June 3, 1969 SHINJI NAKAZAWA ET AL 3,448,219

PRESSURE BALANCING CONSERVATOR FOR A TRANSFORMER

Filed Dec. 5, 1967

Fig. 1

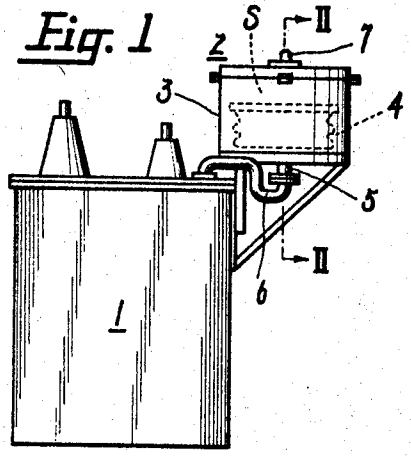


Fig. 2

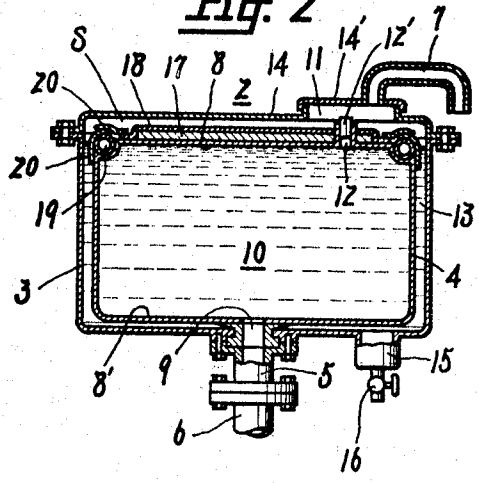


Fig. 3

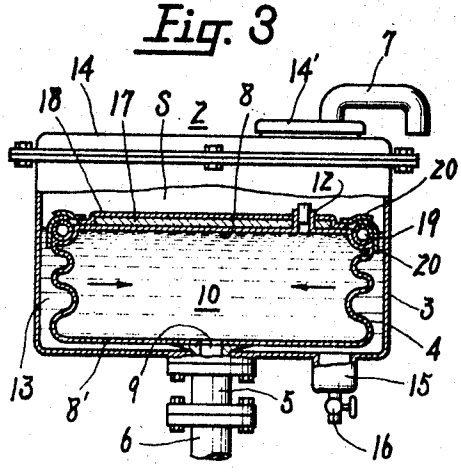
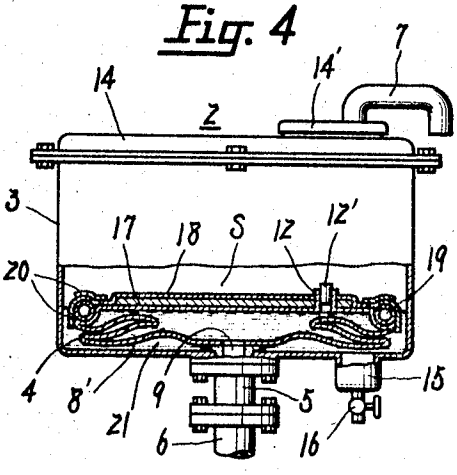


Fig. 4



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PRESSURE BALANCING CONSERVATOR FOR A TRANSFORMER

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U.S. Cl. 174—12 11 Claims

ABSTRACT OF THE DISCLOSURE

A conservator for an oil-filled transformer includes an outer housing with a gas-tight expansible cell located within the housing and is surrounded on the sides and bottom by a balancing liquid. The top wall of the cell is made either of a buoyant material or includes buoyant elements so that it floats on a liquid surrounding the cell within the housing. The bottom wall of the cell is also substantially flat when expanded and the bottom and side walls are made of a flexible material. The construction is such that the top wall will always float at the level of the balancing liquid and the collapsing of the side walls forms a space for the liquid surrounding the cells so that the liquid is always at the same level as the top wall during all conditions of all transformer operations. The space above the top wall is an air space which is vented to atmosphere.

Reference to other patents

This invention is an improvement in the construction of a conservator of a type disclosed in U.S. Patent No. 3,330,902 particularly in respect to the provision of a gas-tight cell within the conservator housing which has a top wall which includes a buoyant element so that the wall will always be positioned at the level of the surrounding liquid in the housing.

Summary of the invention

This invention relates in general to the construction of transformers and in particular, to a new and useful conservator for an oil-filled transformer including a gas-tight cell within a conservator housing which is connected to the transformer to receive the oil therefrom during volumetric changes and which includes a top wall which floats on the surrounding balancing liquid within the conservator housing.

The present invention relates in particular to a conservator device which is adapted to be mounted on the upper end of a transformer and includes a fluid conduit connection from the transformer to an interior gas-tight cell which expands and contracts in accordance with the changes of volume of oil in the transformer. The gas-tight cell is immersed in a balancing oil which is the conservator housing around the walls of the cell and it is dessirable to leave an air space above the liquid and the cell which is vented to atmosphere. In accordance with the present invention the cell is constructed with a substantially flat top wall which floats on the surface of the surrounding balancing liquid in the conservator housing. The construction is such that there will be little likelihood of frictional contact of the walls of the cell with the inner walls of the conservator housing during expansion and contraction of the cell. The sizing of the cell is such that the top flat wall which floats will move upwardly and downwardly with the liquid level. This is accomplished by the collapsing of the side walls of the cell during a withdrawing of the liquid from the cell to the transformer which provides a space for the balancing liquid within the

conservator housing so that the level thereof recedes at the same rate as the collapsing of the gas-tight cell.

Accordingly, it is an object of the invention to provide an improved conservator construction which includes a gas-tight cell within a conservator housing which communicates with a transformer for exchanging transformer oil therebetween and wherein the top wall of the cell is made of a buoyant material or includes buoyant elements.

A further object of the invention is to provide a conservator with a gas-tight cell therein which moves upwardly and downwardly with the level of a balancing liquid in a manner such that it does not frictionally contact the interior walls of the housing.

A further object of the invention is to provide a conservator which is simple in design, rugged in construction and economical to manufacture.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there is illustrated and described a preferred embodiment of the invention.

Brief description of the drawings

FIG. 1 is a side elevational view of an oil-filled transformer having a conservator constructed in accordance with the invention;

FIG. 2 is a section taken along lines II—II of FIG. 1;

FIG. 3 is a view similar to FIG. 1 showing the expansible cell in its normal operating position with side walls partly collapsed; and

FIG. 4 is a view similar to FIG. 2 indicating the expansible cell in a fully collapsed condition.

Detailed description of the preferred embodiments

Referring to the drawings in particular the invention embodied therein comprises an oil-filled transformer **1** having a conservator **2** mounted thereon adjacent the top thereof.

In accordance with the invention the conservator **2** includes a casing or housing **3** in which is located an expansible cell or gas-tight cell **4** which is fixed to the bottom of the housing **3** and is in communication with the transformer **1** through an oil conduit or pipe **5** and a connecting pipe **6.**

The conservator housing **3** is filled with a liquid or balancing oil **13** which surrounds the sides and bottom of the cell **4** and rises and falls in level with the change of level of the top of the cell **4** in accordance with the changes of volume of the oil within the transformer. The top of the interior of the conservator housing includes an air space S which is vented to atmosphere through a vent pipe **7** which is formed on a removable cap **14'** of a top wall member **14** of the conservator housing.

The expansible and collapsible cell **4** is made of a resilient material such as synthetic rubber, synthetic resin which are impermeable to oil, water and air. The cell **4** is provided with a planar top **8** and with a bottom **8'** which maintains a substantially planar shape except in a fully collapsed condition as indicated in FIG. 4. An opening **12** in the top wall **8** is closeable for example by a plug **12'**. Exhausting of the air from the cell **4** through the opening **12** causes a part of the insulation oil **10** of the transformer **1** to enter the cell and during normal operation the cell will be filled with transformer insulation oil **10** to the level indicated in FIG. 3. The balancing oil **13** which surrounds the cell **4** may be of the same constituency as the insulation oil **10.** In the embodiment illustrated the conservator housing **3** includes a well portion **15** which is connected at its lower end to a drain cock

16 to permit draining off of the liquid at such location.

In accordance with the invention, by making the top wall 8 of a buoyant substance or by forming it to include a buoyant element, it is insured that the top wall will remain in its plane and will float on the level of the balancing liquid 13 out of contact with the interior walls of the housing 3. In the embodiment illustrated the top wall includes a thin board 17 made from a foamed plastic or cork material for example which has great porosity and is of a lower specific gravity than the balancing liquid 3. The board 17 is advantageously bonded between two layers 18, 18 of the top wall 8 to provide uniform buoyancy of the whole top surface of the wall. The covering layers 18, 18 on the top and bottom of the board 17 are made from the same material as the other portions of the cell 4.

In addition to the board 17 or as a substitute therefor, the space between the layers 18, 18 may be provided as an air space to provide the necessary buoyancy. With such a construction it would be desirable to provide spacers between the two layers 18, 18 in order to maintain the desired air space in a uniform substantially planar configuration. It is also necessary that the configuration of the top wall 8 be such that no cavities form on the top exterior thereof which would tend to accumulate the balancing oil 13.

It is also desirable in accordance with the invention to provide at least one continuous tube 19 which extends around the complete periphery of the cell 4 or a plurality of tubes 19 arranged at each end and at each side of the top wall 8. The tubes are advantageously wrapped with a portion of the cell material and bonded thereto and they provide an air space therewithin to contribute the uniform buoyancy of the top wall 8. Securing tapes 20 are advantageously employed for holding the tubes 19 in the desired position at the edges of the top wall 8. With the combined buoyant structure indicated the top wall will float uniformly on the balancing oil 13. When the cell 4 is completely filled as indicated in FIG. 2, the side walls will be fully expanded and will be stretched to the position indicated leaving the small air space S at the top of the conservator housing 3.

By defining the cell 4 such that a distance between the side walls of the cell 4 and the inner wall in the housing remains uniform from the top to the bottom of the cell the oil level of the pressure balancing oil 13 will be lowered when the upward surface of the cell 4 is lowered. As the oil volume 10 decreases the level of the liquid 13 will decrease due to the formation of the additional space for this oil upon the folding of the side walls of the cell 4.

In the fully collapsed state of the cell indicated in FIG. 4 an annular depression 21 will be formed under the bottom wall 8 to accommodate the volume of the balancing oil 13. The construction is such that the side wall of the cell 4 will always be spaced from the inner surface of the housing 3 so that no wear or tear of the cell due to frictional engagement will result.

In some instances it is desirable to include a wave shaped deflection plate over the covering sheet 18 on the top wall 8 in order to collect water particles which may

be condensed from the air space S. In such an event the plate is shaped to direct the water particles off the top wall and they would eventually collect in the well 15.

What is claimed is:

1. A conservator for oil immersed transformers comprising a housing, gas-tight expansible cell located within said housing and having a flat top wall and a lower portion secured to the bottom of said housing, conduit means for connecting the interior of said cell to a transformer for receiving and delivering transformer insulating oil thereto, pressure balancing oil in said housing in a quantity to immerse said cell in said balancing oil and to leave an air space in said housing above the level of said balancing oil, vent means connecting the air space above said balancing oil in said housing to atmosphere, said flat top wall being buoyant and floating on the level of said balancing oil.

2. A conservator according to claim 1, wherein said top wall includes a hollow air space providing its buoyancy.

3. A conservator according to claim 1 including a board secured to said top wall made of a light weight buoyant material.

4. A conservator according to claim 3 wherein said board is made of a foam plastic material.

5. A conservator according to claim 4, wherein said board is covered by a sheet of synthetic material which is impermeable to oil, water and air.

6. A conservator according to claim 3 wherein said board covers a major area of the top wall and is secured along its periphery to the upper periphery of said cell.

7. A conservator according to claim 1, including at least one air filled tube connected to said top wall.

8. A conservator according to claim 7, wherein said air filled tube extends around the periphery of said top wall and is bound to said top wall.

9. A conservator according to claim 8, wherein there is a tube located on each side and end of said top wall.

10. A conservator according to claim 8, including a tube affixed to said cell along the two opposing sides of the top wall thereof.

11. A conservator according to claim 1, including a board secured to said top wall, and at least one air filled tube secured to said top wall around the periphery of said cell and said board.

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