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(54) **HIGH VOLTAGE ASSEMBLY**

(57) It is proposed a hermetically sealed high voltage assembly (2) comprising: a hermetically sealed compartment (4) delimited by rigid walls, wherein the compartment (4) contains an active component (12) at least partly surrounded by an insulation liquid (10); a hermetically sealed conservator (6) delimited by rigid walls; and a liquid connection (8) between the conservator (6) and the compartment (4).

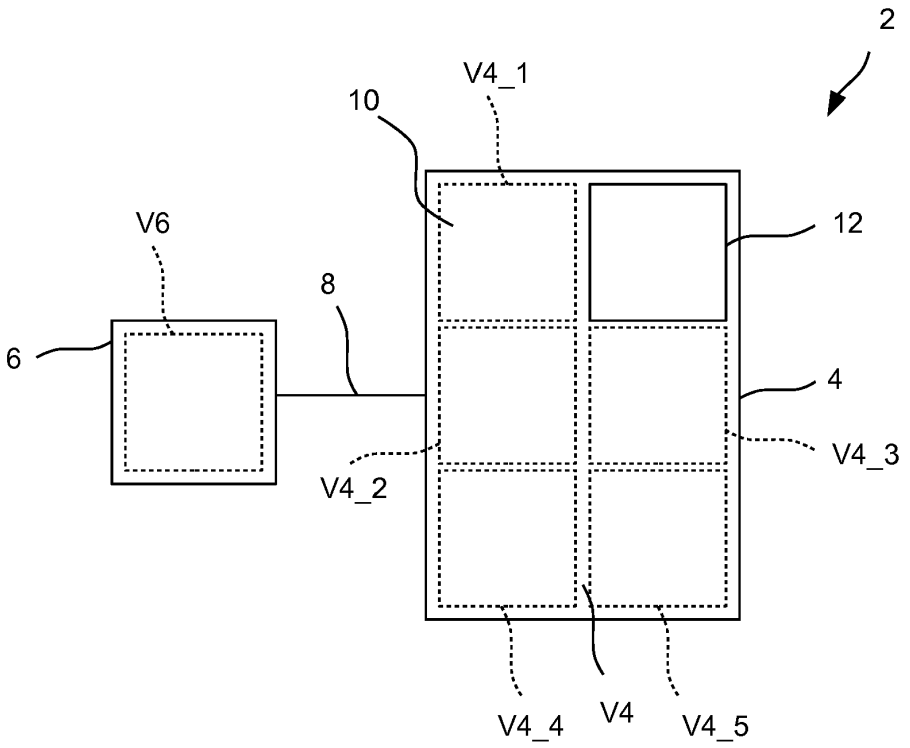

Fig. 1

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a high voltage assembly.

BACKGROUND

[0002] Known high voltage assemblies like oil immersed power transformers or oil immersed reactors comprise a conservator which is adapted to receive an expansion volume of an insulation liquid. The insulation liquid surrounds at least partly an active component in a compartment. Only by way of example reference is made to AT 96108 B.

SUMMARY

[0003] In view of the prior art, it is an object of the present disclosure to improve a high voltage assembly.

[0004] It is proposed a hermetically sealed high voltage assembly comprising: a hermetically sealed compartment delimited by rigid walls, wherein the compartment contains an active component at least partly surrounded by an insulation liquid; a hermetically sealed conservator delimited by rigid walls, wherein a level of insulation liquid inside the conservator is at or below a level of a cover of the compartment; and a liquid connection between the conservator and the compartment.

[0005] Advantageously, an area above the cover of the compartment can be used for other purposes or simply remains free. Moreover, the proposed high voltage assembly may be constructed to present a more compact design in the sense that single components can be arranged close together. Therefore, it is established a degree of freedom with regard to the location of the conservator.

[0006] According to an embodiment a reception volume of the conservator is equal to or greater than one fifth, especially one quarter, and especially one third of a volume of the insulation liquid in the high voltage assembly.

[0007] The proposed volume of the conservator provides a sufficient fluid cushion for the expanding insulation liquid with a flexibility regarding the position of the conservator. This degree of freedom allows further components, for example the bushings, to be placed at a technically favorable position. The dimensions of the high voltage assembly may increase but can be favorably adapted. Advantageously the proposed high voltage assembly can be equipped with an oil-to-air cooler or an oil-to-water cooler. Furthermore, the hermetical seal of the high voltage assembly prevents ageing of the paper insulation as moisture and oxygen are kept away from the insulation liquid.

[0008] An advantageous embodiment is characterized in that the conservator is partly filled with a compressible fluid in direct contact with the insulation liquid. In comparison with a rubber bag lifetime expectation is increased as there is no further component which may get brittle and porous. Moreover, a connection for permanent breathing of the high voltage assembly is avoided.

[0009] An advantageous embodiment is characterized in that operating conditions of the compressible fluid comprise an absolute pressure of the compressible fluid between a lower pressure limit and an upper pressure limit. These operating conditions allow operating the conservator with under pressure of the compressible fluid and therefore provide a limit for the size of the conservator.

[0010] An advantageous embodiment is characterized in that the compartment and the conservator have a joint wall. This allows a more compact high voltage assembly. Furthermore, material consumption is reduced.

[0011] An advantageous embodiment is characterized in that the conservator comprises a pressure relief valve which is adapted to discharge the compressible fluid to the environment if an absolute pressure of the compressible fluid rises above the upper pressure limit.

[0012] An advantageous embodiment is characterized in that the conservator comprises an intake unit which is adapted to supply the conservator with fluid if an absolute pressure of the compressible fluid drops below the lower pressure limit. This ensures safe operation of the high voltage assembly by limiting the pressure of the compressible fluid.

[0013] An advantageous embodiment is characterized in that the supplied fluid is dry air or nitrogen originating from a fluid reservoir. The proposed supplied fluid advantageously does not negatively interfere with the insulation liquid.

[0014] An advantageous embodiment is characterized in that the conservator is arranged besides the compartment. Advantageously this embodiment provides a favorable position for the conservator as an area above the cover is not used for the conservator. Furthermore, the conservator can be arranged in direct neighborhood to the compartment.

[0015] An advantageous embodiment is characterized in that the conservator is arranged inside the compartment. Advantageously, this embodiment provides a compact design of the high voltage assembly.

[0016] An advantageous embodiment is characterized in that the conservator is arranged below the compartment.

[0017] An advantageous embodiment is characterized in that a level of insulation liquid inside the conservator is above a level of the cover of the compartment.

[0018] An advantageous embodiment is characterized in that the conservator is arranged above the compartment.

BRIEF DESCRIPTION OF THE FIGURES

[0019] Figures 1 to 5 show schematically a hermetically sealed high voltage assembly, respectively.

DESCRIPTION OF THE EMBODIMENTS

[0020] Figure 1 shows schematically a hermetically sealed high voltage assembly 2. The high voltage assembly 2 can be a high voltage transformer, a high voltage reactor or a vacuum-type tap changer. The high voltage assembly 2 comprises a hermetically sealed compartment 4 delimited by rigid walls, hermetically sealed conservator 6 and a liquid connection 8 connecting the conservator 6 with the compartment 4. The liquid connection 8 serves to exchange insulation liquid 10 surrounding at least partly an active component 12 in the compartment 4. In the case of an embodiment of the high voltage transformer or the high voltage reactor the active component 12 comprises a core and windings. Most of the insulation liquid 10 resides inside the compartment 4 and the conservator 6 is intended to receive an expansion volume of the insulation liquid 10 as the insulation liquid 10 is subject to temperature differences which results in changes of the volume of the insulation liquid 10.

[0021] For illustration purposes only the volume V4 of the compartment 4 is split into a number of five volume parts V4_1 to V4_5. As the volume V4 receives a major part of the whole insulation liquid 10, the volume V4 approximately reflects a volume of the whole insulation liquid 10 in the high voltage assembly 2 including the insulation liquid 10 residing in the conservator 6 and the liquid connection 8. A reception volume V6 of the conservator 6 is equal or greater than one fifth especially one quarter, and especially one third of the volume V4 of the insulation liquid 10 in the whole high voltage assembly 2. The reception volume V6 is an inner volume for receiving the insulation liquid 10 and a compressible fluid. On the other hand, the reception volume V6 of the conservator 6 is smaller than one third of the volume V4 of the insulation liquid 10.

[0022] Figure 2 shows schematically the hermetically sealed high voltage assembly 2 according to an embodiment. The conservator 6 is partly filled with the compressible fluid 14. The compressible fluid 14 provides a fluid cushion in the sense that when temperature of the insulation liquid 10 rises the insulation liquid 10 expands. This expansion of the insulation liquid 10 results in the insulation liquid 10 flowing from the compartment 4 to the conservator 6. Therefore, the volume of the compressible fluid 14 in the conservator 6 decreases and the pressure of the compressible fluid 14 increases. The contrary applies to the reverse process in the sense of a contraction of the volume of the insulation liquid 10, i.e. the volume of the compressible fluid 14 increases and the pressure of the compressible fluid decreases.

[0023] The compressible fluid 14 is in direct contact with the insulation liquid 10. Examples for the compressible fluid 14 are dried air or nitrogen. In operation of the high voltage assembly 2 the conservator 6 is partly filled with the compressible fluid 14. The operating conditions of the compressible fluid comprise an absolute pressure of the compressible fluid 14 between a lower pressure limit and an upper pressure limit, for example between 0.6 bar and 1.8 bar, especially between 0.8 bar and 1.6 bar, and especially between 0.9 bar and 1.5 bar.

[0024] The conservator 6 comprises a pressure relief valve 16 for discharging the compressible fluid 14 to the environment if an absolute pressure of the compressible fluid 14 rises above the upper pressure limit, for example 1.8 bar, especially above 1.6 bar, and especially above 1.5 bar. Furthermore, the conservator 6 comprises an intake unit 18 being adapted to supply the conservator 6 with fluid if an absolute pressure of the compressible fluid 14 drops below the lower pressure limit, for example 0.9 bar, especially below 0.8 bar, and especially below 0.6 bar. The intake unit 18 comprises a valve 20 which is adapted to open a liquid connection between the conservator 6 and a fluid reservoir 22 if the absolute pressure of the compressible fluid 14 inside the conservator 6 drops below the lower pressure limit, for example 0.9 bar, especially below 0.8 bar, and especially below 0.6 bar. The fluid reservoir 22 contains dry air or nitrogen with a pressure above the upper pressure limit, for example above 0.9 bar, especially above 0.8 bar, and especially above 0.6 bar. Of course the intake unit 18 can be omitted.

[0025] A pressure sensor 24 determines a pressure P of the compressible fluid 14 in the conservator 6. A level sensor 26 determines a level L of insulation liquid 10 inside the conservator 6. A control unit 28 monitors the pressure P and/or the level L and determines a failure F in dependence on the pressure P and/or the level L.

[0026] The compartment 4 comprises a ground 30 and a cover 32. A Buchholz relay 34 is arranged above a level L32 of the cover 32. The conservator 6 is arranged besides the compartment 4. The conservator 6 does not necessarily occupy an area 36 above the cover 32 of the compartment 4. The level L of insulation liquid 10 inside the conservator 6 remains below the level L32 of the cover 32. The conservator 6 and the compartment 4 share a joint wall 38. Of course the conservator 6 and the compartment 4 can be also embodied as separate containers.

[0027] An opening 40 of the liquid connection 8 is arranged at a lower part of the conservator 6 to inhibit compressible fluid 14 from flowing into the compartment 4. An opening 42 of the liquid connection 8 is arranged at a lower part of the compartment 4. In another embodiment the opening 42 is arranged at the middle or upper part of the compartment 4.

[0028] Figure 3 is shows schematically an embodiment of the high voltage assembly 2. With difference to figure 2 the conservator 6 is arranged inside the compartment 4.

[0029] Figure 4 shows schematically an embodiment of the high voltage assembly 2. With difference to figure 2 the conservator 6 is arranged above the compartment 4.

[0030] Figure 5 shows schematically an embodiment of the high voltage assembly 2. With difference to figure 2 the conservator 6 is arranged below the compartment 4.

[0031] All embodiments of the high voltage assembly

2 comprise a joint wall 38 shared between the conservator 6 and the compartment 4. Of course, the conservator 6 can be also arranged separately inside or outside the compartment 4 without having such a joint wall 38.

Claims

1. A hermetically sealed high voltage assembly (2) comprising:

   - a hermetically sealed compartment (4) delimited by rigid walls, wherein the compartment (4) contains an active component (12) at least partly surrounded by an insulation liquid (10);
   - a hermetically sealed conservator (6) delimited by rigid walls, wherein a level (L) of insulation liquid (10) inside the conservator (6) is at or below a level (L32) of a cover (32) of the compartment (4); and
   - a liquid connection (8) between the conservator (6) and the compartment (4).

2. The high voltage assembly (2) according to claim 1, wherein a reception volume (V6) of the conservator (6) is equal to or greater than one fifth, especially one quarter, and especially one third of a volume (V4) of the insulation liquid (10) in the high voltage assembly (2).

3. The high voltage assembly (2) according to claim 1 or 2, wherein the conservator (6) is partly filled with a compressible fluid (14) in direct contact with the insulation liquid (10).

4. The high voltage assembly (2) according to claim 2, wherein operating conditions of the compressible fluid (14) comprise an absolute pressure of the compressible fluid (14) between a lower pressure limit and an upper pressure limit.

5. The high voltage assembly (2) according to one of the preceding claims, wherein the compartment (4) and the conservator (6) have a joint wall (38).

6. The high voltage assembly (2) according to one of the preceding claims, wherein the conservator (6) comprises a pressure relief valve (16) which is adapted to discharge the compressible fluid (14) to the environment if an absolute pressure of the compressible fluid (14) rises above the upper pressure limit.

7. The high voltage assembly (2) according to one of the preceding claims, wherein the conservator (6) comprises an intake unit (18) which is adapted to supply the conservator (6) with fluid if an absolute pressure of the compressible fluid (14) drops below the lower pressure limit.

8. The high voltage assembly (2) according to claim 7, wherein the supplied fluid is dry air or nitrogen originating from a fluid reservoir (22).

9. The high voltage assembly (2) according to one of the preceding claims, wherein the conservator (6) is arranged besides the compartment (4).

10. The high voltage assembly (2) according to claims 1 to 8, wherein the conservator (6) is arranged inside the compartment (4).

11. The high voltage assembly (2) according to claims 1 to 8, wherein the conservator (6) is arranged below the compartment (4).

12. The high voltage assembly (2) according to one of the preceding claims, wherein a level (L) of insulation liquid (10) inside the conservator (6) is above a level (L32) of the cover (32) of the compartment (4).

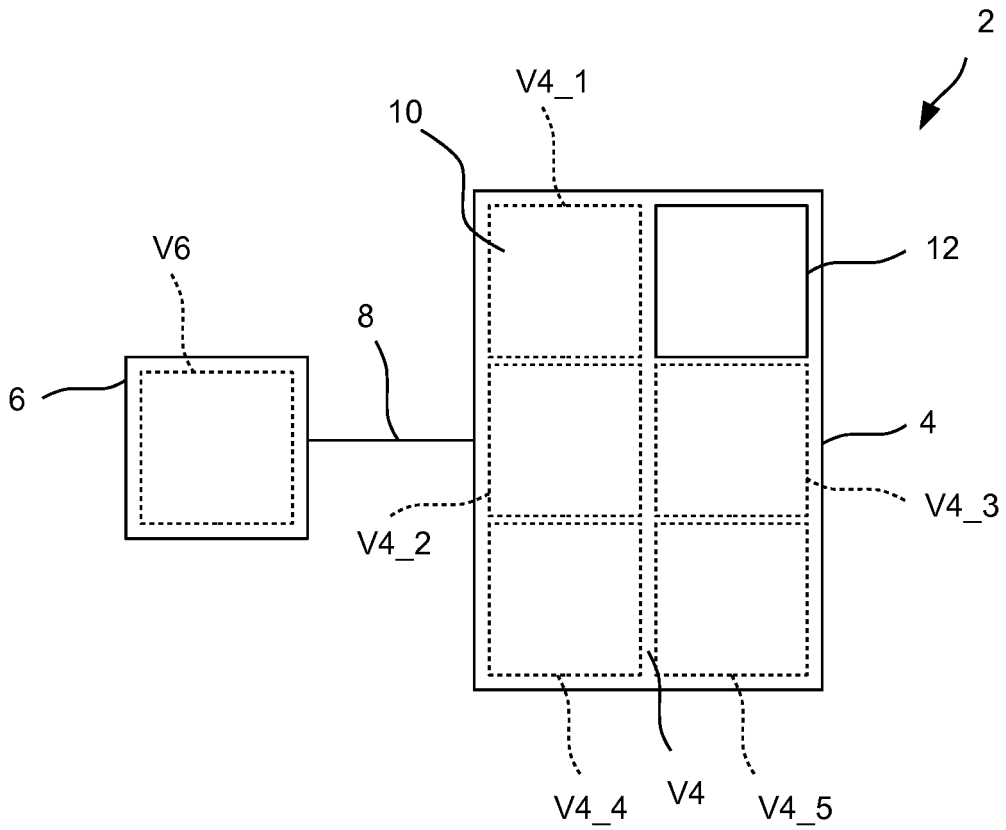
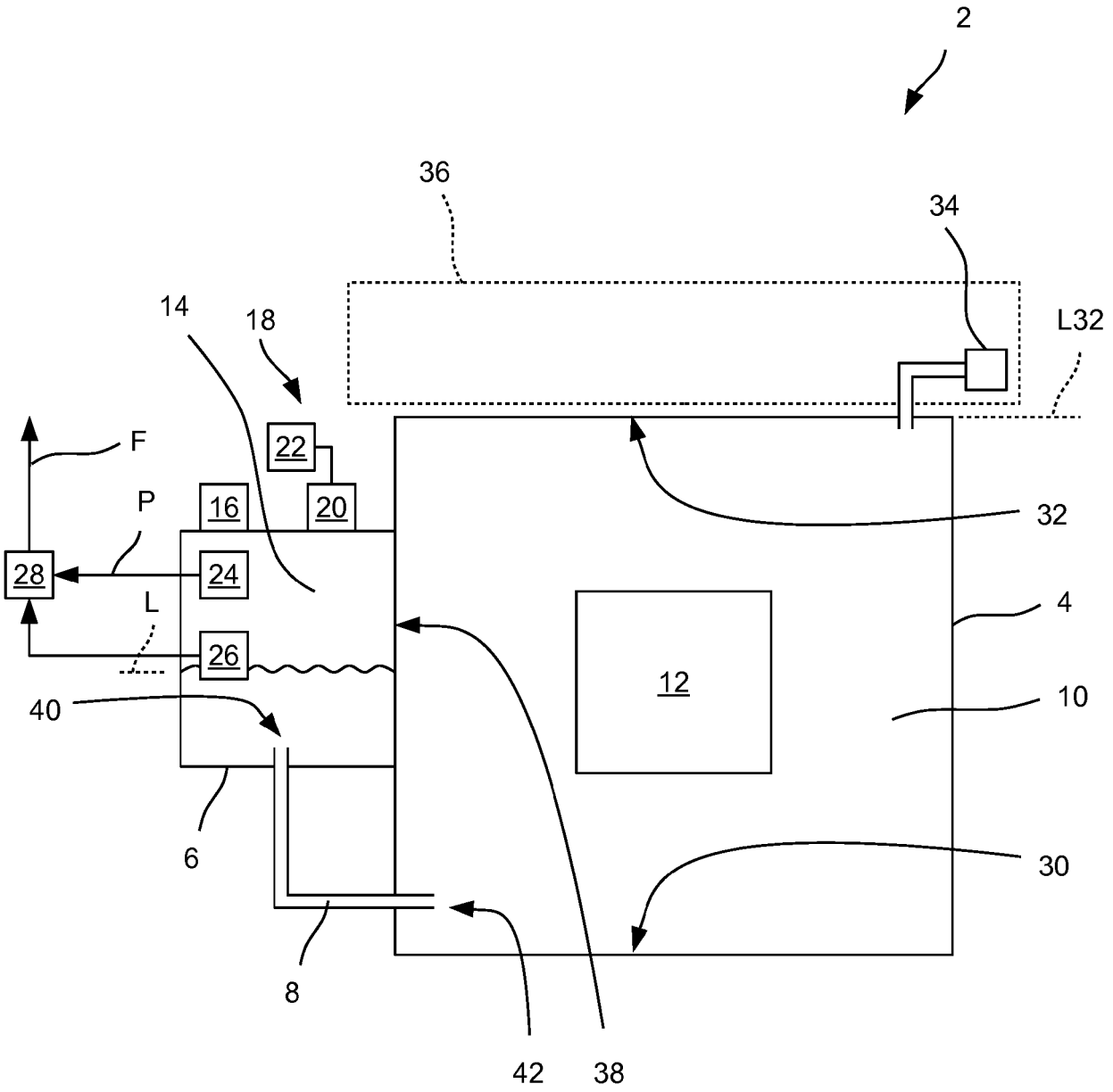


Fig. 1



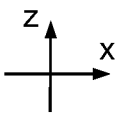


Fig. 2

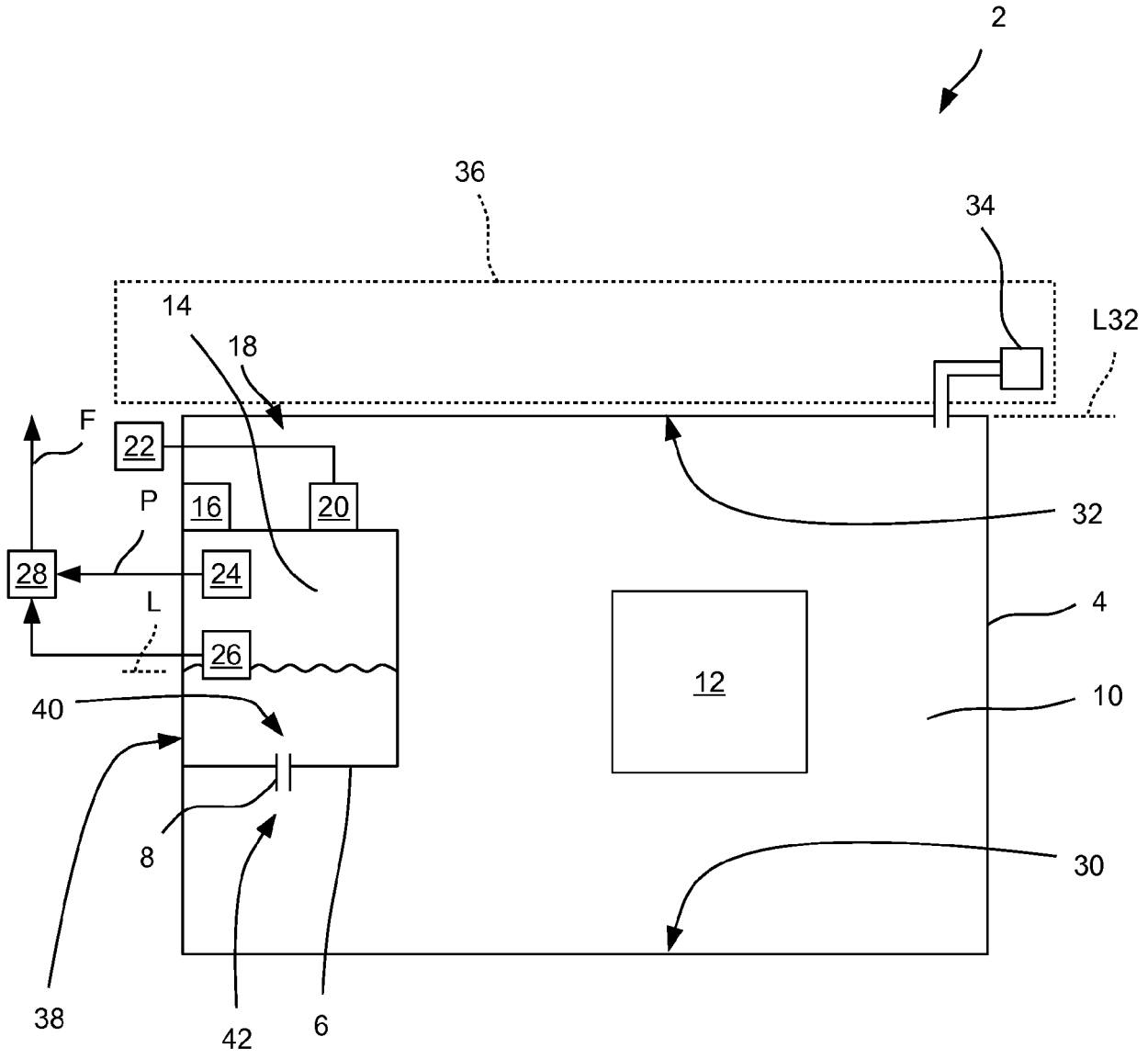


Fig. 3

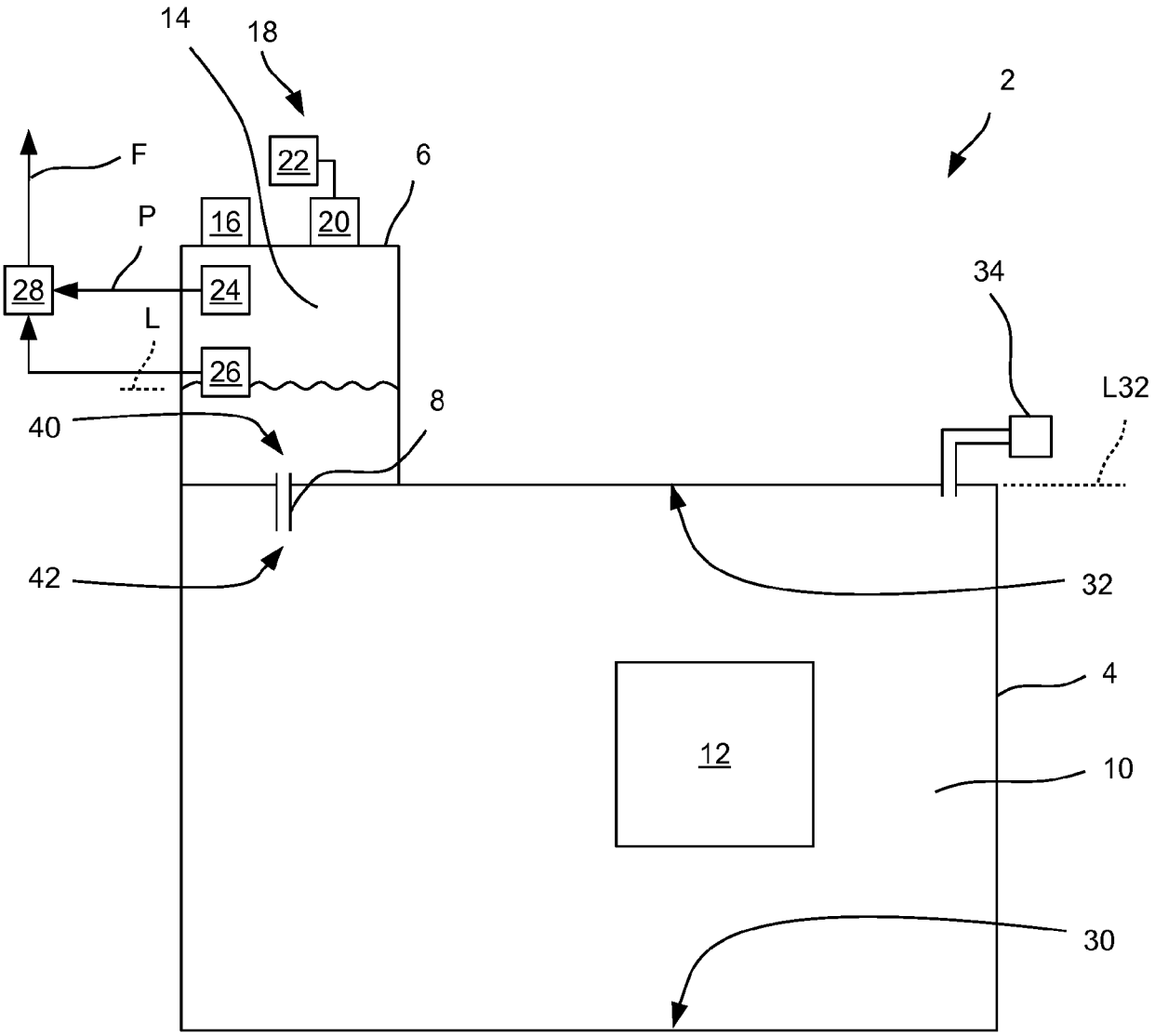


Fig. 4

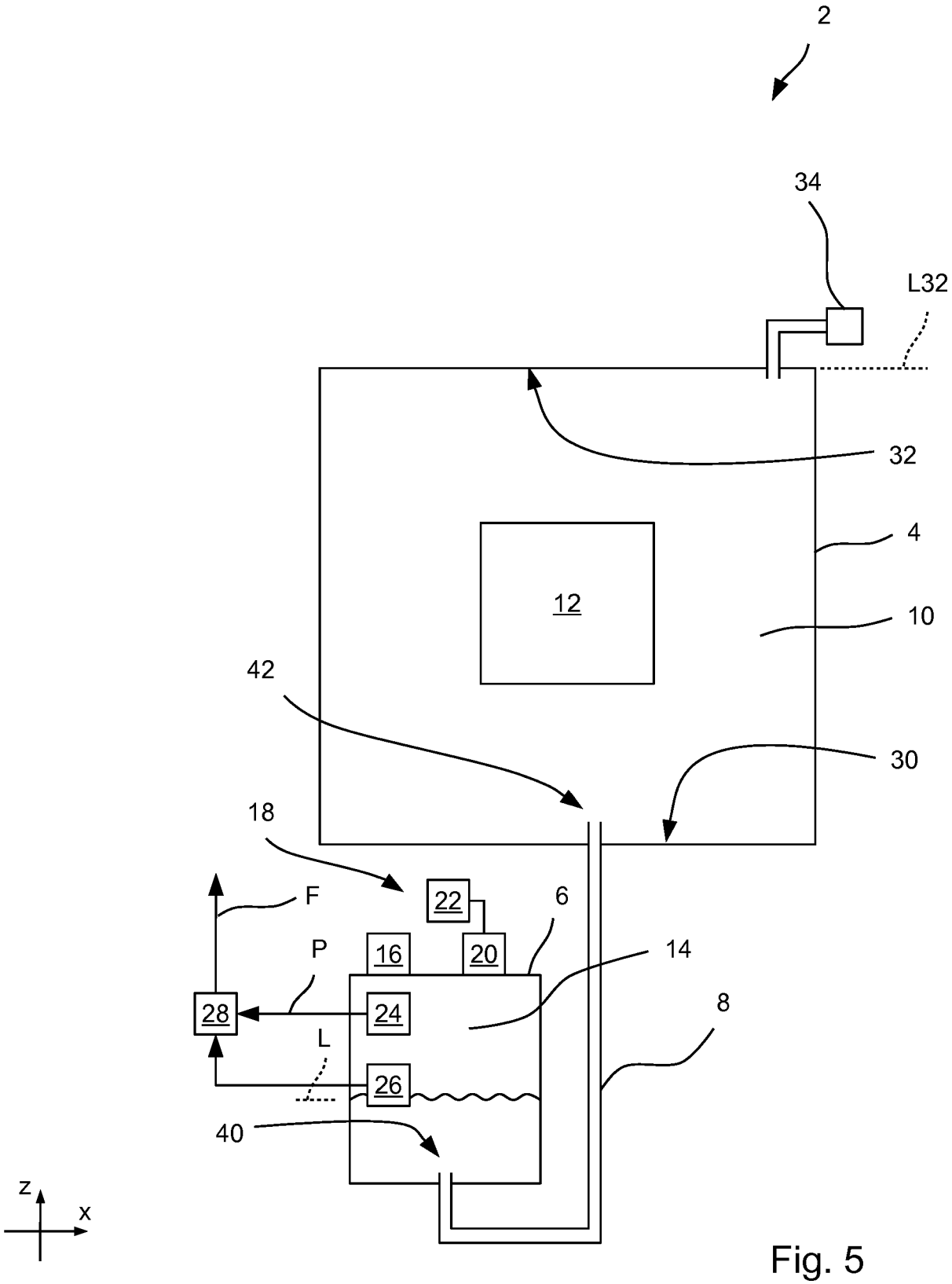


Fig. 5

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Application Number
EP 17 15 8498

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	31 August 2017	Gols, Jan

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