the coolant will flow to the outlet duct along the path formed by the outside of the inverted vessel and the inner wall of the trap body.

**[0009]** Oil drainage occurs when the oil accumulates at the bottom of the trap and reaches the level of the edge of the inverted vessel causing an obstruction, the pressure difference between the inlet and outlet causes the oil particles to be dragged to the outlet.

**[0010]** It has means to prevent the return of the oil particles during the stops, these means confine the oil by means of the outer face of the funnel and the trap body, always below the trap height (S.H.), that is, the base of the funnel and its upper opening.

### Brief description of the drawings

**[0011]** For a better understanding of what is described in the present report, some drawings are included in which, by way of example, a list of the figures of the proposed invention is shown.

Figure 1 shows the linear trap(1), where the inlet (2) and outlet (2') openings can be seen, which cooperate with the inlet and outlet pipes (3-3') respectively. Figure 2 shows the linear trap with the pipes connected to it.

Figure 3 shows an isometric view with a cut through a median plane taken in the direction of the main gas flow direction, showing the inlet and outlet pipes (3 and 3'), their funnel (4), the inverted vessel (5) and the support (6) of the inverted vessel.

Figures 4 shows an A-A cut of figure 2, the inverted vessel (5) and its retainer (6) as well as the funnel (4) can be seen.

**[0012]** The sections of figures 5, 6, and 7 represent schematically the operation of the linear siphon; thus in figure 5 the arrows indicate the direction of circulation of the fluids where the dashed line (A) is the coolant fluid,

the points (C) the oil and the combination of line and points (B) coolant with oil, it can be seen how the oil particles precipitate after leaving the inverted vessel, by reducing its speed.

**[0013]** Figure 6 shows an operating stage in which the oil particles occupy the space between the edge of the inverted vessel and the siphon. Figure 7 shows a representation of how, after the stage shown in the previous figure, the oil particles are sucked up with the coolant.

**Detailed Description of the Embodiments**

**[0014]** The materials used in the manufacture of the invention, as well as the methods of application and all the accessory details that may arise, provided that they do not affect its essentiality, are cited as an example of a preferred mode of realization, being independent of the object of the invention. This preferred mode of realization reflects the materialization and embodiment of the invention by specifying details that help to understand it.

**[0015]** The linear trap object of this preferred realization is made of copper, it has two concentric openings with a mouth that cooperates with the pipes to be joined, a first opening (2) located at the base of the body of the linear trap(1) through which the coolant and the oil penetrate, from this lower inlet opening a convergent element or funnel (4) through which the coolant/oil mixture first circulates and whose reduced cross-section causes an acceleration of the circulating fluids which are projected against the bottom of an inverted vessel (5) surrounding the funnel described above and whose base is located and does not come into contact with the siphon.

**[0016]** The fixing of this inverted vessel, the walls of which are substantially parallel to the funnel, is possible by means of a support (6) which, in this preferred embodiment, is attached solidly to the body of the trap while allowing the passage of fluids as its body has different perforations that form a grid, Figure 4. In order to illustrate the technical effect solved by the recommended linear siphon, its operation is described: the inlet fluid, coolant/oil, enters through the inlet of the linear trap and, as described, the oil particles are captured and retained at the bottom of the siphon, figures 5 and 6, at the moment of saturation, i.e. when the oil particles exceed the edge of the inverted vessel, figure 6, a dragging of these is produced by pressure difference, figure (7). As it has been exposed its disposition allows to separate and to capture the particles of oil in the lubricant without also having to make any figure in the conduits or pipes, being its assembly in line.

**Claims**

1. Linear trap **characterized by** allowing to separate and retain the particles of the oil circulating together with the cooling fluid in a refrigeration installation, which comprises a first inlet opening (2) with a mouth according to the pipe on which it is installed, from this mouth starts a convergent element or funnel (4) whose base has the diameter of the pipe to be installed through which circulates the coolant/oil mixture that pours against an inverted vessel (5) that surrounds the outer wall of the funnel described and whose base is open and has no contact with the bottom of the body of the linear trap(1), the inverted vessel is fixed by at least one support (6) that has allowed the passage of fluids.

2. Linear trap according to the first claim, **characterized in that** the support of the inverted cup is fixed between the inner body of the linear trap and the external face of the inverted cup.

3. Linear trap according to the first claim, **characterized in that** the support of the inverted cup is fixed between the inner side of the inverted cup and the outer side of the funnel.

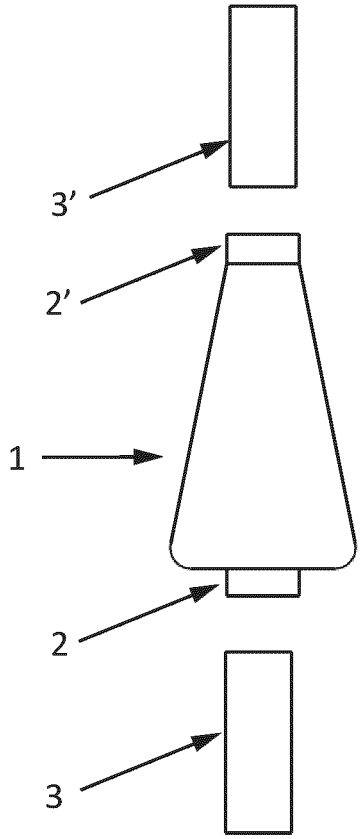



FIG.1

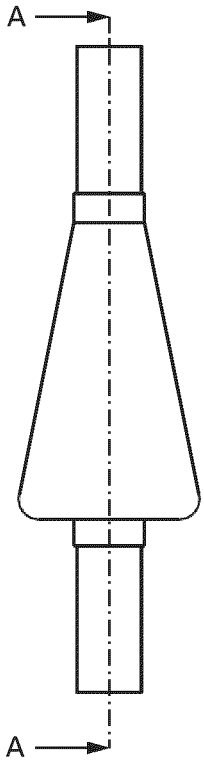



FIG.2

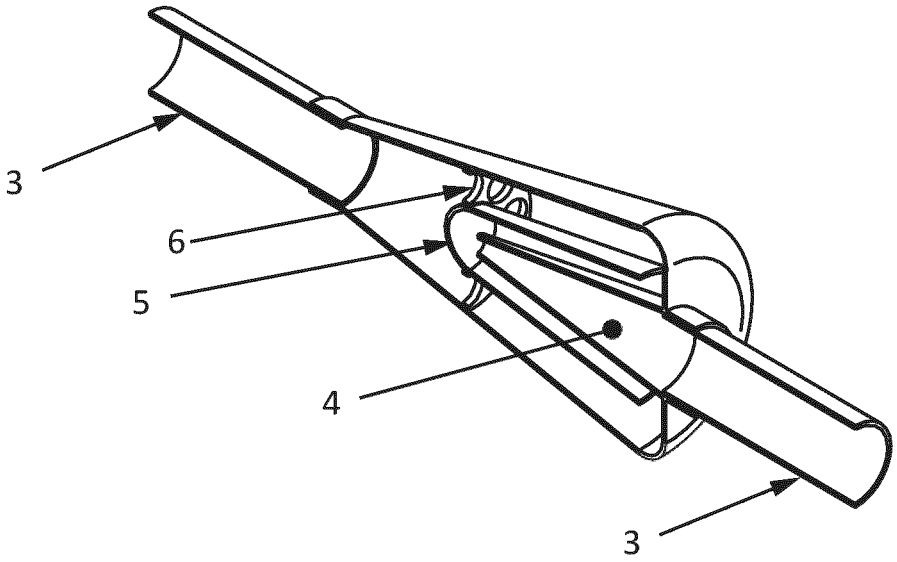



FIG.3

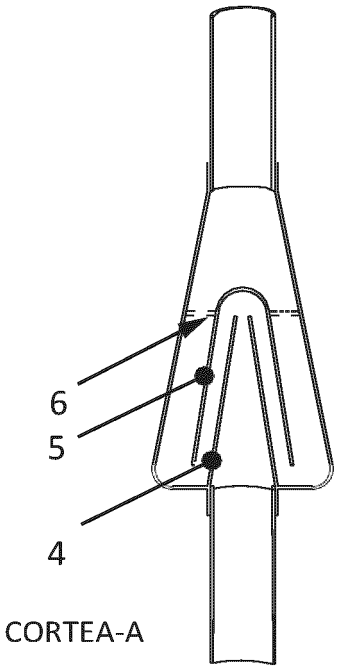
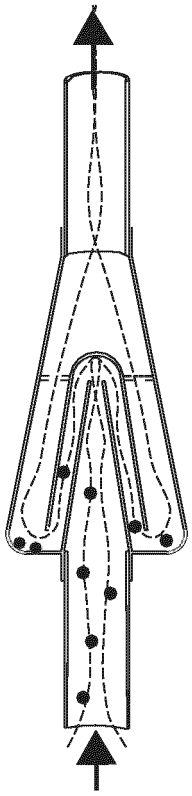



FIG.4



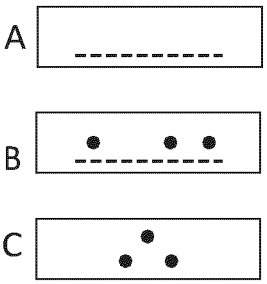



FIG.5

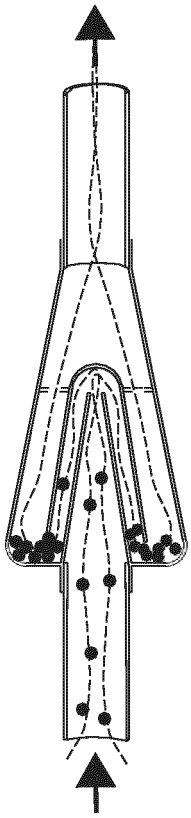


FIG.6

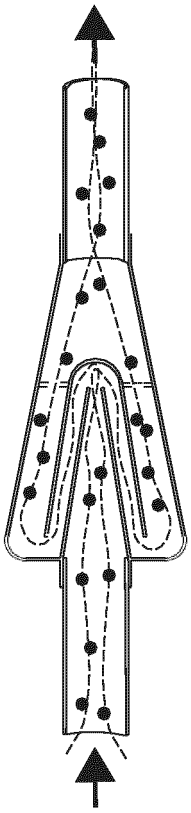


FIG.7

# INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2022/070711

A. CLASSIFICATION OF SUBJECT MATTER

***F25B43/02*** (2006.01)

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

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)

EPODOC, INVENES

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | CN 215597835U U (QINGDAO HAIER AIR CONDITIONER ELECTRIC CO LTD ET AL.) 21/01/2022, Abstract from DataBase WPI. Retrieved from EPOQUE. | 1-3 |
| A | CN 113915807 A (XINCHANG COUNTY TAIPULAI ELECTROMECHANICAL CO LTD) 11/01/2022, Abstract from DataBase WPI. Retrieved from EPOQUE. figure 1 | 1 |
| A | JP H05329401 A (DAIKIN IND LTD) 14/12/1993, Abstract from DataBase EPODOC. Retrieved of EPOQUE. figure 1 | 1 |
| A | US 2006196220 A1 (WESTERMEYER GARY W) 07/09/2006, the whole document. | 1 |

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 09/12/2022 | **(12/12/2022)** |
| Name and mailing address of the ISA/<br>OFICINA ESPAÑOLA DE PATENTES Y MARCAS<br>Paseo de la Castellana, 75 - 28071 Madrid (España)<br>Facsimile No.: 91 349 53 04 | Authorized officer<br>J. Celemín Ortiz-Villajos<br><br>Telephone No. 91 3495493 |

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## INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/ES2022/070711

| Patent document cited in the search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| CN215597835U U | 21.01.2022 | NONE | |
| CN113915807 A | 11.01.2022 | NONE | |
| JPH05329401 A | 14.12.1993 | NONE | |
| US2006196220 A1 | 07.09.2006 | US2006196221 A1<br>US7810351 B2 | 07.09.2006<br>12.10.2010 |

Form PCT/ISA/210 (patent family annex) (January 2015)

## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


- WO 15174022 A **[0005]**