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

(11) **EP 3 705 813 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
23.04.2025 Bulletin 2025/17

(21) Application number: **20159112.0**

(22) Date of filing: **24.02.2020**

(51) International Patent Classification (IPC):
F25B 31/00 *(2006.01)* ***F25B 39/02*** *(2006.01)*
F25B 43/00 *(2006.01)* ***F28F 9/02*** *(2006.01)*
F28F 9/04 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
F25B 31/004; F25B 39/028; F25B 43/006; F28F 9/0243; F28F 9/027; F25B 2339/02

(54) **SUCTION HEADER WITH UPWARD FACING OUTLET FOR EVAPORATORS OF REFRIGERATION SYSTEMS**

SAUGSAMMLER MIT AUFWÄRTSAUSGANG FÜR VERDAMPFER VON KÜHLSYSTEMEN

TÊTE D'ASPIRATION AVEC SORTIE VERS LE HAUT POUR ÉVAPORATEURS DE SYSTÈMES DE RÉFRIGÉRATION

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **08.03.2019 IT 201900003427**

(43) Date of publication of application:
09.09.2020 Bulletin 2020/37

(73) Proprietor: **LU-VE S.P.A.**
21100 VARESE (IT)

(72) Inventors:
- **MERLO, Umberto**
  21040 Uboldo (VA) (IT)
- **FILIPPINI, Stefano**
  21040 Uboldo (VA) (IT)

(74) Representative: **Rastelli, Franco**
Dott. Franco Cicogna & C. SRL
Via Visconti di Modrone, 14/A
20122 Milano (IT)

(56) References cited:
DE-A1- 102011 113 453
US-A1- 2008 190 122
US-A1- 2018 094 842

EP 3 705 813 B1

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a suction header with an upward facing outlet for evaporators of refrigeration systems.

[0002] In direct expansion vapor compression systems of refrigeration systems, there is an increasing need for evaporators in which the suction line ascends towards the ceiling of the cold room.

[0003] "Conventional" suction lines on the other hand pass downwards towards one side of the room; once past the wall, they always continue downwards towards the compression unit. The gradient of the lines allows the lubrication oil to drain, which can therefore return to the compressor.

[0004] Nowadays, however, when an ascending suction line is desired, the header, which is placed on the outlet with a connection towards the base of the evaporator, is connected through a siphon and a corresponding section of the ascending line. In this case the siphon is used to drain the oil to the compressor, avoiding the formation of stagnant points in the evaporator, which can cause strong reductions in heat exchange.

[0005] However, this known type of construction has the disadvantage that many welds are required to install the siphon, with the possibility of refrigerant leakage. It is also necessary to calculate the diameter of the welded lines so as to maintain the gas velocity, in the ascending suction sections, at values between 4 and 10 m/s.

[0006] US 2018/094842 A1 relates to a suction header and its accumulator for refrigeration systems.

SUMMARY OF THE INVENTION

[0007] The main object of the present invention is to provide a suction header with an upward outlet for evaporators in refrigeration systems which, in comparison with well-known manifolds of the same type, does not require either welded assemblies to be made when installing it on the evaporator body, or dimensioning calculations, or tests on operation of the equipment.

[0008] These and other objects are accomplished through the header in claim 1. Preferred embodiments of the invention are apparent from the remaining claims.

[0009] In comparison with the known solutions described above, the header of the invention, understood to be the whole of the manifold body and the related ascending line, offers the advantage of being able to be assembled directly in a factory, so as to avoid both the need for welded assembly at the time of installation, and the need to make calculations for dimensioning the lines, tests, etc.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] These and other objects, advantages and features will be apparent from the following description of a preferred embodiment of the header according to the invention, illustrated by way of non-limiting example in the figures of the attached drawing sheets.

[0011] In these:

- Figure 1 shows in schematic form an evaporator for refrigeration systems equipped with a header with an ascending suction line according to the prior art;
- Figure 2 shows in schematic form an evaporator equipped with a header with an ascending line according to the invention;
- Figure 3 shows the detail of the header mounted on the evaporator in Figure 2;
- Figure 4 shows the header in Figure 3 along cross-section A-A; and
- Figure 5 shows an enlarged view of a detail of the header shown in Figure 2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0012] The evaporator according to the prior art, indicated by 1 in figure 1, comprises a body 6 suspended from the ceiling 2 (or resting on a support structure, which is not illustrated). The body 6 of the evaporator is connected to a header manifold 3 by means of stub pipes 7 in the refrigeration circuit of the evaporator 1 itself.

[0013] The header manifold 3 must in turn be welded, along welding lines 8, to a siphon 4 which has the function of ensuring that the oil returns to the compressor (not shown in the figures). The refrigerant gas and oil that are conveyed by the header manifold 3 are then returned through the ascending line 5 to the compressor.

[0014] The solution now described has the disadvantage of forcing the installer to assemble the manifold on site, and also make the necessary welds. In addition to leaving room for possible oil leaks at the welded lines, this also requires calculations to be made in order to dimension the ascending line, so as to ensure the desired gas velocity in the corresponding suction section, with possible errors.

[0015] In the embodiment illustrated in figures 2 to 5, the header 9 according to the invention comprises a cylindrical body 10 in gas and oil communication with the evaporator 6 via said stub pipes 7.

[0016] Inside the body 10 of the header there is also fixed a section 11 of the ascending line whose lower end 12 is beveled due to the presence of a diagonal cut 17, the latter being also located at a distance from the bottom of the body 10 of the header 9, as more particularly described below.

[0017] The one-piece assembly of body 10, section 11 and stub pipes 7 forming the header 9 according to the invention is fixed on one side to the evaporator body by means of the stub pipes 7 and on the other side to the ascending line 5 at the level of the welded line 14.

[0018] Through the invention, installers no longer need

to assemble detached parts on site, but are provided with a one-piece header which includes both the part collecting stagnating oil and the first section 11 of the ascending line 5.

[0019] As shown in figure 4, the annular cross-section 15 of the incoming gas and oil flow through stub pipes 7 has an area that is substantially equal to that of the circular cross-section 16 of section 11 of the ascending line. In particular, the gas and oil flow entering said circular cross-section 15 descends towards the bottom of the header 9, where stagnating oil 13 is collected. From here the gas and part of the oil go up along the section 11 of the ascending line, entering from its lower end 12.

[0020] In particular, according to the invention, the bevel diagonal cut 17 present on said end 12 of the manifold, which makes it possible to define the height of the free level of stagnating oil 13, is positioned so as to prevent the outlet flow from the last stub pipe 71 on the lower part of the header 9 from entering the same stagnation area 13 directly. For this purpose, the highest point 17a of said diagonal cut 17 is located lower than the outlet section 72 of the last stub pipe 71 from the body 10 of the header 9.

[0021] Modifications may be made to the invention as described and illustrated in the figures above in order to make variants which nevertheless fall within the scope of the following claims. Thus, for example, the section 11 of the ascending line may be mounted on or coaxial with the body 10 of the header, or rest on one of its generatrices, on the side opposite to the inlet of said stub pipes 7.

Claims

1. A suction header with upward outlet for evaporators of refrigeration systems, consisting of a one-piece element comprising a body (10) of the said suction header (9), said body (10) having a bottom for collecting the stagnating oil (13) and a first section (11) of an ascending line (5) assembled inside said body (10), wherein said body (10) of the said suction header (9) is equipped with stub pipes (7) for conveying refrigerant gas and said oil from the same suction header (9), and wherein said first section (11) of said ascending line (5) is in turn fixed to the remaining section of said ascending line (5) of the refrigeration system, **characterized in that** the lower end (12) of said section (11) of said ascending line (5) is beveled due to the presence of a cut (17) oriented diagonal to the level of the said oil (13) stagnating inside the cited bottom of the body (10) and positioned partially immersed into said stagnating oil at a distance from the bottom of the body (10) of said suction header (9) to allow the gas and part of said stagnating oil enter said lower end (12) and go up along said section (11) of the same ascending line (5).

2. The header according to claim 1, **characterized in that** the highest point (17a) of said diagonal cut (17) is located lower than the outlet section (72) of the last stub pipe (71) of the lower part of the said suction header (9), so as to prevent the outlet flow from said last stub pipe 71 from entering said stagnating oil 13 directly.

3. The header according to claim 1, **characterized in that** said suction header (9) has an annular cross-section (15) for passage of the incoming gas and oil flow through said stub pipes (7), the area of which is substantially equal to that of the circular cross-section (16) of the section (11) of ascending line.

4. The header according to claim 1, **characterized in that** said section (11) of ascending line is mounted coaxially with the body (10) of the header, or rests on one of its generatrices, on the side opposite to the inlet of said stub pipes (7).

5. An evaporator for refrigeration systems, **characterized in that** it comprises at least one header according to one or more of the preceding claims.

Patentansprüche

1. Ein Saugsammler mit Aufwärtsausgang für Verdampfer von Kühlsystemen, bestehend aus einem einteiligen Element, das einen Körper (10) des genannten Saugsammlers (9) umfasst, wobei der genannte Körper (10) einen Boden zum Auffangen des stagnierenden Öls (13) und einen ersten Abschnitt (11) einer aufsteigenden Leitung (5) aufweist, die im Inneren des genannten Körpers (10) montiert ist, wobei der genannte Körper (10) des genannten Saugsammlers (9) mit Nebenrohren (7) ausgestattet ist, um gasförmiges Kältemittel und Öl aus demselben Saugsammler (9) abzutransportieren, und wobei der genannte erste Abschnitt (11) der genannten aufsteigenden Leitung (5) wiederum am verbleibenden Abschnitt der genannten aufsteigenden Leitung (5) des Kühlsystems befestigt ist, **dadurch gekennzeichnet, dass** das untere Ende (12) des genannten Abschnitts (11) der genannten aufsteigenden Leitung (5) abgeschrägt ist, und zwar aufgrund des Vorhandenseins eines Schnitts (17), der diagonal zur Oberfläche des genannten am genannten Boden des Körpers (10) stagnierenden Öls (13) verläuft und teilweise in das genannte stagnierende Öl eingetaucht angeordnet ist, und zwar in einem Abstand vom Boden des Körpers (10) des genannten Saugsammlers (9), der es ermöglicht, dass das Gas und ein Teil des genannten stagnierenden Öls in das genannte untere Ende (12) eintreten und entlang des genannten Abschnitts (11) derselben aufsteigenden Leitung (5) nach oben steigen.

2. Der Sammler nach Anspruch 1, **dadurch gekennzeichnet, dass** der höchste Punkt (17a) des genannten diagonalen Schnitts (17) tiefer liegt als die Auslaufstrecke (72) des letzten Nebenrohrs (71) des unteren Teils des genannten Saugsammlers (9), um zu verhindern, dass der Auslauffluss aus dem genannten letzten Nebenrohr 71 direkt in das genannte stagnierende Öl (13) gelangt.

3. Der Sammler nach Anspruch 1, **dadurch gekennzeichnet, dass** der genannte Saugsammler (9) für den Durchlass des eintretenden Gas- und Ölstroms durch die genannten Nebenrohre (7) einen ringförmigen Querschnitt (15) aufweist, dessen Fläche im Wesentlichen gleich der Fläche des kreisförmigen Querschnitts (16) des Abschnitts (11) der aufsteigenden Leitung ist.

4. Der Sammler gemäß Anspruch 1, **dadurch gekennzeichnet, dass** der genannte Abschnitt (11) der aufsteigenden Leitung koaxial mit dem Körper (10) des Sammlers montiert ist oder auf einer seiner Mantellinien ruht, und zwar auf der dem Einlass der genannten Nebenrohre (7) gegenüberliegenden Seite.

5. Ein Verdampfer für Kühlsysteme, **dadurch gekennzeichnet, dass** er mindestens einen Sammler gemäß einem oder mehreren der vorhergehenden Ansprüche aufweist.

Revendications

1. Tête d'aspiration avec sortie vers le haut pour évaporateurs de systèmes de réfrigération, qui se compose d'un élément en une seule pièce comprenant un corps (10) de ladite tête d'aspiration (9), ledit corps (10) ayant une partie inférieure pour la collecte d'huile de stagnation (13) et une première section (11) d'une conduite ascendante (5) assemblée à l'intérieur dudit corps (10), dans laquelle ledit corps (10) de ladite tête d'aspiration (9) est équipé de tubulures (7) pour transporter du gaz réfrigérant et ladite huile provenant de la même tête d'aspiration (9), et dans laquelle ladite première section (11) de ladite conduite ascendante (5) est à son tour fixée à la section restante de ladite conduite ascendante (5) du système de réfrigération, **caractérisée en ce que** l'extrémité inférieure (12) de ladite section (11) de ladite conduite ascendante (5) est biseautée du fait de la présence d'une coupe (17) orientée de façon diagonale par rapport au niveau de ladite huile (13) en stagnation à l'intérieur de la partie inférieure susmentionnée du corps (10) et positionnée en partie immergée dans ladite huile de stagnation à une distance de la partie inférieure du corps (10) de ladite tête d'aspiration (9) pour permettre au gaz et à une partie de ladite huile de stagnation de pénétrer dans ladite extrémité inférieure (12) et de remonter le long de ladite section (11) de ladite conduite ascendante (5).

2. Tête selon la revendication 1, **caractérisée en ce que** le point culminant (17a) de ladite coupe diagonale (17) est situé plus bas que la section de sortie (72) de la dernière tubulure (71) de la partie inférieure de ladite tête d'aspiration (9), de manière à empêcher le flux de sortie provenant de ladite dernière tubulure 71 de pénétrer directement dans ladite huile de stagnation 13.

3. Tête selon la revendication 1, **caractérisée en ce que** ladite tête d'aspiration (9) comporte une section transversale annulaire (15) pour le passage du flux entrant de gaz et d'huile à travers lesdites tubulures (7), dont l'aire est sensiblement égale à celle de la section transversale circulaire (16) de la section (11) de conduite ascendante.

4. Tête selon la revendication 1, **caractérisée en ce que** ladite section (11) de conduite ascendante est montée de façon coaxiale par rapport au corps (10) de la tête, ou est appuyée sur une de ses génératrices, sur le côté opposé à l'entrée desdites tubulures (7).

5. Évaporateur pour systèmes de réfrigération, **caractérisé en ce qu'**il comprend au moins une tête selon une ou plusieurs des revendications précédentes.

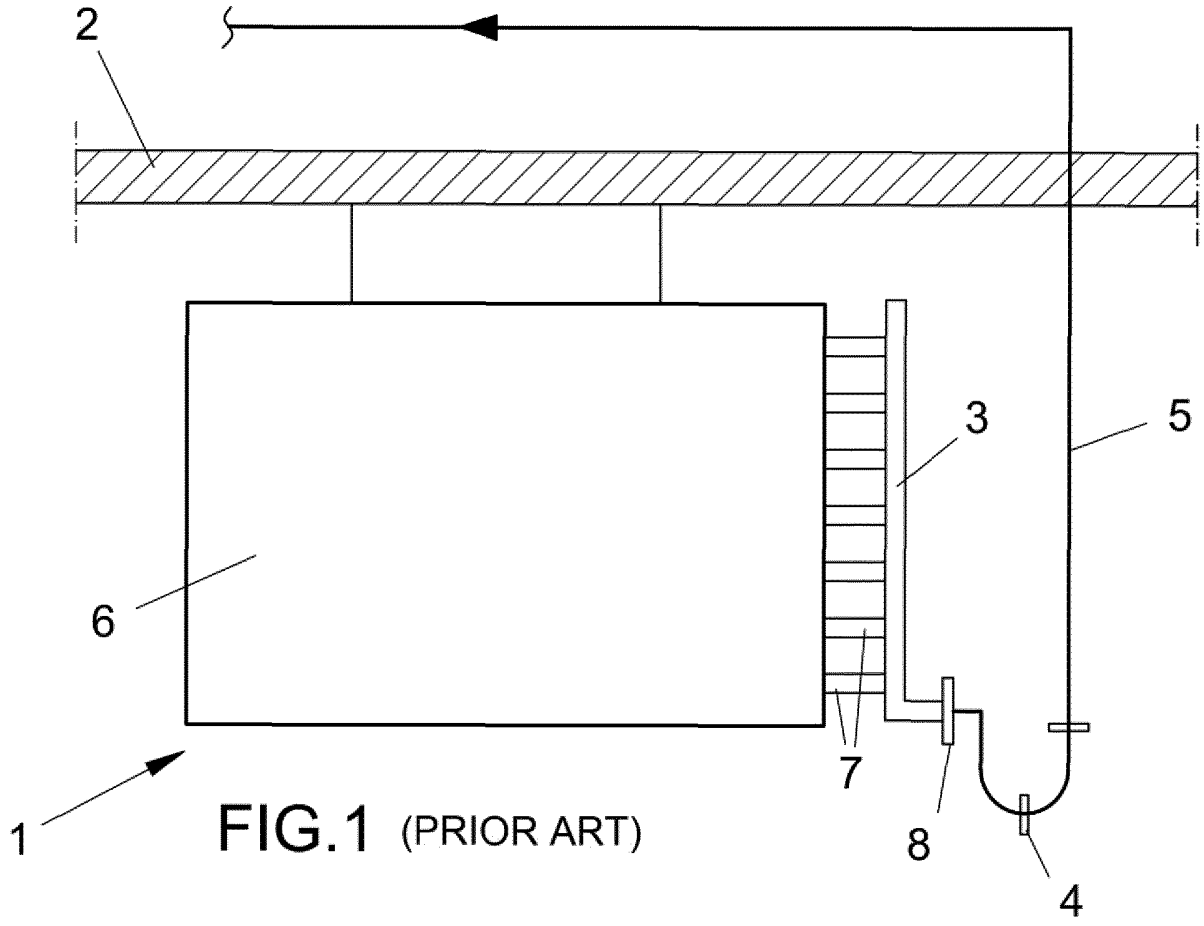

FIG.1 (PRIOR ART)

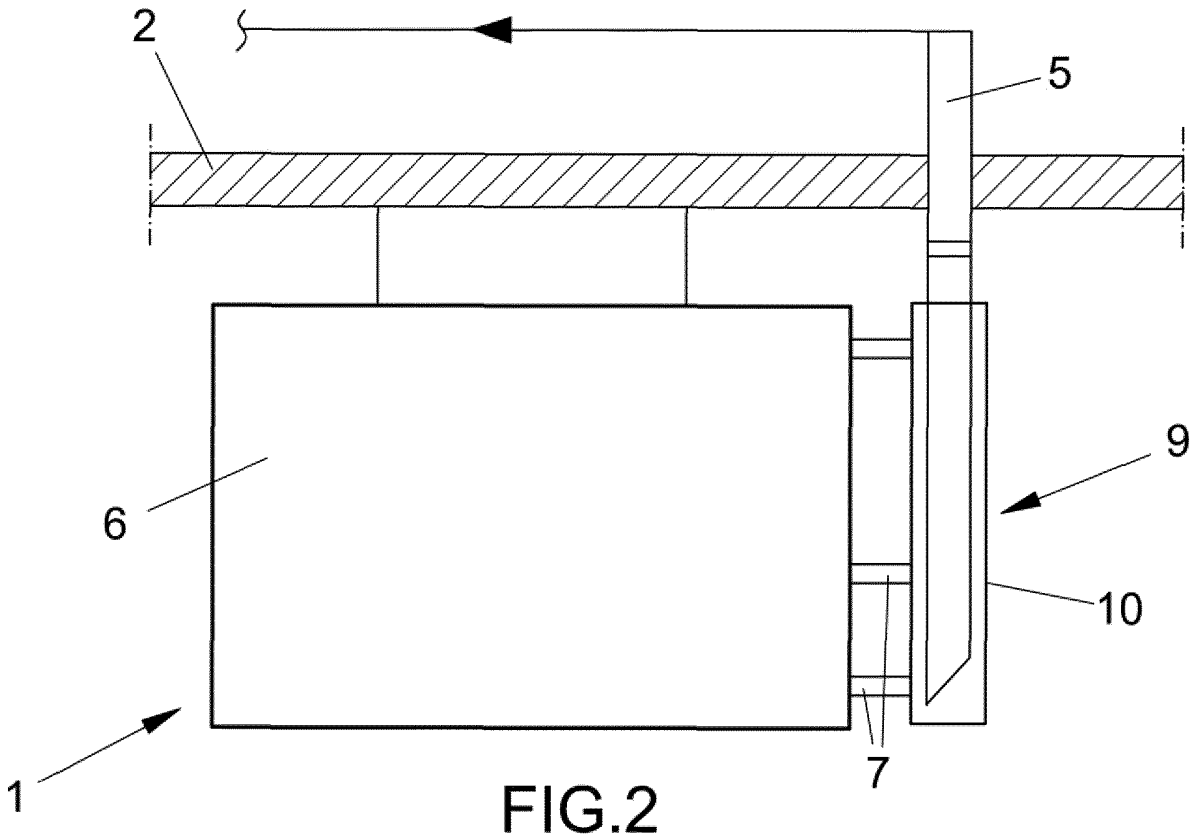

FIG.2

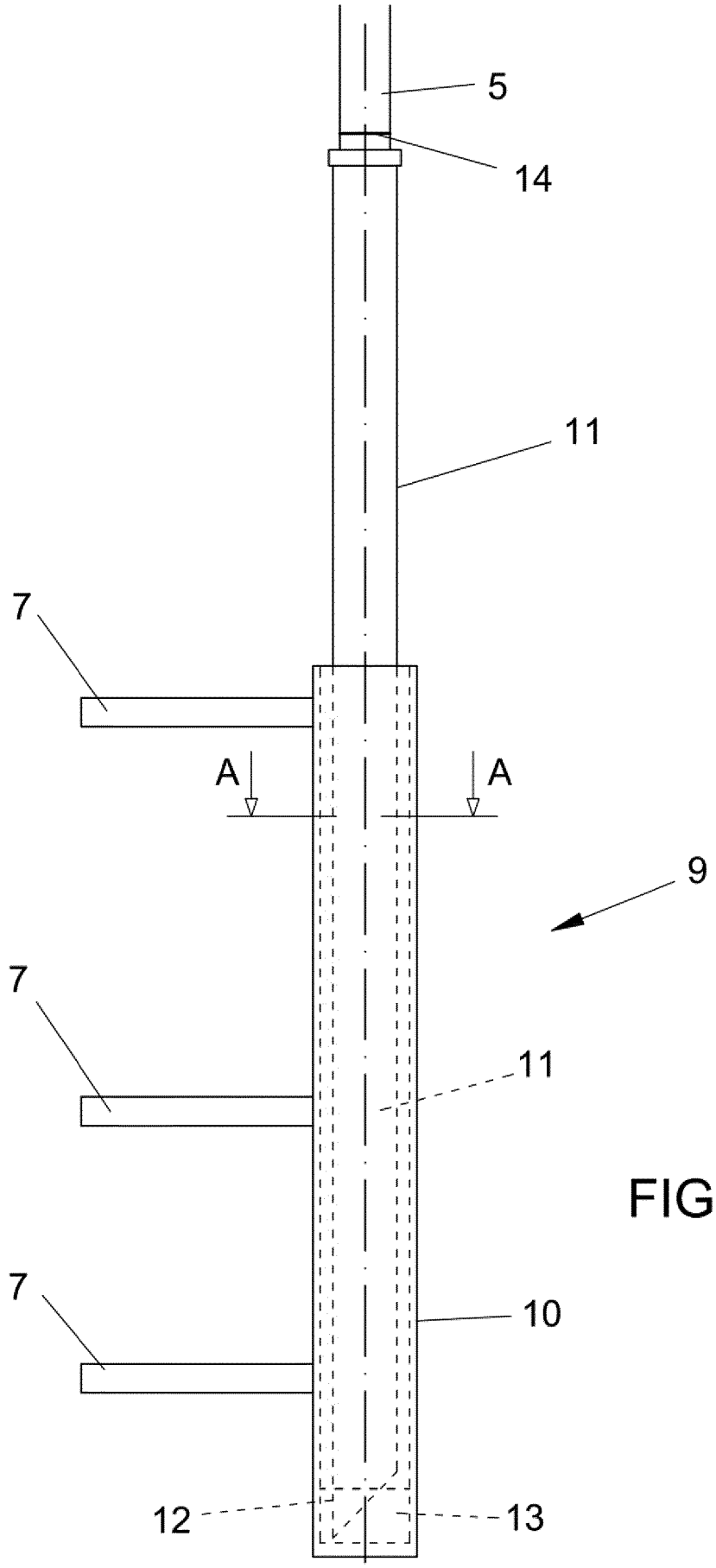

FIG.3

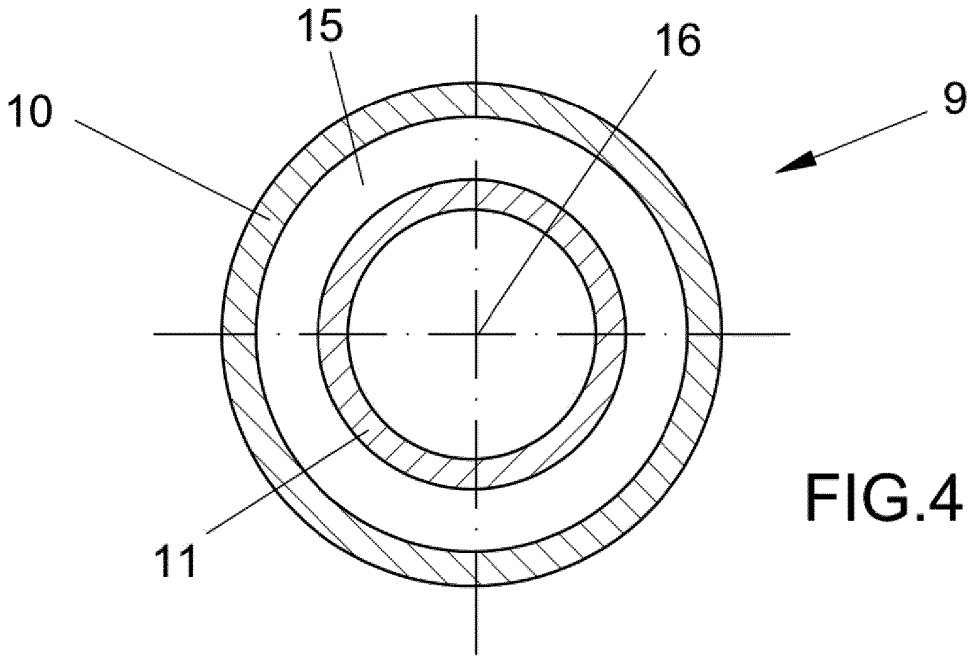

FIG.4

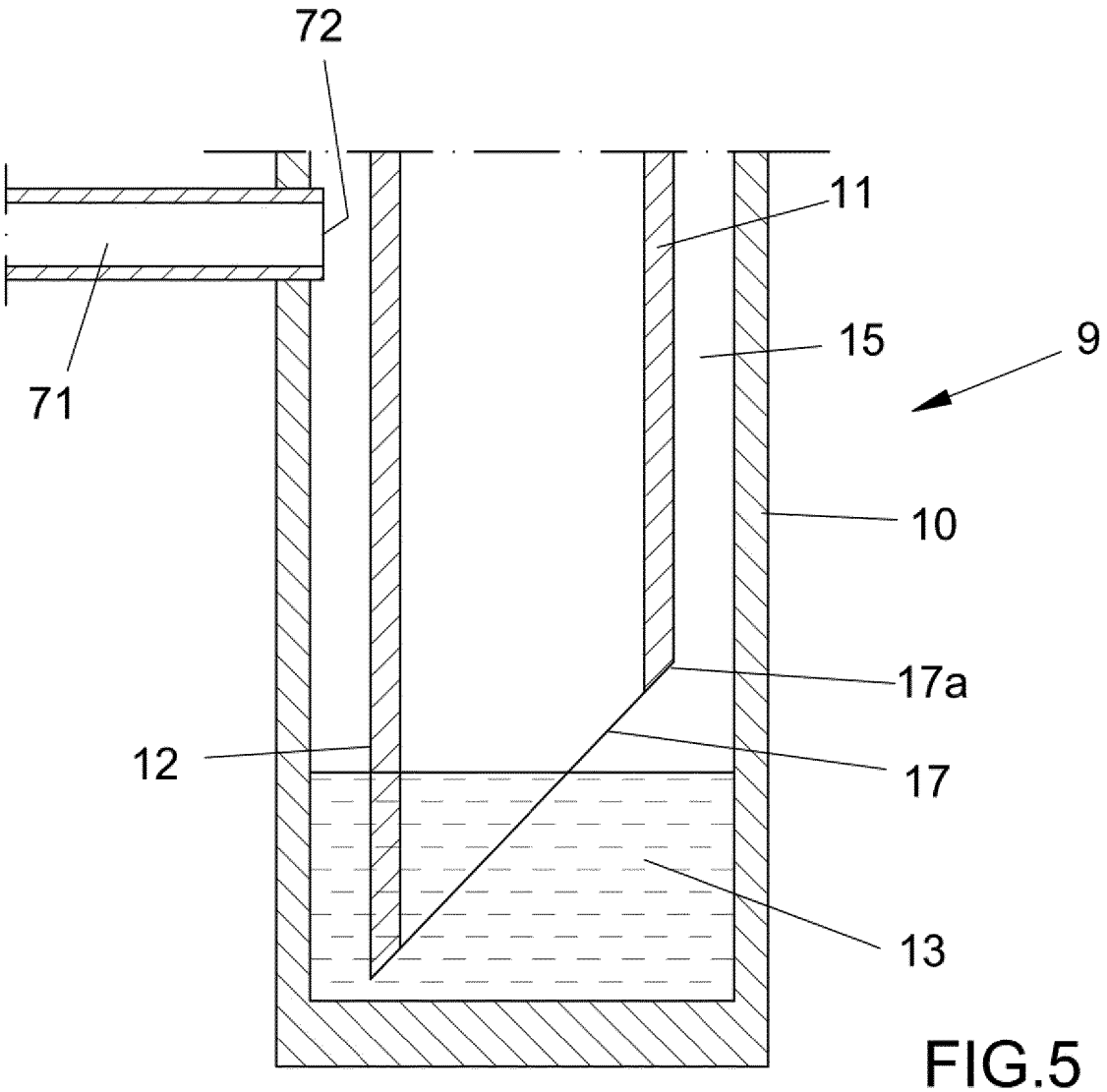

FIG.5

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 2018094842 A1 **[0006]**