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(54) **Insulation liquid expansion assembly**

(57) The invention is related to an insulation liquid expansion assembly for an insulation liquid tank (12, 52) for a high voltage coil (14), comprising an expansion vessel (22, 58, 74) with an inlet (22) and an outlet (24) opening, wherein the inlet opening (22) is foreseen to be fluidic connected with the insulation liquid tank (12, 52). A compensation pipe (26) is foreseen which is fluidic connected at its first end with the outlet opening (24) of the expansion vessel (22, 58, 74). A flexible gas bag (32, 62, 78) is fluidic connected to the compensation pipe (26) so that a gas can flow from the compensation pipe (26) into the gas bag (32, 62, 78) and backwards. Pressure means for applying a pressure force on the interior of the otherwise hermetically sealed compensation pipe (26).

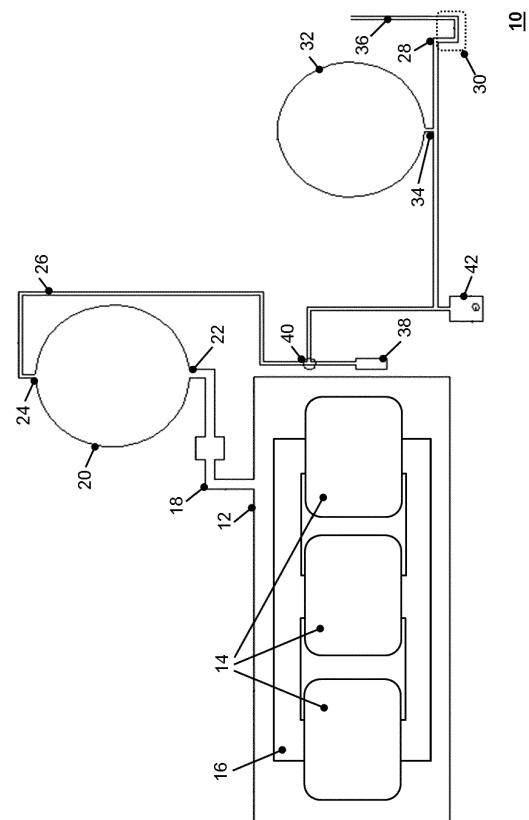


Fig. 1

## Description

**[0001]** The invention is related to an insulation liquid expansion assembly for an insulation liquid tank for a high voltage coil, comprising an expansion vessel with an inlet and an outlet opening, wherein the inlet opening is foreseen to be fluidic connected with the insulation liquid tank.

**[0002]** It is known that transformers, reactors, coils and other electrical devices in high voltage distribution networks, for example with a rated voltage of 110kV or 380kV, are typically arranged within a tank filled with an electrical insulation liquid such as oil. Thus the internal insulation distances which are required to withstand the respective voltage level are reduced and the overall size of the electrical high voltage device can become reduced in an advantageous way. In addition the electrical insulation liquid has the function of a cooling liquid.

**[0003]** Due to a thermal expansion of the insulation liquid during operation typically an expansion vessel is foreseen above the vessel. Thermal expansion depends for example on the actual operational losses of the high voltage device or on the thermal environmental frame conditions. The size of the expansion vessel is chosen in that way, that in case of minimal thermal expansion the insulation liquid tank is still full and that in case of maximum thermal expansion the expansion volume of the insulation liquid can be absorbed by the expansion vessel. Thus the filling level of the expansion vessel is in between  $>0\%$  and  $<100\%$ .

**[0004]** In order to avoid moisture contamination of the insulation liquid the surface of the insulation liquid within the expansion vessel is frequently sealed against the atmosphere. Such a sealing is commonly made by means of a flexible diaphragm or a rubber bag mounted in the expansion vessel.

**[0005]** The effort of such customized solution is high since such diaphragms or rubber bags are leading to a more complex design and a more complex handling on site during the erection and the filling procedure. In addition special monitoring devices are required for supervision of the sealing. Moreover it has also been noted that the availability of the high voltage devices arranged in an insulation liquid tank with expansion vessel is handicapped using a diaphragm or rubber bag. Any damage or leakage of such devices is leading into outages and extensive on site repair activities since the expansion vessel is located at a level above the insulation liquid tank and has only limited access. Due to wearout of the flexible diaphragm or rubber bag over the years their life time is limited a well.

**[0006]** It is objective of the invention to provide an insulation liquid expansion assembly which avoids a diaphragm or a rubber bag within the expansion vessel.

**[0007]** This problem is solved by an insulation liquid expansion assembly of the aforementioned kind. This is characterized by a compensation pipe which is fluidic connected at its first end with the outlet opening of the

expansion vessel, a flexible gas bag which is fluidic connected to the compensation pipe so that a gas can flow from the compensation pipe into the gas bag and backwards and pressure means for applying a pressure force on the interior of the otherwise hermetically sealed compensation pipe.

**[0008]** Basic idea of the invention is not to seal the surface of the insulation liquid directly within the expansion vessel, but to provide expansion means, in particular a flexible gas bag, outside the expansion vessel. The interior space of the insulation liquid tank, the expansion vessel and the flexible gas bag together form a hermetically sealed expandable interior space, wherein expansion takes place outside the expansion vessel by fitting the volume of the flexible gas bag. In order to prohibit insulation liquid flowing out of the expansion vessel, the interior of the hermetically sealed expandable interior space is not only filled with an insulation liquid, but also with a certain volume of a suitable gas. So to say the filling of the insulation liquid tank and expansion vessel with an insulation liquid corresponds to the state of the art, wherein the remaining volume of the expandable interior space, in particular the interior space of the compensation pipe and the of the flexible gas bag, are filled with the suitable gas. The maximum volume of the flexible gas bag will be at least equal to the maximum differential volume of the liquid within the insulation liquid filled tank.

**[0009]** In the easiest case the suitable gas is air. Since the whole expandable interior space is hermetically sealed no additional moisture can infiltrate therein and contaminate the insulation liquid. The operation pressure will be slightly over atmosphere pressure, for example some few mBar. Thus it is ensured, that the flexible gas bag can expand against atmosphere pressure. In order to ensure such an overpressure, pressure means are foreseen at the otherwise hermetically sealed compensation pipe for applying a pressure force on the gas in the hermetically sealed expandable interior space.

**[0010]** This flexible gas bag can be placed at any convenient floor level and distance to the insulation liquid tank by means of the compensation pipe, which might be made from pipes and/or hoses or the like. In order to allow suitable protection against UV-light and mechanical damages the flexible gas bag is preferably mounted inside a housing or enclosure. There are no certain requirements on the shape of a flexible gas bag - typically a cuboid or a cylinder shape might be used.

**[0011]** According to another embodiment of the invention the insulation liquid expansion assembly comprises an insulation liquid tank for a high voltage coil, wherein the expansion vessel is arranged above the insulation liquid tank and is fluidic connected therewith. Thus the insulation liquid tank and the expansion vessel are part of the assembly according to the invention.

**[0012]** According to another embodiment of the invention the inlet opening of the expansion vessel is arranged at its bottom and the outlet opening at its top. So it is ensured, that insulation liquid flowing out of the insulation

liquid tank due to thermal expansion is safely guided into the expansion vessel and flows back in case of a thermal contraction.

**[0013]** According to a further embodiment of the invention the pressure means of the compensation pipe comprise a separator liquid filled syphon which is fluidic connected therewith. The syphon is acting as an over pressure and vacuum protection syphon. The syphon will be filled with a separator liquid (not vaporizing or frizzing at operation conditions), which must not necessarily be but might be identical with the insulation liquid so that both liquids could be oil. The level of the separator liquid in the corresponding tubes or pipes defines the operation pressure of the gas filled bag. In case of higher pressure the separator liquid will be displaced by gas and the gas will be released to the atmosphere. In case of vacuum on the insulation liquid tank air can enter the insulation liquid expansion assembly. The insulation liquid expansion assembly can be operated with different suitable gases.

**[0014]** According to a further embodiment of the invention a riser pipe is foreseen at the open outlet of the syphon. The maximum pressure which might be applied by the separator liquid filled syphon on the hermetically sealed interior space depends on the shape and volume of the syphon itself, the filling level of separator liquid and the riser pipe. Basically the interior volume of the preferably vertically arranged riser pipe corresponds at least to half of the volume of the separator liquid within the syphon to ensure that the separator liquid can't become popped there out under normal conditions.

**[0015]** According to another embodiment of the invention a breather, in particular a silica gel breather is foreseen to become fluidic connected with the compensation pipe temporary. The expandable interior space is hermetically sealed under normal conditions. In case of a maintenance or exchange of the flexible gas bag for example it is possible to temporary connect a breather to the compensation pipe, so that any over- or under- pressure caused by a thermal expansion of the insulation liquid is compensated by opening the breather. Preferably the breather is a dry gas device such as a silica gel breather in order to reduce moisture entering the insulation liquid expansion assembly through the breather. Thus it is possible continue operation of a coil or transformer arranged in the insulation liquid tank during maintenance for a certain time.

**[0016]** According to another embodiment of the invention a three way cock is foreseen for the temporary connection of the breather with the compensation pipe. This enables a high flexibility for connecting or disconnecting any branch of the expandable interior space.

**[0017]** According to a preferred embodiment of insulation liquid expansion assembly the flexible gas bag is made from a foil or membrane. Such an arrangement has the advantage, that an expansion or contraction of the inner volume of the flexible air bag is possible without any major pressure force.

**[0018]** According to another embodiment of the invention the flexible gas bag is hermetically surrounded by a further flexible gas bag, wherein means for detecting a differential pressure inbetween the interior of both gas bags are foreseen. This is useful in case that leakage detection is required. The pressure detecting means might be a differential pressure relay that is be fitted to the surrounding flexible gas bag. If gas is leaking through the inner flexible gas bag a slight differential pressure will be detected.

**[0019]** According to further embodiment of the invention the maximum inner volume of the flexible gas bag is adapted to the inner volume of the expansion vessel. The volume of the expansion vessel is chosen in that way, that it can absorb the whole additional differential volume of the insulation liquid within the insulation liquid tank which might occur due to thermal expansion. Thus the volume of the flexible gas bag is also adapted thereto.

**[0020]** According to a preferred embodiment of the invention the flexible gas bag is arranged within an enclosure or housing. Thus a suitable protection against environmental frame conditions such as snow, wind, UV radiation and the like is provided.

**[0021]** According to another embodiment of the insulation liquid expansion assembly a sump for collecting insulation liquid is arranged at a sink of the compensation pipe. This is a fall back solution just in case that some insulation liquid is entering the compensation pipe due to a fault during maintenance for example. So it is prohibited, that insulation liquid is entering the flexible gas bag even in that case.

**[0022]** According to another embodiment of the invention a monitoring system for supervising the presence of a liquid in the sump is foreseen. Thus any respective fault can become detected automatically.

**[0023]** According to a further embodiment of the insulation liquid expansion assembly a high voltage coil and/or a high voltage transformer is arranged within the insulation liquid tank wherein the tank is filled with insulation liquid such as oil. So a complete working environment is provided as part of the insulation liquid expansion assembly.

**[0024]** Further advantageous embodiments of the invention are mentioned in the dependent claims.

**[0025]** The invention will now be further explained by means of an exemplary embodiment and with reference to the accompanying drawings, in which:

- Fig. 1 shows an exemplary first arrangement with insulation liquid expansion assembly,
- Fig. 2 shows an exemplary second arrangement with insulation liquid expansion assembly and
- Fig. 3 shows an exemplary third arrangement with insulation liquid expansion assembly.

**[0026]** Figure 1 shows an exemplary first arrangement with insulation liquid expansion assembly in a sketch 10. A high voltage transformer with high voltage coils 14 and

a transformer core 16 is arranged within an insulation liquid tank 12. The insulation liquid tank 12 is foreseen to be filled with an insulation liquid such as oil. Above the insulation liquid tank 12 an expansion vessel 20 is arranged, which is fluidic connected therewith by a liquid pipe 18, which ends at an inlet 22 at the bottom of the expansion vessel 20.

**[0027]** At the top of the expansion vessel 20 an outlet opening 24 is foreseen and a compensation pipe 26 is fluidic connected thereto. The compensation pipe 26 is leading to a syphon 30 at its second end 28. The inlet 34 of a flexible gas bag 32 is fluidic connected with the compensation pipe 26, so that gas can flow from the compensation pipe 26 into the flexible gas bag 32 and backwards. The maximum inner volume of the flexible gas bag 32 corresponds approximately to the inner volume of the expansion vessel 20.

**[0028]** The syphon 30 is foreseen to be filled with a separator liquid and to apply a pressure force on the hermetically sealed interior space of the fluidic connected insulation liquid tank 12, the expansion vessel 20 and the flexible gas bag 32. At the open end of the syphon 30 a riser pipe 36 is foreseen in order to prevent separator liquid popping out of the syphon 30.

**[0029]** By use of a three way cock 40 a breather 38 is temporary fluidic connectable with the compensation pipe 26, so that even in case of a maintenance of the flexible gas bag 32 for example the transformer can be operated anyhow. After maintenance the connection of the breather 38 has to be closed so that the interior space is hermetically sealed again. Furthermore a sump 42 is connected to the compensation pipe 26, so that fluid entering the compensation pipe 26 for example by a mistake during maintenance can be collected therein.

**[0030]** Figure 2 shows an exemplary comparable second arrangement with insulation liquid expansion assembly in a sketch 50. In this example an insulation liquid tank 52 and an expansion vessel 58 are fluidic connected and filled with an insulation liquid 54 up to a filling level 56. A respective coil or transformer is not depicted in the insulation liquid tank 52 but it can be assumed to be present. The filling level 56 within the expansion vessel 58 is rather close to full, so only a limited amount of gas 60 is present in the top of the expansion vessel 58. A compensation pipe is connecting the expansion vessel 58 with a flexible gas bag 62 that is filled nearly up to its maximum volume with gas 64. At the distal end of the compensation pipe a separator liquid 68 filled syphon 66 is foreseen to hermetically seal the end of the compensation line and to apply a pressure force thereon. This is an example for a rather high expansion of the insulation liquid.

**[0031]** Figure 3 shows an exemplary comparable third arrangement with insulation liquid expansion assembly in a sketch 70. An insulation liquid tank and an expansion vessel 74 are fluidic connected and filled with an insulation liquid up to a filling level 72. The filling level 72 within the expansion vessel 74 is rather close to empty, so that

larger amount of gas 76 is present in the top of the expansion vessel 74. A compensation pipe is connecting the expansion vessel 74 with a flexible gas bag 80 that is filled with only a small amount of its maximum volume with gas 80. This is an example for a very low expansion of the insulation liquid.

#### List of reference signs

#### 10 [0032]

- |    |                                                                        |
|----|------------------------------------------------------------------------|
| 10 | exemplary first arrangement with insulation liquid expansion assembly  |
| 12 | insulation liquid tank                                                 |
| 14 | coils                                                                  |
| 15 | transformer core                                                       |
| 16 | liquid pipe                                                            |
| 18 | expansion vessel                                                       |
| 20 | inlet opening of expansion vessel                                      |
| 22 | outlet opening of expansion vessel                                     |
| 24 | compensation pipe                                                      |
| 26 | second end of compensation pipe                                        |
| 28 | syphon                                                                 |
| 30 | flexible gas bag                                                       |
| 32 | inlet of flexible gas bag                                              |
| 34 | riser pipe                                                             |
| 36 | breather                                                               |
| 38 | three way cock                                                         |
| 40 | sump                                                                   |
| 42 | exemplary second arrangement with insulation liquid expansion assembly |
| 50 | insulation liquid tank                                                 |
| 52 | insulation liquid                                                      |
| 54 | first filling level of insulation liquid                               |
| 56 | expansion vessel                                                       |
| 58 | gas in expansion vessel                                                |
| 60 | flexible gas bag                                                       |
| 62 | gas in flexible gas bag                                                |
| 64 | syphon                                                                 |
| 66 | liquid in syphon                                                       |
| 68 | exemplary third arrangement with insulation liquid expansion assembly  |
| 70 | second filling level of insulation liquid                              |
| 72 | expansion vessel                                                       |
| 74 | gas in expansion vessel                                                |
| 76 | flexible gas bag                                                       |
| 78 | gas in flexible gas bag                                                |
| 80 |                                                                        |

#### 50 Claims

1. Insulation liquid expansion assembly for an insulation liquid tank (12, 52) for a high voltage coil (14), comprising

- an expansion vessel (22, 58, 74) with an inlet (22) and an outlet (24) opening, wherein the inlet opening (22) is foreseen to be fluidic connected

with the insulation liquid tank (12, 52),

**characterized by**

- a compensation pipe (26) which is fluidic connected at its first end with the outlet opening (24) of the expansion vessel (22, 58, 74),
  - a flexible gas bag (32, 62, 78) which is fluidic connected to the compensation pipe (26) so that a gas can flow from the compensation pipe (26) into the gas bag (32, 62, 78) and backwards and
  - pressure means for applying a pressure force on the interior of the otherwise hermetically sealed compensation pipe (26).
2. Insulation liquid expansion assembly according to claim 1, **characterized in that** it comprises an insulation liquid tank (12, 52) for a high voltage coil (14), wherein the expansion vessel (22, 58, 74) is arranged above the insulation liquid tank (12, 52) and fluidic connected therewith.
  3. Insulation liquid expansion assembly according to claim 2, **characterized in that** inlet opening (22) of the expansion vessel (22, 58, 74) is arranged at its bottom and the outlet opening (24) at its top.
  4. Insulation liquid expansion assembly according to any of the previous claims, **characterized in that** the pressure means of the compensation pipe (26) comprise a liquid (68) filled syphon (30, 66) which is fluidic connected therewith.
  5. Insulation liquid expansion assembly according to claim 4, **characterized in that** a riser pipe (36) is foreseen at the open outlet of the syphon (30, 66).
  6. Insulation liquid expansion assembly according to any of the previous claims, **characterized in that** a breather (38), in particular a silica gel breather, is foreseen to become fluidic connected with the compensation pipe (26) temporary.
  7. Insulation liquid expansion assembly according to claim 6, **characterized in that** a three way cock (40) is foreseen for the temporary connection of the breather (38) with the compensation pipe (26).
  8. Insulation liquid expansion assembly according to any of the previous claims, **characterized in that** the flexible gas bag (32, 62, 78) is made from a foil or membrane.
  9. Insulation liquid expansion assembly according to claim 8, **characterized in that** the flexible gas bag (32, 62, 78) is hermetically surrounded by a further flexible gas bag, wherein means for detecting a differential pressure inbetween the interior of both gas

bags are foreseen.

10. Insulation liquid expansion assembly according to any of the previous claims, **characterized in that** the maximum inner volume of the flexible gas bag (32, 62, 78) is adapted to the inner volume of the expansion vessel (22, 58, 74).
11. Insulation liquid expansion assembly according to any of the previous claims, **characterized in that** the flexible gas bag (32, 62, 78) is arranged within an enclosure or housing.
12. Insulation liquid expansion assembly according to any of the previous claims, **characterized in that** a sump (42) for collecting liquid is arranged at a sink of the compensation pipe (26).
13. Insulation liquid expansion assembly according to claim 12, **characterized in that** a monitoring system for supervising the presence of a liquid in the sump (42) is foreseen.
14. Insulation liquid expansion assembly according to any of the previous claims, **characterized in that** a high voltage coil (14) and/or a high voltage transformer is arranged within the insulation liquid tank (12, 52) and **in that** it is filled with an insulation liquid (54).

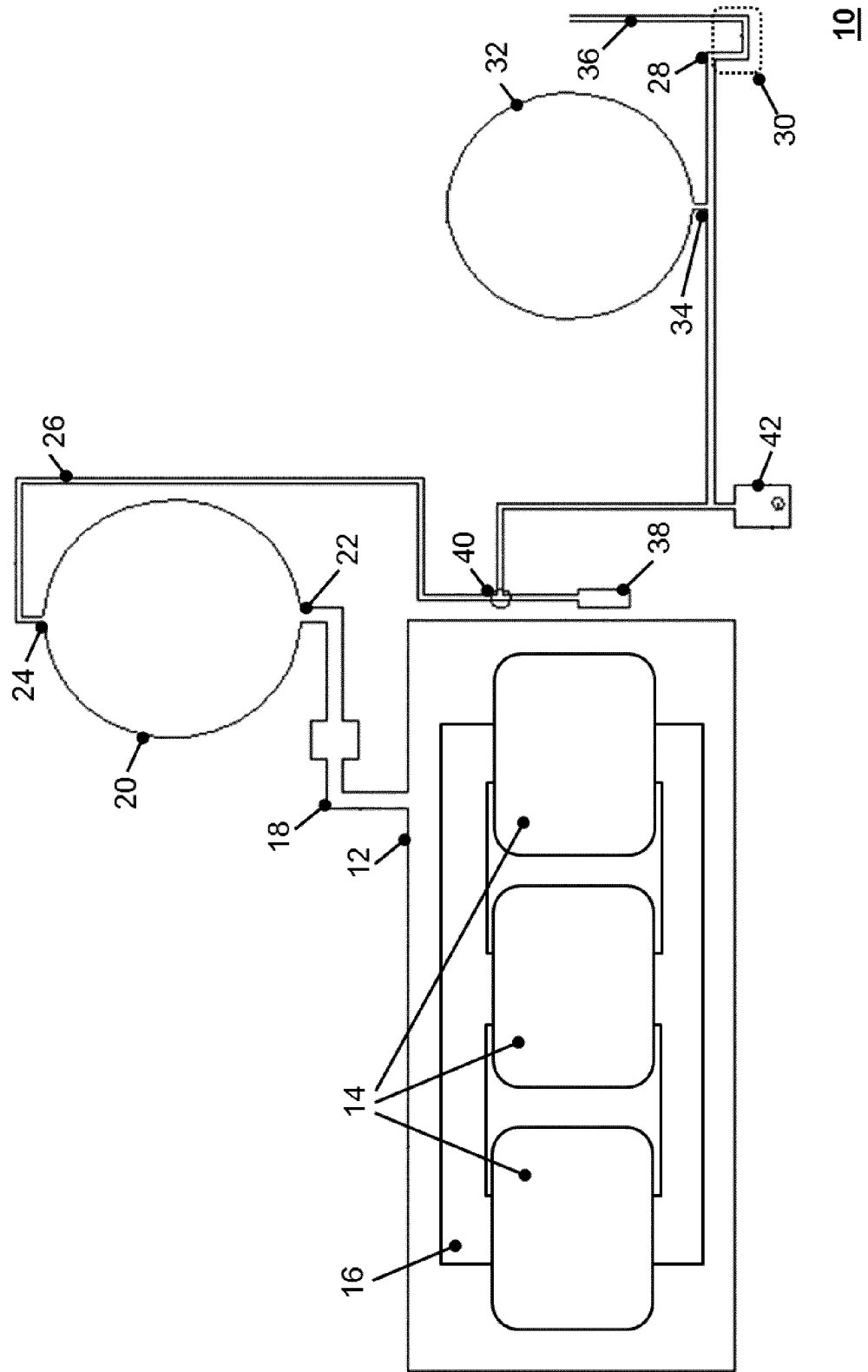


Fig. 1

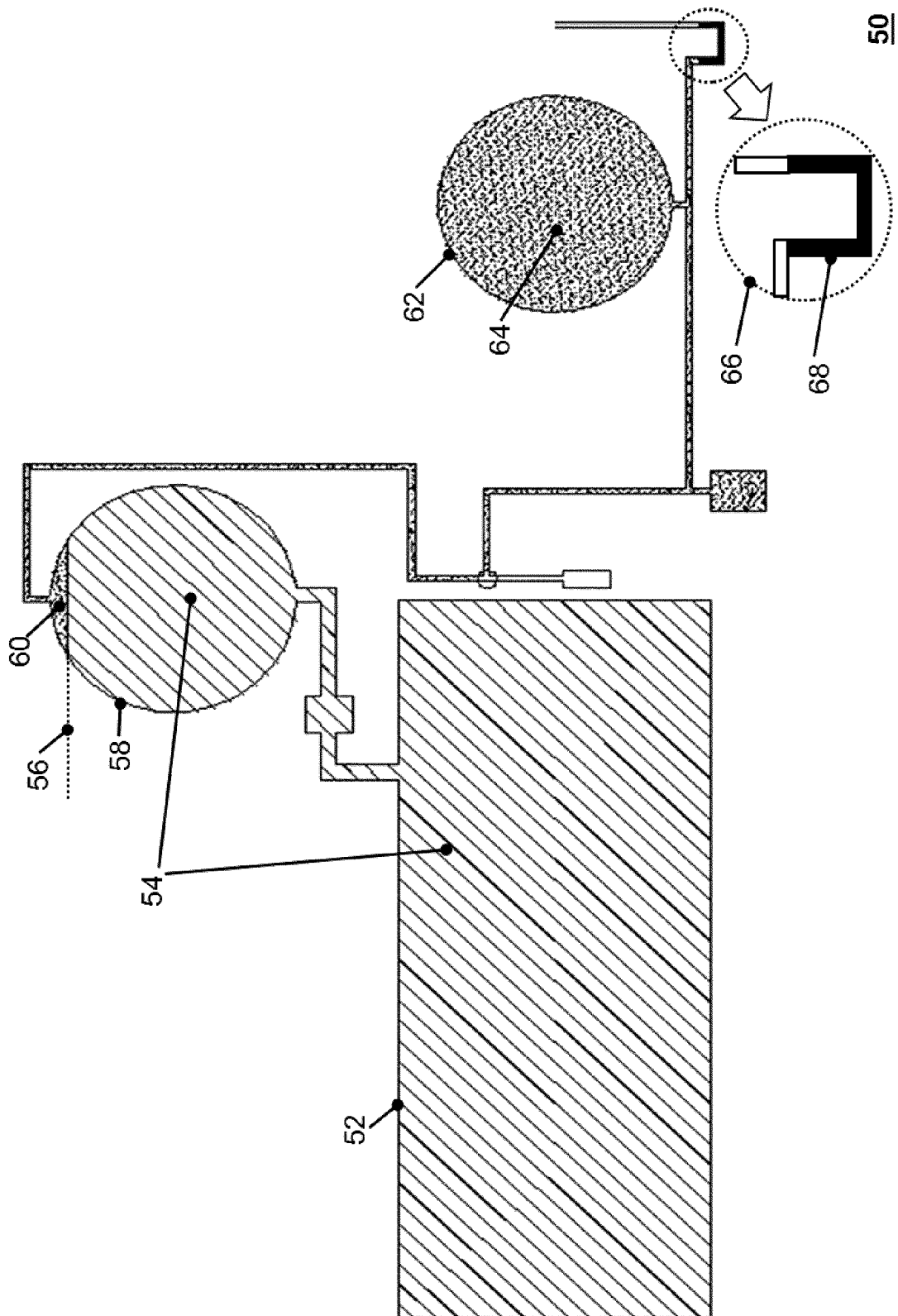


Fig. 2

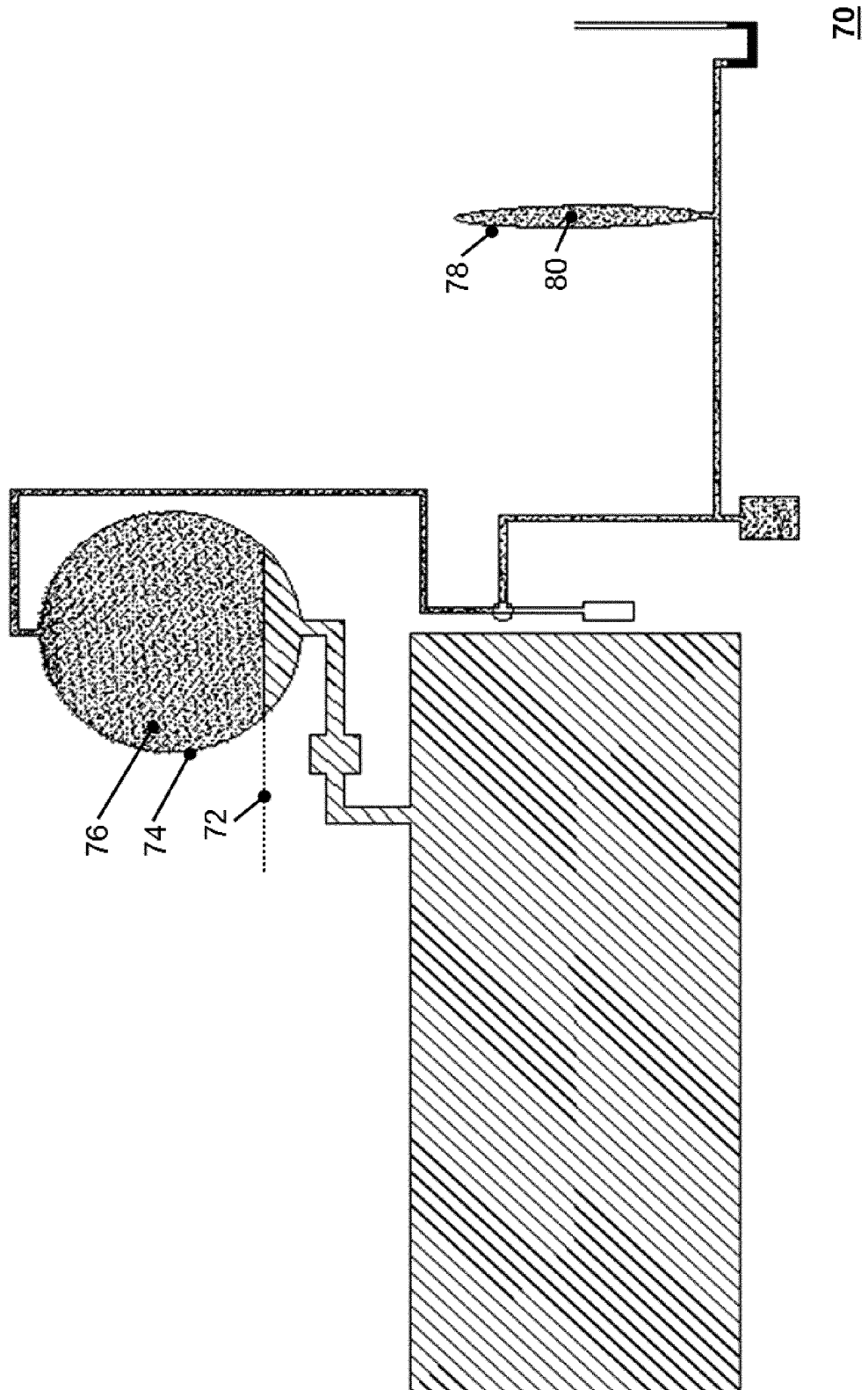


Fig. 3





## EUROPEAN SEARCH REPORT

 Application Number  
 EP 15 15 9799

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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) |
| X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | GB 945 688 A (HENRI JOSSE)<br>8 January 1964 (1964-01-08)<br>* the whole document *                             | 1-3,10,<br>11,14                 | INV.<br>H01F27/14                       |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                 |                                  | TECHNICAL FIELDS SEARCHED (IPC)         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                 |                                  | H01F                                    |
| <div style="border: 1px solid black; padding: 5px;"> <p><del>The present search report has been drawn up for all claims</del></p> </div>                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                                  |                                         |
| Place of search                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                 | Date of completion of the search | Examiner                                |
| Munich                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                 | 21 September 2015                | Tano, Valeria                           |
| 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<br>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>& : member of the same patent family, corresponding document |                                                                                                                 |                                  |                                         |

EPO FORM 1503 03/02 (P04C01)



Application Number

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**CLAIMS INCURRING FEES**

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

**LACK OF UNITY OF INVENTION**

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-5, 10, 11, 14

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



**LACK OF UNITY OF INVENTION**  
**SHEET B**

Application Number

EP 15 15 9799

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-5, 10, 11, 14

Insulation liquid expansion assembly for an insulation liquid tank for a high voltage coil, comprising an expansion vessel with an inlet and an outlet opening, wherein the inlet opening is foreseen to be fluidic connected with the insulation liquid tank, further comprising a compensation pipe which is fluidic connected at its first end with the outlet opening of the expansion vessel, a flexible gas bag which is fluidic connected to the compensation pipe so that a gas can flow from the compensation pipe into the gas bag and backwards and pressure means for applying a pressure force on the interior of the otherwise hermetically sealed compensation pipe (claim 1);  
the pressure means of the compensation pipe comprising a liquid filled syphon which is fluidic connected therewith (claim 4)

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2. claims: 6, 7

Insulation liquid expansion assembly for an insulation liquid tank for a high voltage coil, comprising an expansion vessel with an inlet and an outlet opening, wherein the inlet opening is foreseen to be fluidic connected with the insulation liquid tank, further comprising a compensation pipe which is fluidic connected at its first end with the outlet opening of the expansion vessel, a flexible gas bag which is fluidic connected to the compensation pipe so that a gas can flow from the compensation pipe into the gas bag and backwards and pressure means for applying a pressure force on the interior of the otherwise hermetically sealed compensation pipe (claim 1);  
a breather, in particular a silica gel breather, is foreseen to become fluidic connected with the compensation pipe temporary (claim 6)

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3. claims: 8, 9

Insulation liquid expansion assembly for an insulation liquid tank for a high voltage coil, comprising an expansion vessel with an inlet and an outlet opening, wherein the inlet opening is foreseen to be fluidic connected with the insulation liquid tank, further comprising a compensation pipe which is fluidic connected at its first end with the outlet opening of the expansion vessel, a flexible gas bag which is fluidic connected to the compensation pipe so that a gas can flow from the compensation pipe into the gas bag and backwards and pressure means for applying a pressure force on the interior of the otherwise hermetically sealed



**LACK OF UNITY OF INVENTION**  
**SHEET B**

Application Number

EP 15 15 9799

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

compensation pipe (claim 1);  
the flexible gas bag being made from a foil or membrane  
(claim 8)

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4. claims: 12, 13

Insulation liquid expansion assembly for an insulation liquid tank for a high voltage coil, comprising an expansion vessel with an inlet and an outlet opening, wherein the inlet opening is foreseen to be fluidic connected with the insulation liquid tank, further comprising a compensation pipe which is fluidic connected at its first end with the outlet opening of the expansion vessel, a flexible gas bag which is fluidic connected to the compensation pipe so that a gas can flow from the compensation pipe into the gas bag and backwards and pressure means for applying a pressure force on the interior of the otherwise hermetically sealed compensation pipe (claim 1);  
a sump for collecting liquid is arranged at a sink of the compensation pipe (claim 12)

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**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 15 15 9799

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

21-09-2015

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